

CONWAY CORPORATION

CONWAY, ARKANSAS

2018

CONWAY CORPORATION

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APPENDIX A – STANDARD DETAILS

APPENDIX B – https://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10930
(By reference)

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ADVERTISEMENT FOR BIDS

The project will consist of: _____ . Plans and Specifications and complete instruction to bidders for this project may be picked up at the Conway Corporation Engineering Building at #800 South Harkrider, Conway, Arkansas. A \$25.00 nonrefundable fee is required for the plans.

Contractors submitting bids must possess a State Contractors License, furnish a Bid Bond, be able to furnish a Performance Bond, provide a financial statement, and a verifiable statement of experience and equipment schedule as more fully defined in the instructions to bidders.

Sealed, bonded bids will be accepted until _____.

CONWAY CORPORATION

Brett McDaniel
Manager, Engineering & Planning

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PROPOSAL

(A UNIT PRICE CONTRACT)

Place _____

Date _____

Proposal of _____ (hereinafter called "Bidder"), organized and existing under the laws of the State of _____, Doing business as _____.

To _____ (hereinafter called "Developer").

The Bidder, in compliance with your invitation for bids for the construction of the _____; having examined the plans and specifications with related documents and the site of the proposed work, and being familiar with all of the conditions surrounding the construction of the proposed project including the availability of materials and labor, and being familiar with the job site conditions, hereby proposes to furnish all labor, materials, and supplies, and to construct the project in accordance with the contract documents, within the time set forth therein, and at the prices stated below. These prices are to cover all expenses incurred in performing the work required under the contract documents, of which this proposal is a part.

Bidder hereby agrees to commence work under this contract on or before a date to be specified in written "Notice to Proceed" of Developer and to fully complete the project within _____ () **consecutive calendar days** as stipulated in the specifications. Bidder further agrees to pay as liquidated damages the sum of \$250.00 for each consecutive calendar day thereafter as hereinafter provided in Paragraph 15 of the General Conditions.

Bidder acknowledges receipt of the following addenda:

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LVQ

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The above unit prices shall include all labor, materials, bailing, dewatering, shoring, removal, over-head, profit, insurance, etc. to cover the finished work of this project.

Bidder understands that Developer reserves the right to reject any or all bids and to waive any informality in the bidding.

The bidder agrees that this bid shall be good and may not be withdrawn for a period of 60 calendar days after the scheduled time for receiving bids.

Upon receipt of written notice of the acceptance of this bid, bidder will execute the formal contract attached within 10 days and deliver a Surety Bond or Bonds as required by Paragraph 22 of the General Conditions. The bid security in the sum of _____ (\$_____) is to become the property of Developer in the event the contract and bond are not executed within the time above set forth, as liquidated damages for the delay and additional expense to Developer caused thereby.

IF AWARDED THE WORK, the following subcontractors will be used on this work. (The Bidder shall list below the names of subcontractors, if any, he proposes to use for this job in accordance with Act 159 of the 1949 Acts of the Arkansas General Assembly, as amended).

Respectfully Submitted,

Bidder: _____

By: _____
(Signature and Title)

(SEAL – If Bidder is a Corporation)

(Business Address)

Arkansas Contractor's License Number

NOTE: DO NOT DETACH PROPOSAL FORM FROM OTHER PAPERS BOUND IN THIS BOOK. Complete Proposal Form with ink or type, and submit.

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PERFORMANCE AND PAYMENT BOND

We, _____

(State whether Individual, Partnership, or Corporation)

Hereinafter called Principal, and _____

as Surety, hereinafter called Surety, are held and firmly bound unto _____ of the
City of _____, _____ (State) as obligee, hereinafter called Owner, in the amount of

Dollars (\$ _____),
for the payment whereof the Principal and Surety bind themselves, their heirs, personal
representatives, successors and assigns, jointly and severally, firmly by these presents.

The Principal has by written Agreement dated _____ entered into a
contract with _____ for

which contract is by reference made a part hereof and is hereinafter referred to as the Contract.

The condition of this obligation is such that if the Principal shall faithfully perform its obligations in the time and in the manner specified in the Contract and shall fully indemnify and save harmless Owner from all cost and damage which it may suffer by reason of the Principal's failure so to do, including the failure to furnish any necessary corrective work or property as specified in the Contract, and including payment of liquidated and consequential damages of Owner, and shall fully reimburse and repay Owner all outlay and expense which Owner may incur in making good any such default and further, if the Principal shall pay all sales or use taxes due the State of Arkansas and shall pay all persons all indebtedness for labor or materials furnished or performed under said Contract, failing which such persons shall have a direct right of action against the Principal and Surety jointly and severally under this obligation, subject to Owner's priority, then this obligation shall be null and void; otherwise, it shall remain in full force and effect.

This bond shall be construed as an Arkansas statutory performance and payment bond and all mandatory statutory provisions are deemed incorporated herein by reference, except that if any provision herein is more beneficial to the persons protected hereby than the statutory provisions, the provisions of this bond shall prevail.

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No suit shall be brought to enforce the Surety's obligations under the statutory provisions pertaining to Arkansas statutory performance and payment bonds after one year from the date of final payment is made on the Contract, provided that nothing herein shall be construed to limit or shorten any statute of limitation applicable to other obligations of the Surety or Owner under the Contract; it is agreed that Owner may bring suit on this bond against the Surety alone or against the Principal and Surety jointly at any time before suit against the Principal for breach of a written contract would be barred. This bond shall be executed by an agent of the Surety resident in the State of Arkansas, shall be deemed an Arkansas Contract and shall be construed and enforced in accordance with the laws of Arkansas. Any alterations which may be made in the terms of the Contract, or in the work to be done under it, or the giving by Owner of any extension of time for the performance of the Contract, or any other forbearance on the part of either Owner or the Principal to the other shall not in any way release the Principal and Surety or Sureties, or either or any of them, their heirs, personal representatives, successors or assigns, from their liability hereunder, notice to the Surety or Sureties of any such alterations, extension or forbearance being hereby waived.

In no event shall the aggregate liability of the Surety exceed the sum set out herein.

Executed this _____ day of _____, 20____.

ATTEST:

_____ (Principal)
By _____

COUNTERSIGNED

_____ Surety

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CONTRACT AGREEMENT

1. THIS CONTRACT AND AGREEMENT, made and entered into this ____ day of _____, 20__, by and between _____ (“Customer”), of _____ (City), _____ (State), and _____ (“Developer”) of _____ (City), _____ (State).

WITNESSETH:

That for and in consideration of the payments to be made as hereinafter set forth, the Contractor hereby agrees to furnish all tools, labor, equipment, materials, and supplies required to be furnished and to commence and complete the construction described as follows:

In exact accordance with the Plans on file at the office of Conway Corporation, and Specifications, Proposals, Stipulations, and Special Provisions attached hereto and made a part hereof as fully as though copied herein, under the direct supervision and to the entire satisfaction of Conway Corporation and in accordance with the laws of the State of Arkansas.

2. It is further agreed and understood by and between the parties hereunto that the Developer agrees to pay and the Contractor agrees to accept as full and final compensation for all work done under this agreement, the lump sum amount adjusted for variation of quantities at the unit prices named in the Proposal which is hereto attached, such payment to be made in lawful money of the United States, at the time and in the manner set forth in the Specifications.

3. The Contractor agrees, for the consideration above-expressed, to begin and complete the work within the time specified in the Proposal. If Contractor shall fail to complete the work in the time specified, he shall pay to Developer, as liquidated damages, ascertained and agreed, and not in the nature of a penalty, the amount specified in the Proposal for each day delayed, for each Schedule delayed which shall be deducted from the final amount to be paid under the contract, provided that extensions of time with waiver of liquidated damages may be granted as provided for in the Specifications.

4. The Contractor agrees to furnish a Bond, with an approved Surety thereon, guaranteeing the performance of this Contract, as required by the laws of the State of Arkansas, and for not less than one hundred (100) percent of the amount of this Contract. Said Bond shall be conditioned on full and complete performance of this Contract and for the payment of all labor and materials entering into or incident to the proposed improvement and shall guarantee the work against faulty workmanship or materials for a period of one (1) year after completion. The Surety on said Bond shall be a Surety Company of financial resources satisfactory to Conway Corporation and authorized to do business in the State of Arkansas.

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5. The Contractor agrees also to carry Public Liability Insurance, Property Damage Insurance, and Workmen's Compensation Insurance in amounts as required by these Specifications.

WITNESS OUR HANDS THIS _____ DAY OF _____, 20____.

Developer

By _____
(Name)

(Title)

SEAL

Contractor

By _____
(Name)

(Title)

WITNESS:



CONSTRUCTION CONTRACT AWARD
NOTIFICATION

To: Safety Supervisor, Safety Division, Arkansas Department of Labor

From: Brett McDaniel, Manager, Engineering and Planning, Conway Corporation

Contract Date: _____

A Construction Contract Has Been Awarded To:

This Project Will Consist Of: _____

Location Of Work: _____

Estimated Start Date: _____

Estimated Completion Date: _____

Faxed Completed Form To: 1-501-682-4532

Date Sent: _____

Sent By: _____

INSTRUCTIONS TO BIDDERS

1. QUALIFICATIONS OF CONTRACTORS

Before submitting a bid, bidders must be licensed under the terms of Act 124 of the 1939 Acts of the Arkansas General Assembly, as amended, and the successful bidder must be legally qualified in all respects to do business in the State of Arkansas.

Bidders shall prepare a Financial Statement, Experience Record, and Equipment Schedule. These statements shall reflect the current status of the bidder. The statements of each bidder must show net liquid assets or credit facilities in an amount of not less than fifteen (15) percent of the total amount bid. Each bidder must have had at least three (3) years experience in construction of similar improvements and must have successfully completed at least three (3) such projects. References for, at least, three projects must be provided. However, a statement of experience is not necessary if the Contractor has performed work for Conway Corporation within the immediately preceding twenty-four (24) months. A financial statement is not required if one has been filed with Conway Corporation within the immediately preceding twelve (12) months. Each bidder must have equipment available, which, in the opinion of the Engineer, is adequate to complete the work under these Specifications in the time allowed for completion. Should any bids be received from bidders whose statements, when filed, fail to show that the bidder's qualifications meet the minimum requirements above-enumerated, such bids may be rejected. Any party that has not performed work for Conway Corporation within the previous twelve months should submit all information to the Manager of Engineering prior to receiving a bid package in order to confirm they meet the qualifications of this section.

2. LOCAL CONDITIONS

Bidders shall become thoroughly familiar with the Specifications and Plans, and make their own estimates of the existing facilities and the difficulties, which will attend the execution of the work called for by the proposed Contract, including local conditions, uncertainty of weather, and all other contingencies. Bidders shall satisfy themselves by personal examination of the location of the proposed work and by such means as they may choose, as to actual conditions and requirements. Information derived from the Plans and Specifications or from the Engineer or his assistants shall not relieve the bidder of this responsibility.

3. PROPOSAL GUARANTEES

Proposals must be accompanied by either a certified or cashier's check, drawn on a National Bank or a bank having membership in the Federal Reserve System, or a Bid Bond executed by a satisfactory Surety. **The check or bid bond must be in a separate sealed envelope attached to the front of the sealed bid package.** The proposal guarantee shall be in an amount not less than five (5) percent of the bid and made payable to Conway Corporation. A lesser amount will not be accepted.

The amount of any check or bond shall be retained by Conway Corporation as liquidated damages if the bidder neglects or refuses to enter into a contract and to furnish the required contract bond within ten (10) days the prescribed contract and bond forms are presented for signature.

Checks of unsuccessful bidders will be returned after a contract has been executed.

4. PROPOSALS

(a) Proposals shall be strictly in accord with the prescribed forms, furnished with the Specifications. Any modification or deviations therefrom may be considered sufficient cause for rejection.

(b) The bidder shall state in figures the lump and unit prices for which he proposes to do each item of work covered by the Proposal. In the event a mathematical error has occurred on the bid and the total price for an item is not equal to the quantity of the item and the unit price submitted in the bid, the unit price shall be used to determine the actual lump sum price. If the sum of unit prices do not equal the lump sum, then the sum of unit prices will be used for the bid.

(c) It is to be understood that the lump sum required in the Proposal is for the furnishing of all materials required to be furnished and the doing of all work required under these Contract Documents, including items for which no quantities are given, and the quantities given in the List of Variable Quantities at the end of the Proposal. The "Unit Prices for Variation of Quantities" required are for adjustment of the "Basic Bid" by reason of variation of actual variable quantities from the quantities given in the "List of Variable Quantities". In case unit prices are not required, it is to be understood that the lump sum required in the Proposal is for the furnishing of all materials required to be furnished and the doing of all work required under these Contract Documents.

(d) Proposals may be submitted for any or all Schedules. However, all work within the Schedule must be included in the bid. Where a bidder bids on more than one Schedule and desires to accept the work only when awarded more than one Schedule, he may so state in his proposal, but any reservation on the part of the bidder to make a decision on what Schedules he will accept after bids are opened will render the bid null and void.

(e) Proposals must be signed, in writing, by an individual authorized to bind the bidder.

(f) Proposals must be submitted complete, with all other Contract Documents in their original binding as furnished by the Engineer. They must be submitted at the place and on or before the time specified in the Advertisement for Bids.

(g) Proposals must be submitted in sealed envelopes addressed to Conway Corporation, and clearly marked on the outside of the envelope, "Proposal for Construction Contract" to be opened at (date and time). The Bidder's current Arkansas Contractors license number must be marked on the envelope.

(h) Conway Corporation will not consider bids covering only a portion of these Specifications.

(i) The unbalancing of bids will not be tolerated. Evidence of material unbalancing will be considered cause for rejection.

5. MODIFICATION OF BIDS

No modification of bids already submitted will be considered unless such modifications are received prior to the hour set for opening.

6. BID BONDS, CONTRACT BONDS, AND INSURANCE

Attention of bidders is called to Act 82 of the 1935 Acts of the Arkansas General Assembly, which require that all bid bonds, performance bonds, labor bonds, employer's liability insurance, public liability insurance, workmen's collective insurance, and property damage insurance must be secured through resident agents of Arkansas.

7. CLARIFICATION OF CONTRACT DOCUMENTS

If any person contemplating submitting a bid for the proposed contract is in doubt as to the true meaning of any part of the Plans, Specifications, or other proposed Contract Documents, he may submit to the Engineer a written request for any interpretation thereof. The person submitting the request will be responsible for its prompt delivery. Any interpretation of the proposed Documents will be made only by an Addendum duly issued, and a copy of such Addendum will be transmitted to each person who has previously secured or who subsequently secures a set of Documents. Conway Corporation will not be responsible for any other explanations or interpretations of the proposed Documents.

8. EXECUTION OF CONTRACT DOCUMENTS

Following the award and within ten (10) days, provided for in the Proposal, the successful bidder shall properly execute the Contract Documents.

9. BASIS OF AWARD

Bids will be considered on the basis of the Lump Sum price or prices given in the proposal. In the event Unit Prices are required, they will not be considered except that evidence of serious unbalancing of the Unit Prices shall be considered cause for rejection of bids.

The Contract(s) will be awarded to the bidder (or bidders in the case of more than one Schedule of Work) submitting the lowest and best bid (or combination of bids), considering the Contractor’s experience and ability to do the work, and the character and quality of the equipment he proposes to furnish. Conway Corporation reserves the right to select such bids or combination of bids which in its opinion would serve its interest best. Conway Corporation reserves the right to select between any alternatives in the proposal.

I certify that I have read and understand the entire contract including all specifications and conditions thereto. I also understand it is solely the responsibility of the contractor to comply with any and all safety requirements required to perform the job outlined in the contract as well as any safety procedures of the Department of Labor, OSHA, or any other applicable agency with jurisdiction. These safety procedures include, but are not limited to, the current edition of the Occupational Safety and Health Administration Standard for Excavation and Trenches Safety System, 29 CFR 1926, Subpart P. This responsibility includes, but is not limited to, supplying a “Competent Person” as defined in paragraph (b) of 1926.550 of the above stated Subpart P. I have full authority to bind the contractor listed in the contract.

(Name)

(Contractor)

(Date)

GENERAL CONDITIONS

1. DEFINITIONS

Wherever used in the Contract Documents, the following terms shall have the meanings indicated which shall be applicable to both the singular and plural thereof:

A. ADDENDA -- Written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the Contract Documents, Drawings and Specifications, by additions, deletions, clarifications or corrections.

B. BID -- The offer or proposal of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

C. BIDDER -- Any person, firm or corporation submitting a Bid for the Work.

D. BONDS -- Bid, Performance, and Payment Bonds and other instruments of security furnished by the Contractor and his surety in accordance with the Contract Documents.

E. CHANGE ORDER -- A written order to the Contractor authorizing an addition, deletion or revision in the Work within the general scope of the Contract Documents, or authorizing an adjustment in the Contract Price or Contract Time.

F. COMPETENT PERSON -- One who is capable of identifying existing and predictable hazards in the surroundings, or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

G. CONTRACT DOCUMENTS -- The Contract, including Advertisement For Bids, Information For Bidders, Bid, Bid Bond, Agreement, Payment Bond, Performance Bond, Notice of Award, Notice To Proceed, Change Order, Drawings, Specifications and Addenda.

H. CONTRACT PRICE -- The total monies payable to the Contractor under the terms and conditions of the Contract Documents.

I. CONTRACT TIME -- The number of calendar days stated in the Contract Documents for the completion of the Work.

J. CONTRACTOR -- The person, firm or corporation with whom Conway Corporation has executed the Agreement and has a valid State Contractors License.

K. DRAWINGS -- The part of the Contract Documents which show the characteristics and scope of the Work to be performed and which have been prepared or approved by the Engineer.

L. ENGINEER -- The Manager of Engineering and Planning of Conway Corporation, or designated representative thereof.

M. FIELD ORDER -- A written order effecting a change in the Work not involving an adjustment in the Contract Price or an extension of the Contract Time, issued by the Engineer to the Contractor during construction.

- N. NOTICE OF AWARD -- The written notice of the acceptance of the Bid from Conway Corporation to the successful Bidder.
- O. NOTICE TO PROCEED -- Written communication issued by Conway Corporation to the Contractor authorizing him to proceed with the Work and establishing the date for commencement of the Work.
- P. OWNER -- Conway Corporation.
- Q. PROJECT -- The undertaking to be performed as provided in the Contract Documents.
- R. RESIDENT PROJECT REPRESENTATIVE -- The authorized representative of Conway Corporation who is assigned to the Project site or any part thereof.
- S. SHOP DRAWINGS -- All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the Contractor, a Subcontractor, Manufacturer, Supplier or Distributor, which illustrate how specific portions of the Work shall be fabricated or installed.
- T. SPECIFICATIONS -- A part of the Contract Documents consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship.
- U. SUBCONTRACTOR -- An individual, firm or corporation having a direct contract with the Contractor or with any other Subcontractor for the performance of a part of the Work at the site.
- V. SUBSTANTIAL COMPLETION -- That date as certified by the Engineer when the construction of the Project or a specified part thereof is sufficiently completed, in accordance with the Contract Documents so that the Project or specified part can be utilized for the purposes for which it is intended (beneficial use).
- W. SUPPLEMENTAL GENERAL CONDITIONS -- Modifications to General Conditions required by a Federal Agency for participation in the Project and approved by the agency in writing prior to inclusion in the Contract Documents.
- X. SUPPLIERS -- Any person, supplier or organization who supplies materials or equipment for the Work, including that fabricated to a special design, but who does not perform labor at the site.
- Y. WORK -- All labor necessary to produce the construction required by the Contract Documents, and all materials and equipment incorporated or to be incorporated in the Project.
- Z. WRITTEN NOTICE -- Any notice to any party of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at his last given address, or delivered in person to said party or his authorized representative on the Work.

2. ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS

(a) The Contractor may be furnished additional instructions and detail drawings, by the Engineer, as necessary to carry out the Work required by the Contract Documents.

(b) The additional drawings and instruction thus supplied will become a part of the Contract Documents. The Contractor shall carry out the Work in accordance with the additional detail drawings and instructions.

3. SCHEDULES, REPORTS AND RECORDS

(a) The Contractor shall submit to Conway Corporation such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data as Conway Corporation may request concerning Work performed or to be performed.

(b) Prior to the first partial payment estimate the Contractor shall submit schedules showing the order in which he proposes to carry on the Work, estimated date of completion of each part and, as applicable:

- (1) the dates at which special detail drawings will be required; and
- (2) respective dates for submission of Shop Drawings, the beginning of manufacture, the testing and the installation of materials, supplies and equipment.
- (3) a Schedule Of Values delineating the various items of work incorporated into lump sum items listed in the LVQ. The values shall denote anticipated costs for the installation of each of the various items of the lump sum amount from which partial pay requests may be determined.

(c) The Contractor shall also submit a schedule of monthly payments that he anticipates he will earn during the course of the Work.

4. DRAWINGS AND SPECIFICATIONS

(a) The intent of the Drawings and Specifications is that the Contractor shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the Work in accordance with the Contract Documents and all incidental work necessary to complete the Project in an acceptable manner, ready for use, occupancy or operation by Conway Corporation.

(b) In case of conflict between the Drawings and Specifications, the Specifications shall govern. Figure dimensions on Drawings shall govern over scale dimensions, and detailed Drawings shall govern over general Drawings.

(c) Any discrepancies found between the Drawings and Specifications and site conditions or any inconsistencies or ambiguities in the Drawings or Specifications shall be immediately reported to the Engineer, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. Work done by the Contractor after his discovery of such discrepancies, inconsistencies or ambiguities shall be done at the Contractor's risk.

5. SUBMITTALS

(a) Contractor Submittal. Shop drawings and engineering data (submittals) covering all materials, which will become a permanent part of the Work under this Contract shall be submitted to Engineer for review. Submittals shall verify compliance with the Contract Documents, and shall include drawings and descriptive information in sufficient details to show the kind, size, manufacture and applicable Standard's conformity (ASTM, AWWA, NSF, etc.) of materials; performance characteristics; and dimensions needed for installation and correlation with other materials. The Contractor shall furnish the Engineer with four (4) hard copies and one (1) electronic copy (pdf) of the submission.

All submittals, regardless of origin, shall be identified with the job name and number of this Contract, Contractor's name, references to applicable specification paragraphs and Contract Drawings, and date. Each submittal shall indicate the intended use of the item in the Work. When catalog pages are submitted,

applicable items shall be clearly identified and inapplicable data crossed out. The current revision, issue number, and date shall be indicated on all drawings and other descriptive data.

Contractor shall be solely responsible for the completeness of each submission. Contractor accepts sole responsibility for determining and verifying all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, and that each submittal meets the requirements of the Work and the Contract Documents.

All deviations from the Contract Documents shall be identified as deviations on each submittal. Such submittals shall, as pertinent to the deviation, indicate essential details of all changes proposed by Contractor, including modifications to other materials and or facilities that may be a result of the deviation.

Any material submitted other than that specified, which requires additional work to be performed, shall be noted by the Contractor prior to submittal. The cost of any additional work required shall be borne by the Contractor.

All submittals shall be submitted to the Engineer after the contract is signed. Engineer will review and return marked copies to Contractor. Contractor shall not order any material until submittal for said material has been returned marked "No Exceptions Taken" or "Make Corrections Noted". Engineer may accept submittals from Contractor's agent but this shall not relieve Contractor of Contractor's sole responsibility for errors, omissions, or deviations in the drawings and data, nor of Contractor's sole responsibility for compliance with the Contract Documents.

Delays in obtaining Engineer's review of submittals, will not entitle Contractor to extension of the Contract Times unless delay of the Work is directly caused by a change in the Work authorized by a Change Order or by failure of Engineer to review any submittal within the submittal review period specified herein and to return the submittal to Contractor.

(b) Engineer's Review of Submittals. Engineer's review of submittals will cover only general conformity to the Plans and Specifications. Engineer's review does not indicate a thorough review of all dimensions, quantities, and details of the material, or item shown. Engineer's review shall not relieve Contractor of Contractor's sole responsibility for errors, omissions, or deviations in the drawings and data, nor of Contractor's sole responsibility for compliance with the Contract Documents.

Engineer's submittal review period shall be 15 business days in length and shall commence on the first business day immediately following the date of arrival of the submittal or resubmittal in Engineer's office. The time required to mail the submittal or resubmittal back to the Contractor shall not be considered a part of the submittal review period. The Engineer may withhold action on any submittal which requires coordination with other submittals until such submittals are received.

When submittals are returned marked "Rejected" or "Amend and Resubmit", the corrections shall be made as noted thereon and as instructed by Engineer, and resubmitted.

When submittals are returned marked "No Exceptions Taken", or "Make Corrections Noted", no additional copies need be furnished unless requested by Engineer.

(c) Resubmittal of Drawings and Data. Contractor shall accept full responsibility for the completeness of each resubmittal. Contractor shall verify that all corrected data and additional information previously requested by Engineer are provided on the resubmittal.

When corrected copies are resubmitted, Contractor shall in writing direct specific attention to all revisions and shall list separately any revisions made other than those called for by Engineer on previous submissions.

Requirements specified for initial submittals shall also apply to resubmittals.

Bond, Mobilization, and Submittals as a pay item (if listed in the list of variable quantities) shall not exceed 3% (three percent) of the total bid.

6. MATERIALS, SERVICES AND FACILITIES

(a) It is understood that, except as otherwise specifically stated in the contract Documents, the Contractor shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, supervision, temporary construction of any nature, staging area(s) and all other services and facilities of any nature whatsoever necessary to execute, complete, and deliver the Work within the specified time.

(b) Materials and equipment shall be so stored as to insure the preservation of their quality and fitness for the Work. Stored materials and equipment to be incorporated in the Work shall be located so as to facilitate prompt inspection.

(c) Manufactured articles, materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.

(d) Materials, supplies and equipment shall be in accordance with samples submitted by the Contractor and approved by the Engineer.

(e) Materials, supplies or equipment to be incorporated into the Work shall not be purchased by the Contractor or the Subcontractor subject to a chattel mortgage or under a conditional sale contract or other agreement by which an interest is retained by the seller.

7. INSPECTION AND TESTING

(a) All materials and equipment used in the construction of the Project shall be subject to adequate inspection and testing in accordance with generally accepted standards.

(b) The Contractor shall provide at his expense the necessary testing and inspection services required by the Contract Documents, unless otherwise provided.

(c) Conway Corporation shall provide all other inspection and testing services not required by the Contract Documents.

(d) If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any Work to specifically be inspected, tested, or approved by someone other than the Contractor, the Contractor will give the Engineer timely notice of readiness. The Contractor will then furnish the Engineer the required certificates of inspection, testing or approval.

(e) Neither observations by the Engineer nor inspections, tests or approvals by persons other than the Contractor shall relieve the Contractor from his obligations to perform the Work in Accordance with the requirements of the Contract Documents.

(f) The Engineer and his representatives will at all times have access to the Work. In addition, authorized representatives and agents of any participating Federal or State Agency shall be permitted to inspect all work, materials, payrolls, records of personnel, invoices of materials, and other relevant data and records. The Contractor will provide proper facilities for such access and observation of the Work and also for any inspection, or testing thereof.

g) If any Work is covered contrary to the request of the Engineer, it must, if requested by the Engineer, be uncovered for his observation and replaced at the Contractor's expense.

(h) If any Work has been covered which the Engineer has not specifically requested to observe prior to its being covered, or if the Engineer considers it necessary or advisable that covered Work be inspected or tested by others, the Contractor at the Engineer's request, will uncover, expose or otherwise make available for observation, inspection or testing as the Engineer may require, that portion of the Work in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such Work is defective, the Contractor will bear all expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction.

8. **SUBSTITUTIONS**

Whenever a material, article or piece of equipment is identified on the Drawings or Specifications by reference to brand name or catalogue number, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements and that other products of equal capacities, quality and function shall be considered. The Contractor may recommend the substitution of a material, article, or piece of equipment of equal substance and function for those referred to in the Contract Documents by reference to brand name or catalogue number, and if, in the opinion of the Engineer, such material, article, or piece of equipment is of equal substance and function to that specified, the deductible from the Contract Price and the Contract Documents shall be appropriately modified by Change Order. The Contractor warrants that if substitutes are approved, no major changes in the function or general design of the Project will result. All costs associated with any redesign required to accommodate the substitution shall be borne by the Contractor. Incidental changes or extra component parts required to accommodate the substitute will be made by the Contractor without a change in the Contract Price or Contract Time.

9. **PATENTS**

The Contractor shall pay all applicable royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and save Conway Corporation harmless from loss on account thereof, except that Conway Corporation shall be responsible for any such loss when a particular process, design, or the product of a particular manufacturer or manufacturers is specified, but if the Contractor has reason to believe that the design, process or product specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the Engineer.

10. **SURVEYS, PERMITS, REGULATIONS**

(a) Conway Corporation shall furnish all land surveys and establish all base lines for locating the principal component parts of the Work together with a suitable number of bench marks adjacent to the Work as shown in the Contract Documents. From the information provided by Conway Corporation, unless otherwise specified in the Contract Documents, the Contractor shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, stakes for pile locations and other working points, lines, elevations and cut sheets.

(b) The Contractor shall carefully preserve bench marks, reference points and stakes and, in case of willful or careless destruction, he shall be charged with the resulting expense and shall be responsible for any mistakes that may be caused by their unnecessary loss or disturbance.

(c) Permits and licenses of a temporary nature necessary for the prosecution of the Work shall be secured and paid for by the Contractor. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by Conway Corporation, unless otherwise specified. The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the Work as drawn and specified. If the Contractor observes that the Contract Documents are at variance therewith, he shall promptly notify the Engineer in writing, and any necessary changes shall be adjusted as provided in Section 13, Changes in the Work.

(d) All work shall be done in conformity with the laws of the State of Arkansas, and any subdivision thereof, municipal and local laws and ordinances, in all applicable Federal Statutes, Laws or Regulations. No inmate of convict labor will be employed on this project.

11. PROTECTION OF WORK, PROPERTY AND PERSONS

(a) The Contractor will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. He will take all necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to all employees on the job and other persons who may be affected thereby, all the Work and all materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

Damage resulting from construction activity outside the easement(s) shall be repaired / remedied immediately at the sole expense of the Contractor. The Engineer reserves the right to quantify and withhold payment from the closest representative pay item(s) in the area of the damage until the necessary repairs / remedies are made to the satisfaction of the engineer.

(b) Act 291 of the 1993 Arkansas General Assembly requires that whenever any agency of the state, county, municipality, or school district, or other local taxing unit or improvement district enters into a contract for public works improvements, which involves any trench or excavation which equals or exceeds five (5) feet in depth, the agency shall include in their specifications for the contract the current edition of the Occupational Safety and Health Administration Standard for Excavation and Trenches Safety System, 29 CFR 1926, Subpart P. This document is hereby incorporated into these Specifications by reference.

(c) The Contractor will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. He will erect and maintain, as required by the conditions and progress of the Work, all necessary safeguards for safety and protection. He will notify owners of adjacent utilities when prosecution of the Work may affect them. The Contractor will immediately remedy all damage, injury or loss to any property, caused directly or indirectly, in whole or in part, by the Contractor, any Subcontractor or anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable except damage or loss attributable to the fault of the Contract Documents or to the acts or omissions of Conway Corporation or the Engineer or anyone employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of the Contractor.

(d) In emergencies affecting the safety of persons or the Work or property at the site or adjacent thereto, the Contractor, without special instruction or authorization from the Engineer or Conway Corporation, shall act to prevent threatened damage, injury or loss. He will give the Engineer prompt Written Notice of any significant changes in the Work or deviations from the Contract Documents caused thereby, and a Change Order shall thereupon be issued for review and consideration covering the changes and deviations involved.

(e) The plans have been drawn to avoid existing utilities, service lines and structures as much as possible. The contractor shall have all existing utilities located before any excavation begins, in order to avoid damage to existing utilities. Any damage by the contractor to existing utilities, which were located prior to digging, is the responsibility of the contractor. If damage to existing utilities occurs following a 'locate request' in the defined area and the utilities were not located prior to digging, the responsibility shall be determined between the contractor and the owner of the damaged utilities. The Contractor shall be aware of the potential for utility lines to conflict with intended construction efforts, and the Contractor shall use appropriate precautionary measures to locate and protect such utility lines and services so as to avoid damage and interruptions to service.

The Contractor shall contact the owners of the various existing services as may be affected by the construction and solicit their assistance in identifying, locating, marking, and protecting these facilities prior to beginning any excavation or other work which might endanger the existing services. If such services are damaged or impaired because of the Contractor's actions or omissions, the Contractor shall be responsible for the cost of repairs or replacements of the affected or damaged service.

(f) Project areas may contain confined spaces which may require permit issuance for entry. Confined spaces may include but are not limited to sewer manholes, lift stations, pump stations various tanks and underground structures. These spaces may be considered permit – required entry due to consistently changing / unknown atmospheric conditions, water flows, chemical operations, etc. associated with sanitary sewer or drinking water systems operations. OSHA §1926.1204 Permit-Required Confined Space Program regulation requires the Contractor maintain a Confined Space Program. The Contractor shall provide employees the necessary training, equipment and information required to work in these environments.

12. SUPERVISION BY CONTRACTOR

(a) The Contractor will supervise and direct the Work. He will be solely responsible for the means, methods, techniques and procedures of construction. The Contractor will employ and maintain at the job site a qualified supervisor or superintendent who shall be the Contractor's representative at the site. The supervisor shall have full authority to act on behalf of the Contractor and all communications given to the supervisor shall be as binding as if given to the Contractor. The supervisor shall be present on the site at all times as required to perform adequate supervision and coordination of the Work.

(b) It shall be solely the responsibility of the Contractor to supply a **Competent Person** as described in the current edition of the Occupational Safety and Health Administration Standard for Excavation and Trenches Safety System, 29 CFR 1926, Subpart P.

(c) **It is understood and agreed that the Contractor has satisfied himself as to the nature and location of the Work, the confirmation of the ground, the character, quality and quantity of the materials to be encountered, the character of the equipment and facilities needed preliminary to and during the prosecution of the Work, the general local conditions, and all other matters which can in**

any way affect the work under this contract. No verbal agreement or conversation with any officer, agent, or employee of Conway Corporation or Engineer, either before or after the execution of this contract, shall affect or modify any of the terms or obligations herein contained.

13. CHANGES IN THE WORK

(a) Conway Corporation may at any time, as the need arises, order changes within the scope of the Work without invalidating the Agreement. If such changes increase or decrease the amount due under the Contract Documents, or in the time required for performance of the Work, an equitable adjustment shall be authorized by Change Order.

(b) The Engineer, also, may at any time, by issuing a Field Order, make changes in the details of the Work. The Contractor shall proceed with the performance of any changes in the Work so ordered by the Engineer unless the Contractor believes that such Field Order entitles him to a change in Contract Price or Time, or both, in which event he shall give the Engineer Written Notice thereof within three (3) days after the receipt of the ordered change, and the Contractor shall not execute such changes pending the receipt of an executed Change Order or further instruction from Conway Corporation.

(c) Conway Corporation may utilize this provision for additional projects by a mutually agreed upon Change Order.

14. CHANGES IN CONTRACT PRICE

(a) The Contract Price may be changed only by a Change Order. The value of any Work covered by a Change Order or of any claim for increase or decrease in the Contract Price shall be determined by one or more of the following methods in the order of precedence listed below:

- (1) Unit prices previously approved.
- (2) An agreed lump sum.
- (3) The actual cost for labor, direct overhead, materials, supplies, equipment, and other services necessary to complete the Work.

15. TIME FOR COMPLETION AND LIQUIDATED DAMAGES

(a) The date of beginning and the time for completion of the Work are essential conditions of the Contract Documents and the Work embraced shall be commenced on a date specified in the Notice To Proceed.

(b) The Contractor will proceed with the Work at such rate of progress to insure full completion within the Contract Time. It is expressly understood and agreed, by and between the Contractor and Conway Corporation, that the Contract Time for the completion of the Work described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the Work.

(c) If the Contractor shall fail to complete the Work within the Contract Time, or extension of time granted by Conway Corporation, then the Contractor will pay to Conway Corporation the amount for liquidated damages as specified in the Bid for each calendar day that the Contractor shall be in default after the time stipulated in the Contract Documents.

(d) The Contractor shall not be charged with liquidated damages or any excess cost when the delay in completion of the Work is due to the following, and the Contractor has promptly given Written Notice of such delay to Conway Corporation or Engineer:

- (1) To unforeseeable causes 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 Conway Corporation, acts of another Contractor in the performance of a contract with Conway Corporation, fires, floods, and abnormal and unforeseeable weather.

16. CORRECTION OF WORK

(a) The Contractor shall promptly remove from the premises all Work rejected by the Engineer for failure to comply with the Contract Documents, whether incorporated in the construction or not, and the Contractor shall promptly replace and re-execute the Work in accordance with the Contract Documents and without expense to Conway Corporation and shall bear the expense of making good all Work of other Contractors destroyed or damaged by such removal or replacement.

(b) All removal and replacement Work shall be done at the Contractor's expense. If the Contractor does not take action to remove such rejected Work within ten (10) days after receipt of Written Notice, Conway Corporation may remove such Work and store the materials at the expense of the Contractor.

17. SUBSURFACE CONDITIONS

(a) The Contractor shall promptly, and before such conditions are disturbed, except in the event of an emergency, notify Conway Corporation by Written Notice of:

- (1) Latent physical conditions at the site differing materially from those indicated in the Contract Documents; or
- (2) Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in Work of the character provided for in the Contract Documents.

(b) The Engineer shall promptly investigate the conditions, and if in the opinion of the Engineer such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required for, performance of the Work, an equitable adjustment shall be made and the Contract Documents shall be modified by a Change Order. Any claim of the Contractor for adjustment hereunder shall not be allowed unless he has given the required Written Notice; provided that Conway Corporation may, if it determines the facts so justify, consider and adjust any such claims asserted before the date of final payment.

18. SUSPENSION OF WORK, TERMINATION AND DELAY

(a) Conway Corporation may, at any time and without cause, suspend the Work or any portion thereof for a period of not more than ninety (90) days or such further time as agreed upon by the Contractor, by Written Notice to the Contractor and the Engineer which notice shall fix the date on which Work shall be resumed. The Contractor will resume that Work on the date so fixed. The Contractor may be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension.

(b) If the Contractor is adjudged bankrupt or insolvent, or if he makes a general assignment for the benefit of his creditors, or if a trustee or receiver is appointed for the Contractor or for any of his property, or if he files a petition to take advantage of any debtor's act, or to reorganize under the bankruptcy or applicable laws, or if he repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment, or if he repeatedly fails to make prompt payments to Subcontractors or for labor, material or equipment or if he disregards laws, ordinances, rules regulations or orders of any public body having jurisdiction of the Work or if he disregards the authority of the Engineer, or if he otherwise violates any provision of the Contract Documents, then Conway Corporation may, without prejudice to any other right or remedy and after giving the Contractor and his surety a minimum of ten (10) days from delivery of a Written Notice, terminate the services of the Contractor and take possession of the Project and of all materials, equipment, tools, construction equipment and machinery thereon owned by the Contractor, and finish the Work by whatever method he may deem expedient. In such case the Contractor shall not be entitled to receive any further payment until the Work is finished. If the unpaid balance of the Contract Price exceeds the direct and indirect costs of completing the Project, including compensation for additional professional services, such excess shall be paid to the Contractor. If such costs exceed such unpaid balance, the Contractor will pay the difference to Conway Corporation. Such costs incurred by Conway Corporation will be determined by the Engineer and incorporated in a Change Order.

(c) Where the Contractor's services have been so terminated by Conway Corporation, said termination shall not affect any right of Conway Corporation against the Contractor then existing or which may thereafter accrue. Any retention or payment of monies by Conway Corporation due the Contractor will not release the Contractor from compliance with the Contract Documents.

(d) After ten (10) days from delivery of a Written Notice to the Contractor and the Engineer, Conway Corporation may, without cause and without prejudice to any other right or remedy, elect to abandon the Project and terminate the Contract. In such case, the Contractor shall be paid for all Work executed and any expense sustained if warranted.

(e) If, through no act or fault of the Contractor, the Work is suspended for a period of more than ninety (90) days by Conway Corporation or under an order of court or other public authority, or the Engineer fails to act on any request for payment within thirty (30) days after it is submitted, or Conway Corporation fails to pay the Contractor substantially the sum approved by the Engineer or awarded by a mediator within thirty (30) days of its approval and presentation, then the Contractor may, after ten (10) days from delivery of a Written Notice to Conway Corporation and the Engineer, terminate the Contract and recover from Conway Corporation payment for all Work executed and all expenses sustained. In addition and in lieu of terminating the Contract, if the Engineer has failed to act on a request for payment or if Conway Corporation has failed to make any payment as aforesaid, the Contractor may upon ten (10) days notice to Conway Corporation and the Engineer stop the Work until he has been paid all amounts then due, in which event and upon resumption of the Work, Change Orders shall be issued for adjusting the Contract Price or extending the Contract Time or both to compensate for the costs and delays attributable to the stoppage of the Work.

(f) If the performance of all or any portion of the Work is suspended, delayed, or interrupted as a result of a failure of Conway Corporation or Engineer to act within the time specified in the Contract Documents, or if no time is specified, within a reasonable time, an adjustment in the Contract Price or an extension of the Contract Time, or both, shall be made by Change Order to compensate the Contractor for the costs and delays necessarily caused by the failure of Conway Corporation or Engineer.

19. PAYMENTS TO CONTRACTOR

(a) The Engineer will, on or about the last of each month, make an estimate of the Work completed to date. As soon thereafter as possible and after the Contractor has filed receipted bills showing that he has paid the previous months bills, the Contractor will be paid ninety (90%) percent of the value of such Work, including materials on the site which are to be permanently incorporated in the Work, deducting amounts previously paid. A final estimate will be made following a final inspection as provided under paragraph 20 below, after which time and within a period of forty (40) days, the Contractor will be paid the full amount of the Contract Price, less amounts previously paid. Conway Corporation shall retain ten (10%) percent of the amount of each payment until final completion and acceptance of all Work covered by the Contract Documents. Conway Corporation at any time, however, after fifty (50%) percent of the Work has been completed, if it is found that satisfactory progress is being made, may reduce retainage to five (5%) percent of the current and remaining estimates. On completion and acceptance of a part of the Work on which the price is stated separately in the Contract Documents, payment may be made in full, including retained percentages, less authorized deductions.

(b) The request for payment may also include an allowance for the cost of such major materials and equipment, which are suitably stored at the site.

(c) All Work covered by partial payment made shall thereupon become the sole property of Conway Corporation, but this provision shall not be construed as relieving the Contractor of the sole responsibility for the care and protection of the Work upon which payments have been made or the restoration of any damaged Work, or as a waiver of the right of Conway Corporation to require the fulfillment of all terms of the Contract Documents.

(d) The entire balance found to be due the Contractor, including the retained percentages, but except such sums as may be lawfully retained by Conway Corporation, shall be paid to the Contractor within thirty (30) days of completion and acceptance of the Work.

(e) The Contractor will indemnify and save Conway Corporation or Conway Corporation's agents harmless from all claims growing out of the lawful demands of Subcontractors, laborers, workmen, mechanics, materialmen, and furnishers of machinery and parts thereof, equipment, tools, and all supplies, incurred in the furtherance of the performance of the Work. The Contractor shall furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived by filing a Final Contractors Affidavit from Section 20 below. If the Contractor fails to do so, Conway Corporation may, after having notified the Contractor, either pay unpaid bills or withhold from the Contractor's unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the Contractor shall be resumed, in accordance with the terms of the Contract Documents, but in no event shall the provisions of this sentence be construed to impose any obligations upon Conway Corporation to either the Contractor, his Surety, or any third party. In paying any unpaid bills of the Contractor, any payment so made by Conway Corporation shall be considered as a payment made under the Contract Documents by Conway Corporation to the Contractor and Conway Corporation shall not be liable to the Contractor for any such payments made in good faith.

(f) Conway Corporation may withhold or, on account of subsequently discovered evidence, nullify the whole or part of any certificate to such extent as may be necessary to protect Conway Corporation from loss on account of:

- (1) Defective work not remedied,

- (2) Claims filed or reasonable evidence indicating probably filing of claims,
- (3) Failure of the Contractor to make payments properly to Subcontractors or for material or labor,
- (4) Damage to another Contractor.

When the above grounds are removed, payment shall be made for amounts withheld because of them.

20. **ACCEPTANCE OF FINAL PAYMENT AS RELEASE**

As soon as the Work has been substantially and satisfactorily completed, the Engineer will make a final estimate stating that the Work provided for under this Contract has been completed and as accepted by him under the terms and conditions thereof, with qualifications, if any, as stated. If certain parts of the Work are not completed or if certain corrections must be made in the Work even though the Work is substantially completed, the Engineer is authorized to determine the amount which in his opinion is required for completion and/or correction of the Work and such amount may be withheld from the final payment to the Contractor, pending the completion and correction as required. The balance found to be due the Contractor shall be paid by Conway Corporation within forty (40) days after the date of the final estimate. **Prior to the filing of the final estimates, the Contractor shall file with the Engineer a receipt in full from each manufacturer, Subcontractor, dealer and supplier for all equipment and material used on the Work and a complete release of all liens which may have arisen from this Contract and shall file a Final Contractor's Affidavit substantially in the form on the next page.**

FINAL CONTRACTOR'S AFFIDAVIT

STATE OF _____

COUNTY OF _____

Before me, the undersigned authority, personally appeared _____, who, after being duly sworn, deposes and says that:

- 1. Affiant is the _____ of _____ hereinafter called "Contractor" and as such makes this affidavit upon personal knowledge.
- 2. This affidavit is made for the purpose of including final payment from to Contractor for work done at (legal description): _____

pursuant to the contract or invoice dated _____

- 3. All laborers, materialmen and subcontractors who worked for Contractor under said contract have been paid in full, except for those listed below. I understand that if any subcontractor, materialmen or laborer is not paid and is not disclosed below, I may be barred from further business with Conway Corporation.

Contractor

By: _____

Print Name: _____

Print Title: _____

Print Address: _____

SWORN TO and subscribed before me this ____ day of _____, _____

By _____ (name), as _____

(title) of _____ (name of corporation),

a _____ (State) corporation, on behalf of the corporation. He/She

(please check as applicable) / _____ / is personally known to me or has produced / _____ / his/her

_____ (State) driver's licenses, or / _____ / his/her _____

_____ (type of identification) as identification.

NOTARY PUBLIC, STATE OF ARKANSAS

(Signature)

(Commission Expiration Date)

(Printed Name)

Conway Corporation shall have the right, if it so elects, to withhold sufficient money to pay any such balances until receipts in full are satisfactorily evidenced of final determination are filed with the Engineer who may then make the final estimate.

The making and acceptance of the final payment shall constitute a waiver of all claims by Conway Corporation, other than those arising from incomplete or uncorrected Work, unsettled liens, or from faulty workmanship or materials, and of all claims by the Contractor, except those previously made and still unsettled.

If the Work has been partially but substantially completed to the extent that all adjustments in the Contract sum may be made, the Engineer may, if material delay and completion is anticipated or if otherwise deemed in the interest of the Work, make the final estimate, retaining, in addition to other requirements which may be specified under payments, an amount representing the cost of the unfinished Work. Such payments shall be made under the terms and conditions governing final payment.

Neither the making of the final estimate, nor final payment, shall relieve the Contractor of his responsibility for faulty materials or workmanship, and he shall remedy any defects and pay for any damage resulting therefrom which shall appear within a period of one (1) year from the date of substantial completion. Conway Corporation shall give notice of observed defects with reasonable promptness, and all questions arising of this paragraph shall be decided by the Engineer.

21. INDEMNITY, HOLD HARMLESS AND INSURANCE

21.1 Contractor Agrees:

(a) To defend, pay on behalf of, indemnify and hold Conway Corporation harmless against any and all claims, demands, suits and Corporation harmless against any and all claims, demands, suits and judgments that may be asserted for damages or alleged damages from any type of injuries to (including death of) persons or damage to property including costs and expenses incidental thereto, arising wholly or in part from, or in connection with work performed by contractor or it's subcontractors on behalf of Conway Corporation. Contractor also agrees to waive subrogation against Conway Corporation.

(b) To defend, pay on behalf of, indemnify and hold Conway Corporation harmless from any and all claims, demands, suits and judgments or any other type of loss, damage, liability, cost or expense, including fines, penalty and clean-up costs, relating to the environmental damage, or for the violation of any law or regulation, caused by or resulting from, wholly or in part by the contractor's activities or operations of the contractor or it's subcontractors.

21.2 If suit is brought against Conway Corporation to recover for, or on account of, any matter provided for in subparagraph (a) and (b) above, at its sole cost and expense, Contractor shall, at Conway Corporation's request, and at Conway Corporations option, appear and defend, with counsel reasonably acceptable to Conway Corporation, said suit, whether or not well founded, and will pay any judgment that may be entered therein against Conway Corporation or Contractor or both. The indemnification of Conway Corporation by Contractor hereunder shall include, but not be limited to, the reasonable attorney's fees and court costs incurred by Conway Corporation or on Conway Corporation's behalf in connection with any such suit, claim, demand, or judgment. Notwithstanding anything to the contrary herein, Contractor shall not indemnify Conway Corporation for Conway Corporation's sole or gross negligence or intentional misconduct. The word "Contractor" as used in subparagraphs (a) and (b) above shall include Contractor's agents, contractors, subcontractors, representatives, servants, employees, invitees, successors, subsidiaries, affiliates or assigns, and the word "Conway Corporation" as used in this Section 21.2 shall include Conway

Corporation, the officers, directors, agents, employees, representatives, licensees, invitees (express or implied) of each, and their heirs, successors and assigns.

21.3 Without limiting any obligation or liabilities of Contractor under this Operating Agreement, Contractor, at its own expense, shall provide and maintain during the term of this Operating Agreement insurance coverage from an insurance company with an A.M. Best rating of A- or above in forms and amounts as follows:

(a) Worker's Compensation Insurance in accordance with all applicable state, federal and maritime laws, including Employer's Liability Insurance in the amounts of not less than:

- \$500,000 Bodily Injury for each accident
- \$500,000 Bodily Injury by disease, each employee
- \$500,000 Bodily Injury by disease, policy limit

The policy shall be endorsed to include a waiver of subrogation in favor of Conway Corporation and its affiliated and associated companies. Notwithstanding applicable statutory exemptions, Worker's Compensation Insurance shall be maintained regardless of the number of employees employed by Contractor or the type of work performed.

(b) Commercial General Liability Insurance including Contractual Liability Coverage, covering liability assumed (including, but not limited to, liability of Conway, Contractor's Protective Liability Coverage for work sublet, Products/Completed Operations Coverage, Broad Form Property Liability Coverage, Personal Injury Liability Coverage and Explosion, Collapse and Underground "XCU" Hazards, in the amount of not less than \$1,000,000 per occurrence / \$2,000,000 aggregate for Bodily Injury and Property Damage applying to each project or job location where work is performed for or on behalf of Conway Corporation.

(c) Commercial Automobile Liability Insurance including all owned, hired, leased, borrowed, assigned and non-owned vehicles, (Symbol 1) in the amount of not less than \$1,000,000 per occurrence.

(d) Excess/Umbrella Liability Insurance following the form of the liability insurance as required in paragraphs (a), (b) and (c) above, in the amount of not less than \$5,000,000 per occurrence.

(e) Builder's Risk/Installation Floater in an amount not less than the total cost of materials and supplies used in the project. Coverage should be provided on an all risk (special) form including the perils of testing. Conway Corporation shall be added as an additional insured.

21.4 Contractor's insurance policies required by Section 21.3.b through 21.3.e above shall include Conway Corporation and its affiliated and associated companies as additional insureds with respect to Contractor's liability arising from all acts performed or permitted under this Operating Agreement. Contractor hereby waives all rights of recourse, including any right to which another may be subrogated, against Conway Corporation for bodily injury including death and property damage. All of Contractor's policies of insurance shall be primary insurance and non-contributing with any other insurance maintained by Contractor and its affiliated and associated companies. The policies shall provide Conway Corporation with at least thirty (30) days prior written notice of cancellation or change in limits of liability. Contractor shall provide Conway Corporation with certificates of insurance issued to Conway Corporation evidencing coverage currently in effect upon execution of this Operating Agreement and for the duration of this Operating Agreement.

21.5 Contractor shall be liable for all acts and omissions of its contractors and subcontractors. Contractors and subcontractors must meet the requirements of sections 21.3.a through 21.3.e as a condition to the contracting or subcontracting of any work. The Contractor or subcontractor may provide such insurance, or Contractor may provide such insurance on behalf of each Contractor or subcontractor by means of separate and individual policies.

21.6 Contractor waives, and each insurer of Contractor shall waive, any rights of subrogation and all rights of recourse against Conway Corporation and its affiliated and associated companies, with respect to any bodily injury (including death) or property damage or Worker's Compensation benefits or related medical payments.

22. CONTRACT SECURITY

The Contractor shall within ten (10) days after the receipt of the Notice of Award furnish Conway Corporation with a Performance Bond and a Payment Bond in penal sums equal to the amount of the Contract Price, conditioned upon the performance by the Contractor of all undertakings, covenants, terms, conditions and agreements of the Contract Documents, and upon the prompt payment by the Contractor to all persons supplying labor and materials in the prosecution of the Work provided by the Contract Documents. Such Bonds shall be executed by the Contractor and a corporate bonding company licensed to transact such business in the state in which the Work is to be performed and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570. The expense of these Bonds shall be borne by the Contractor. If at any time a surety on any such Bond is declared bankrupt or loses its right to do business in the State in which the Work is to be performed or is removed from the list of Surety Companies accepted on Federal Bonds, Contractor shall within ten (10) days after notice from Conway Corporation to do so, substitute an acceptable Bond (or Bonds) in such form and sum and signed by such other surety or sureties as may be satisfactory to Conway Corporation. The premiums on such Bond shall be paid by the Contractor. No further payments shall be deemed due nor shall be made until the new surety or sureties have been furnished an acceptable Bond to Conway Corporation.

23. ASSIGNMENTS

Neither the Contractor nor Conway Corporation shall sell, transfer, assign or otherwise dispose of the Contract or any portion thereof, or of his right, title or interest therein, or his obligations thereunder, without written consent of the other party.

24. SOCIAL MEDIA

The Contractor shall not post any information on social media about Conway Corp personnel or projects without prior written approval from Conway Corp.

25. SEPARATE CONTRACTS

(a) Conway Corporation reserves the right to let other contracts in connection with this Project. The Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and the execution of their Work, and shall properly connect and coordinate his Work with theirs. If the proper execution or results of any part of the Contractor's Work depends upon the Work of any other

Contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such Work that render it unsuitable for such proper execution and results.

(b) Conway Corporation may perform additional Work related to the Project or may let other contracts containing provisions similar to these. The Contractor will afford the other Contractors who are parties to such Contracts (or Conway Corporation, if it is performing the additional Work), reasonable opportunity for the introduction and storage of materials and equipment and the execution of Work, and shall properly connect and coordinate his Work with theirs.

(c) If the performance of additional Work by other Contractors or Conway Corporation is not noted in the Contract Documents prior to the execution of the Contract, written notice thereof shall be given to the Contractor prior to starting any such additional Work. If the Contractor believes that the performance of such additional Work by Conway Corporation or others involves him in additional expense or entitles him to an extension of the Contract Time, he may make a claim as provided in Section 14 and 15.

26. SUBCONTRACTING

(a) The Contractor may utilize the services of specialty Subcontractors on those parts of the Work, which under normal contracting practices, are performed by specialty Subcontractors.

(b) The Contractor shall not award Work to Subcontractor(s), in excess of fifty (50%) percent of the Contract Price, without prior written approval of Conway Corporation.

(c) The Contractor shall be fully responsible to Conway Corporation for the acts and omissions of his Subcontractors, and of persons either directly or indirectly employed by them, as he is for the acts and omissions of persons directly employed by him.

(d) The Contractor shall cause appropriate provisions to be inserted in all subcontracts relative to the Work to bind Subcontractors to the Contractor by the terms of the Contract Documents insofar as applicable to the Work of Subcontractors and to give the Contractor the same power as regards terminating any subcontract that Conway Corporation may exercise over the Contractor under any provision of the Contract Documents.

(e) Nothing contained in this Contract shall create any contractual relation between any Subcontractor and Conway Corporation.

27. ENGINEERS AUTHORITY

(a) The Engineer shall act as Conway Corporation's representative during the construction period. He shall decide questions which may arise as to quality and acceptability of materials furnished and Work performed. He shall interpret the intent of the Contract Documents in a fair and unbiased manner. The Engineer will make visits to the site and determine if the Work is proceeding in accordance with the Contract Documents.

(b) The Contractor will be held strictly to the intent of the Contract Documents in regard to the quality of materials, workmanship and execution of the Work. Inspections may be made at the factory or fabrication plant of the source of material supply.

(c) The Engineer will not be responsible for the construction means, controls, techniques, procedures, or construction safety. The Engineer shall not be deemed the **Competent Person** as identified

in the current edition of the Occupational Safety and Health Administration Standard for Excavation and Trenches Safety System, 29 CFR 1926, Subpart P.

(d) The Engineer shall promptly make decisions relative to interpretation of the Contract Documents.

(e) The Engineer shall have authority to condemn and reject any defective Work and to suspend the Work when it is not being done properly, but the responsibility for the Work in compliance with the Contract Documents and all applicable laws, rules and regulations shall be the Contractor's.

28. **LAND AND RIGHTS-OF-WAY**

(a) Prior to issuance of Notice To Proceed, Conway Corporation shall obtain all land and rights-of-way necessary for carrying out and for the completion of the Work to be performed pursuant to the Contract Documents, unless otherwise mutually agreed.

(b) Conway Corporation shall provide to the Contractor information, which delineates and describes the lands owned and rights-of-way acquired.

(c) The Contractor shall provide at his own expense and without liability to Conway Corporation any additional land and access thereto that the Contractor may desire for temporary construction facilities, or for storage of materials.

29. **GUARANTY**

(a) The Contractor shall guarantee all materials and equipment furnished and Work performed for a period of one (1) year from the date of Substantial Completion. The Contractor warrants and guarantees for a period of one (1) year from the date of Substantial Completion of the system that the completed system is free from all defects due to faulty materials or workmanship and the Contractor shall promptly make such corrections as may be necessary by reason of such defects including the repairs of any damage to other parts of the system resulting from such defects. Conway Corporation will give notice of observed defects with reasonable promptness. In the event that the Contractor should fail to make such repairs, adjustments, or other Work that may be made necessary by such defects, Conway Corporation may do so and charge the Contractor the cost thereby incurred. The Performance Bond shall remain in full force and effect through the guarantee period.

30. **DISPUTE RESOLUTION**

The parties agree to use their best efforts to resolve any disputes that may arise out of the operation of this Agreement amicably to avoid the expense of litigation. In the event a situation arises where the parties are unable to resolve a disputed issue, then the parties shall pursue non-binding mediation. The parties agree, in good faith, to commit the resources necessary to mediate the matter in accordance with procedures to be established by the mediator. The mediator shall be chosen by agreement of the parties and the expense shared equally. The Parties further agree that all actions or proceedings arising directly or indirectly from this Agreement shall be commenced and litigated only in the Circuit Court of Faulkner County, Arkansas. The Parties hereby expressly consent to the jurisdiction over them of the above listed courts, in all actions or proceeding arising directly or indirectly from this Agreement. All disputes shall be based on Arkansas law.

31. **TAXES**

The Contractor will pay all sales, consumer, use and other similar taxes required by the law of the place where the Work is performed.

32. **USE OF COMPLETED PORTIONS**

Conway Corporation shall have the right to take possession of and use any completed or partially completed portions of the Work, notwithstanding that the time for completing the entire Work on such portions may not have expired; but such taking possession in use shall not be deemed an acceptance of any Work not completed in accordance with the Contract Documents. If such prior use of completed portions increases the cost of, or delays the Work, the Contractor shall be entitled to such extra compensation or extension of time, or both, as the Engineer may determine. Conway Corporation, in taking possession of completed portions, shall agree to accept the decision of the Engineer, on matters relating to responsibility for damages that may occur to any portion of the Work during the period of possession proceeding acceptance and final payment.

33. **DRINKING WATER AND SANITARY FACILITIES**

(a) The Contractor shall provide safe drinking water for his workmen during the construction period. The water shall be delivered through a spigot, angle jet fountain, or other approved device. Common drinking cups will be prohibited.

(b) The Contractor shall furnish adequate sanitary facilities for workmen in the work area during the construction period.

34. **GOVERNING LAW**

The interpretation of the provisions of this Agreement and of the rights of the parties hereto shall be under the laws of the State of Arkansas. Any legal action filed subsequent to the mediation in Section 30 shall be in Faulkner County, Arkansas.

35. **WAIVER**

Non-enforcement of any provision shall not constitute a waiver of that provision, nor shall it affect the enforceability of that provision or the remainder of this agreement.

DETAILED SPECIFICATIONS

PART I – CONTRACT STIPULATIONS

I-1. PLANS AND SPECIFICATIONS:

These Detailed Specifications are drawn with the object of securing first-class workmanship and materials throughout the work embraced in this contract and of securing completed structures properly and well constructed, with regard to all local conditions.

The Plans show the proposed location and details of construction. All work shall be done in workmanlike manner in complete accord with the Plans and with these Specifications.

I-2. EXTENT OF WORK:

It is mutually agreed and understood that the Contractor will furnish all tools, labor, equipment, materials, and supplies required to be furnished, and construct and complete all work shown on the Plans and described in these Specifications.

Any work or material not specifically mentioned in the Specifications, but designated on the Plans or forming an essential part of the work mentioned or designated, shall be furnished as though specifically mentioned.

I-3. CONSTRUCTION PERIOD:

The construction period stated in the contract is based upon the assumption that the Contractor will be able to get reasonable delivery on critical materials. It is not the intent of these Specifications to assess liquidated damages against the Contractor for delays beyond his control occasioned by failure to get reasonable delivery of critical materials. The Contractor will be required to furnish the Engineers two copies of each purchase order for materials and equipment as they are issued. Notice to proceed with the work will be delayed at the Contractor's volition until critical materials vital to the construction are obtained and on the site.

Extensions of time with freedom from liquidated damages will be granted the Contractor for delays occasioned by delivery of materials or equipment where such delays were, in the opinion of the Engineers, beyond the Contractor's control.

Failure to get items of materials or equipment not essential to the completion of those portions of the work, which in the opinion of the Engineer requires constant supervision by a Resident Supervising Engineer, shall not be deemed justification for waiver of liquidated damages, however, even though such delays are beyond the Contractor's control, and even though such items of materials or equipment may be essential to the actual placing in operation of a portion or all of the project. When such items of materials or equipment are delayed for reasons beyond the Contractor's control, he shall complete all other work within the specified construction period. In this situation, liquidated damages will not be assessed to cover the time required to receive and install such non-essential items provided the Contractor completes all other work within the specified construction period.

I-4. STAKING OUT WORK:

The Contractor shall furnish labor to act as rodmen, chainmen and to perform all other duties required to assist the Engineer in staking out the work. Professional services, as required, shall be obtained by Conway Corporation. All charges for labor to assist the Engineer shall be paid for by the Contractor.

I-5. STORM WATER POLLUTION PREVENTION (SWPP):

SWPP shall include all measures necessary to conform to the requirements of the Arkansas Department of Environmental Quality and the EPA Manual titled Storm Water Management for Construction Activities: Developing Pollution Prevention Plans and Best Management Practices. The Contractor shall implement and maintain the SWPP Plan. Varying construction methods and site conditions may dictate the need for changes in the SWPP plan. The Contractor shall update SWPP measures during construction as needed or as directed by the Engineer. SWPP as a unit price item shall include any required plan development, modification, labor and materials required for implementation and maintenance, and other items as required to maintain compliance.

DETAILED SPECIFICATIONS

PART II - GENERAL CONSTRUCTION SPECIFICATIONS

II-1. PLANNING AND EXECUTION OF WORK

The construction work included under these Specifications shall be so planned and executed that the various portions of the work will be carried on concurrently and the whole completed within the time allowed. Submittals shall be required on all materials.

The work shall be so planned that water and sewer service will not be unnecessarily interrupted. When it becomes necessary to take existing facilities out of service, the Contractor shall notify Conway Corporation and the Engineer in advance, and it shall be the Contractor's responsibility to properly inform all affected customers prior to the actual interruption of service.

II-2. ARKANSAS ONE CALL LAW

CONTRACTOR SHALL ABIDE BY ALL PROVISIONS OF ARKANSAS STATE LAW, CHAPTER 271, "ARKANSAS UNDERGROUND FACILITIES DAMAGE PREVENTION ACT", AND ANY SUBSEQUENT AMENDMENTS TO CHAPTER 271. CONTRACTOR SHALL BE RESPONSIBLE FOR ALL WHITE LINING OF PROPOSED EXCAVATION ROUTES AND FOR ALL NOTIFICATIONS TO ARKANSAS ONE CALL CENTER FOR ALL LOCATES NEEDED PRIOR TO ANY EXCAVATION OR DEMOLITION, IN ACCORDANCE WITH ALL PROVISIONS OF CHAPTER 271. CONWAY CORPORATION WILL NOT BE LIABLE FOR ANY DAMAGES, CONSEQUENTIAL OR INCIDENTAL, WHICH MAY OCCUR AS A RESULT OF CONTRACTOR FAILING TO ABIDE BY ALL THE PROVISIONS OF CHAPTER 271. CONTRACTOR SHALL BE SOLELY LIABLE FOR ANY AND ALL DAMAGES CAUSED BY CONTRACTOR, CONTRACTOR'S SUBCONTRACTORS, AND/OR CONTRACTOR'S ASSIGNS TO ANY UTILITY SYSTEMS, INCLUDING BUT NOT LIMITED TO CONWAY CORPORATION'S SYSTEMS.

II-3. CROSSING AND PARALLELING EXISTING UTILITIES

The construction of the water and sewer lines will require crossing and paralleling existing utilities, including storm drains, water lines, natural gas lines, sewers, underground telephone cables, underground electric lines, underground CATV lines, etc.

The approximate locations of most such utilities are shown on the Plans, but the location of individual utility services are not shown.

The owner of each utility line, as well as each property owner, shall be contacted by the Contractor prior to the construction of any crossing or parallel construction in close enough proximity to the utility or private line, to possibly cause damage to it.

If, during construction, the Contractor causes any damage to public or private lines, it shall be solely the responsibility of the Contractor to repair and or pay for the repair of said lines and any subsequent damages to the utility company or property owner. Conway Corporation shall not be held liable for any damages caused by the Contractor. In some cases change orders may be issued where unforeseen utility or private lines cause, in the opinion of the Engineer, substantial changes in the required work.

The following telephone number is listed to assist the Contractor in making the necessary contacts with the local utility systems: Arkansas One-Call, 1-800-482-8998.

The grade of the water mains shall be gradually changed to lower the line where necessary to get under existing utilities. All water mains must cross under storm drains with a minimum of one (1) foot vertical separation.

Fittings shall not be used to change the grade at these locations, unless approved by the Engineer.

The cost of all work included in this Section above this point shall be included in the unit contract price for installing pipe and will not be paid for separately.

All water and sewer mains require a minimum of ten (10) feet horizontal separation and the water main must cross over the sewer main with a minimum of one and one-half (1.5) feet vertical separation. Where these minimum separations cannot be maintained encasement pipe shall be installed as directed by the Engineer.

II-4. EXCAVATION – GENERAL

All clearing, grubbing, topsoil replacement, fence replacement, landscaping, shrubbery, and other items not listed as a unit price item but affected by the project shall not be paid for separately but shall be considered subsidiary to the unit price item for pipe.

All excavation shall be carried out accurately to the line and grade as shown on the Plans and as established by the Engineers. When excavation is carried below or beyond that required, the space shall be filled with properly compacted gravel, flowable select material, or with concrete, in accordance with the Engineer's instructions. No claim for additional compensation shall be made for such backfilling of excess excavation unless Conway Corporation or its agent is responsible for the error.

All excavation shall be dewatered before any construction is undertaken therein. Concrete shall be placed only upon dry, firm foundation material and pipe and bedding shall be laid only in dry trenches. Trenches may be dewatered by well – pointing or sump pumping. Pumping equipment shall be continuously monitored and shall be maintained in continuous operation until backfill is completed. The water displacement process shall comply with all applicable regulations and shall not cause flooding of public or private property. The Contractor shall obtain all necessary permits, where applicable (ADEQ). All costs associated with dewatering shall not be paid separately but shall be considered subsidiary to the closest representative unit price item.

Rock excavation shall be solid rock formation which cannot be excavated efficiently, in the opinion of the Engineer, without blasting, or jack hammering, by adequate power shovels or excavators of recognized standard manufacture and adequate size, well handled by skilled operators. The term “excavated efficiently” as used in this classification shall be interpreted to mean that where, in the opinion of the Engineer, rock can be excavated at a lower cost per cubic yard of useful excavation by blasting, or jackhammering, it shall be so excavated and will be classified as rock.

The volume of rock excavation in trenches will be determined by the horizontal measurement of length of trench in which rock occurs, the vertical measurement of the depth of the rock, and a width of the pipe diameter plus twenty-four inches.

All excavation not included under the classification of rock excavation shall be common excavation.

Common excavation shall include normal trench sloping and trench dewatering, backfilling, maintenance of backfill, disposal of waste materials, and all other work incident thereto.

II-5. BLASTING

Blasting will be permitted only when proper precautions are taken for the protection of persons, the work and adjacent property, and any damage done to the work or property by blasting shall be repaired by the Contractor at the Contractor’s expense. All operations involving the handling, storage and use of explosives shall be conducted with every precaution prescribed by State laws and in accordance with the latest approved rules and regulations of the United States Bureau of Mines. The location and design of powder magazines, methods of transporting explosives, and all other precautions taken to prevent accidents or damage from blasting, shall be subject to the approval of the Engineer, but the Contractor shall be liable for all injuries to or deaths of persons or damage to property caused by blasts or explosions.

The cost of all blasting, approved by the Engineer, shall be included in rock excavation and paid for as described herein.

II-6. DUCTILE IRON BACKFILL

After pipe work has been approved, trenches shall be backfilled with fine, loose earth free from clods or stones larger than two (2) inches in any dimension and of proper moisture content. This selected material shall be carefully deposited in layers of not to exceed four (4) inches in thickness on both sides of the pipe, and thoroughly and carefully compacted around the pipe until the backfill has been brought up to the spring-line of the pipe. Next, this selected material will be deposited, by hand, to a minimum height of twelve (12) inches above the top of the bell of the pipe to form a cushion above the pipe. The remainder of the backfill may then be placed by any approved method, which will not injure or disturb the pipe.

After settlement occurs, trenches shall be refilled and smoothed until all trench backfill permanently conforms to the surface of the ground or meets the approval of the Engineer. It is the intent of this specification that the contractor shall be responsible for all settlement of backfill in trenches occasioned by the work covered herein. The Contractor shall refill trenches as often as necessary to bring them back to original grade and during the period when settlement is occurring shall refill them frequently enough to maintain appearance and safety at all times. All DIP shall include polyethelene encasement as specified herein.

The cost of all work under this section shall be included in the contract prices for sewer trench or water pipe and will not be paid for separately.

II-7. PVC/FRP/GRP BEDDING/INITIAL BACKFILL

The bedding of sewer pipe (pressure and gravity) and PVC water pipe shall be completed as described herein and in accordance with the details shown on the Plans. The bedding shall extend from six (6) inches below the pipe to six (6) inches above the pipe. The bedding material shall be ¾” Concrete Rock and shall be submitted for approval by the Engineer.

| <u>Sieve Size</u> | <u>Percent Passing</u> |
|-------------------|------------------------|
| 1” | 100 |
| 3/4” | 90 - 100 |
| 1/2” | ----- |

| | | |
|-----|------|---------|
| | 3/8" | 20 - 55 |
| # 4 | | 0 - 10 |
| # 8 | | 0 - 5 |

The maximum embedment particle shall not exceed 3/4" for angular rock per AWWA C-605. The bedding material shall be compacted to 90 percent Standard Proctor Density (AASHTO T-99). The intent of this bedding is to provide uniform support for flexible PVC pipe. If rocky, muddy, wet or unstable trench bottom is encountered, the Contractor shall, at the direction of the Owner, or the Owner's representative, undercut the trench bottom as shown on the Plans and install the granular material as detailed on the Plans or as directed by the Owner or the Owner's representative.

All PVC pressure sewer and water pipe shall be laid with an approved marker ball placed approximately every fifty (50) feet and at every angular deflection. The marker ball shall be buried approximately 24" below finished grade. Any marker ball determined by the Engineer to be damaged and unsuitable for use shall be immediately removed from the job site.

Marker balls shall be Greenlee Onmi Marker, or approved equal. Marker balls shall be color coded by utility application.

Payment for marker balls shall be considered subsidiary to the unit price for pipe. Payment for Pipe Bedding shall be by the ton.

II-8. THRUST RESTRAINT

All pressure pipe shall include thrust restraint as required by anticipated working and surge pressures, soil conditions, and other applicable site conditions. Adequate backing, using Class "B" concrete shall be provided at all points of unbalanced pressure, such as bends, tees, or the end of the pipe. A minimum contact area of the backing shall be two (2) square feet. The concrete shall be contained within the designated area by metal or wood forms that are sufficiently tight as to keep the loss of material to a minimum, or by other means as approved by the Engineer. The fittings shall be wrapped in a polyethylene material before concrete is poured. Concrete for backing shall be measured by the cubic yard and paid for as Class "B" concrete.

II-9. EXCAVATION IN LANDSCAPED, CULTIVATED AND LAWN AREAS

Wherever it becomes necessary in excavating to disturb lawns, vegetation, shrubbery, landscaping, or cultivated areas, the same shall be restored to pre-construction condition as soon as practicable after completion of the backfill.

Trenches where lawn sod has been disturbed shall be backfilled in accordance with applicable provisions of Section II and compacted by hand, if necessary. The top four (4) inches of the backfill shall be topsoil (River Loam consistence) and all spoil dirt shall be removed from the surface surrounding the trench.

After replacing the sod, it shall be covered loosely with topsoil (River Loam consistence), tamped lightly to protect the roots, and sprinkled with water. Sprinkling shall then be continued at regular intervals to insure proper conditions for growth. Shrubby shall be taken up ahead of construction, stored, kept watered, and reset in such manner as to damage it as little as possible.

At the discretion of the Engineer, grass seed may be used to restore some lawn areas. Where grass seed is approved by the Engineer, the seed shall be equal to the surrounding lawn area. After the area is prepared as above, the grass seed shall be applied in an approved amount and coverage. The area shall then be raked, covered with straw and sprinkled with water. Sprinkling shall then be continued at regular intervals to insure proper conditions for growth.

If in the opinion of the Engineer, previously removed sod, vegetation, shrubbery, or other landscaping items are not suitable for reuse, then new like kind items shall be substituted for the damaged items at the Contractor's expense.

Trenches through cultivated areas shall be backfilled in accordance with applicable provisions of Section II. The top twelve (12) inches of the backfill shall be topsoil (River Loam consistence) and all spoil dirt shall be removed from the surface surrounding the trench.

The cost of all work under this Section shall be included in the contract prices for pipe and will not be paid for separately. Applicable instruments of Section 620 of the Standard Specifications for Highway Construction, Arkansas State Highway and Transportation Department, 2014 or the latest edition thereof shall supplement this section of specification by reference. The Engineer, at his discretion, may withhold a quantifiably equitable percentage of the payment for 'Trench, LF' until a thriving stand of vegetation exists over at least 80% of the area under consideration.

II-10. EXCAVATION IN ROAD-WAYS AND OTHER SPECIAL SURFACES

Where applicable Arkansas State Highway Commission, County or City ordinances or standards and specifications are more stringent than the procedures laid out in this section the applicable ordinances, standards or specifications shall be adhered to. If the resulting changes create appreciable changes in the cost of restoring road-ways or other special surfaces a change order will be issued.

TRAFFIC MAINTENANCE, TEMPORARY STRUCTURES, TRAFFIC CONTROL DEVICES AND SAFETY PROVISIONS SHALL BE IN ACCORDANCE WITH MUTCD AND AHTD DIVISION 600 GUIDELINES, PAYMENT FOR WHICH SHALL NOT BE SEPARATE BUT SHALL BE CONSIDERED SUBSIDIARY TO THE CLOSEST REPRESENTATIVE BID ITEM. In all cases, traffic flow shall be maintained.

Conway Corporation will provide necessary State Highway permits. The acquisition and cost of all other permits required will be the responsibility of the contractor. The notification, to the Authority of the right-of-way, of excavation within any right-of-way is the responsibility of the contractor

Whenever it becomes necessary in excavating for pipe trench to disturb special surfaces, such as paved or gravel roads, drives, walks, or parking areas, the original surface shall be restored after completion of the backfill operation. In these instances, special care shall be used in making the backfill to eliminate future settlement. The trench shall be backfilled with gravel or Flowable Select Material for the full depth. The surface shall be restored using the same type of surfacing materials that were used in the original surfacing.

Backfill of trench lines across and within roadways, private drives, parking lots, or walks shall be in strict accordance with the applicable provisions as stated herein and Arkansas State Highway Commission and City of Conway rules and regulations. The condition of the backfill, with special regard to the degree of compaction, shall be checked and approved by the Engineer before any surfacing is placed over the backfill.

All granular fill material placed within the limits of any road-way, private drive, parking lot or walk shall be Class 7 Aggregate Base Course at optimum moisture content and compacted with a sheep's foot vibratory roller to a minimum of ninety-five percent (95%) modified proctor density in six (6) inch maximum lifts. Finished compacted ditch lines must be free of any surface dips where ponding water could occur.

Flowable select material may be specified for backfilling ditch lines within the limits of road-ways, private drives, parking lots, walks or other uses as approved by the Engineer. The material shall be placed in close conformity with the lines, grades, dimensions, and details shown on the plans or established by the Engineer. Backfill of said trenches shall be in accordance to Arkansas State Highway Commission and City of Conway rules and regulations.

Temporary pavement restoration (cold or hot mix asphaltic concrete for temporary, hot mix only at final restoration) shall be placed immediately upon backfill of any trench across or within the limits of any asphalt or concrete surface street / parking area. The replacement of permanent surfacing shall follow as soon as practical after the completion of the backfilling operation so as to restore the roadway or special surface to its original condition and traffic capacity. If in the opinion of the Engineer the replacement of surfacing is lagging, he may, at his discretion, stop the pipe laying operation until the replacement of surfacing proceeds in a satisfactory manner.

No claims will be allowed for additional width of pavement cut and replaced occasioned by the Contractor cutting the street wider than what is required. The quantity of asphalt and concrete pavement cut and replaced will be determined by the horizontal length of pavement actually cut and replaced measured along the centerline of the trench multiplied by the minimum width of the trench plus twenty-four (24) inches. Minimum trench width shall apply. Where a width greater than the above is required and authorized by the Engineer, the actual width of pavement cut and replaced shall be used in determining the quantity of pavement cut and replaced. Where utility lines are laid at the edge of paved roads or streets, requiring less pavement cut and replaced than that specified above, the actual width of pavement cut and replaced will be used in determining the quantity of pavement cut and replaced.

The unit prices for the cutting and replacement of gravel, concrete, and asphalt surfacing as stipulated in the List of Variable Quantities shall include materials, placement, and all work incident thereto.

II-10.1. EXCAVATION IN PAVED STREETS

Excavation within paved streets and repair of the street pavement shall conform to the following requirements:

1. The edges of the pavement cut shall be neatly cut or sawn to provide a uniform appearance.
2. The minimum trench width shall be pipe O.D. plus twelve (12) inches, unless otherwise directed, or specified herein.
3. Backfill of the excavation shall be as follows:
 - a. The backfill material may be crushed stone (Class 7 aggregate base course as specified in the Arkansas State Highway Commission's "Standard Specifications for Highway Construction"), Flowable Select Material as approved by the City Engineer, other select material as approved by the City Engineer.

- b. The crushed stone or select material shall be placed in lifts not exceeding six (6) inches in thickness with each lift being brought to an optimum moisture content and compacted with a vibratory sheeps foot roller to not less than ninety-five percent (95%) modified proctor density.
 - c. The Flowable Select Material may be placed in a single pour to the required elevation of the pavement repair section or to the top of the subgrade on unimproved streets.
 - d. The backfill shall be brought to an elevation that will accommodate the finished pavement repair as required in the following paragraph 5.
- 4. Temporary pavement restoration shall be placed immediately upon backfill of any trench across or within the limits of any asphalt or concrete surface. The temporary repair shall consist of the following:
 - a. The temporary surface material shall consist of a minimum three (3) inch thickness of Cold Mix Asphalt or Asphaltic Concrete Hot Mix. A temporary surface of crushed stone base course is not suitable.
 - b. A temporary application of additional compacted crushed stone base course may be used to fill the area between the final subgrade elevation as required to accommodate the finished repair as described in paragraph 5 below and the temporary asphalt surface material.
 - c. The maximum length of time a temporary surface may remain before permanent repairs are made is forty-five (45) days, unless written approval is received, by the City Engineer, for an extension due to adverse weather conditions.
 - d. The temporary surface shall be maintained, repaired and reconstructed by the Contractor as required to maintain a smooth riding surface as determined by the City Street Department.
- 5. Permanent pavement restoration for streets (collector and arterial streets as designated on the master street plan and streets in industrial, commercial and office areas) except residential streets shall be constructed as follows:
 - a. The existing pavement, base course, subgrade material and trench backfill shall be removed to a elevation eight (8) inches below the bottom elevation of existing asphalt pavement on the street and to a width that will provide a 1 foot width of undisturbed subgrade beyond the edge of the excavated trench. The existing pavement shall be smooth cut or saw cut to provide a neat line.
 - b. An eight (8) inch thickness of 3,000 psi concrete shall be placed across the trench and exposed one (1) foot subgrade on each side of the trench. The surface of the concrete shall not extend above the elevation of the bottom of the existing street asphalt pavement. The street repair will not be deemed acceptable if a city Street Department inspection and approval of the trench backfill and area prepared to receive concrete is not received prior to pouring the concrete. The Contractor shall notify the city Street Department of a needed inspection of the repair area twenty-four (24) hours in advance of pouring the concrete.
 - c. Asphaltic Concrete Hot Mix Surface Course shall be placed on the concrete in two (2) inch maximum compacted lifts to the surface of the existing pavement.

- d. The repair for concrete streets shall be as described in paragraph a and b above, except the existing pavement, base, and trench backfill shall be removed to eight (8) inches below the existing concrete street surface and an eight (8) inch thickness of 3,000 psi concrete poured to match the existing street surface.
- e. The finished street surface shall provide a smooth ride over the repair area without humps or depressions that would create a jolt in a passing vehicle. Rough repairs will not be accepted.
6. Permanent pavement restoration for residential streets and other minor streets and alleyways not covered in paragraph 5 above shall be constructed as follows:
- a. The existing pavement, base course, subgrade material and trench backfill pavement shall be removed to an elevation six (6) inches below top elevation of existing asphalt street surface and to a width that will provide a one (1) foot width of undisturbed subgrade beyond the edge of the excavated trench. The existing pavement shall be smooth cut or saw cut to provide a neat line.
- b. Asphaltic Concrete Hot Mix Surface Course shall be placed in two (2) inch maximum lifts to the surface of the existing pavement. The street repair will not be deemed acceptable if a city Street Department inspection and approval of the trench backfill and area prepared to receive the asphalt is not received prior to placement of the final asphalt repair. The Contractor shall notify the city Street Department of a needed inspection of the repair area twenty-four (24) hours in advance of placement of final asphalt repair.
- c. The repair for concrete streets shall be as described in paragraph (a) above, except the existing pavement, base, and trench backfill shall be removed to six (6) inches below the existing concrete street surface and a six (6) inch thickness of 3,000 psi concrete poured to match the existing street surface. The street repair will not be deemed acceptable if a city Street Department inspection and approval of the trench backfill and area prepared to receive concrete is not received prior to pouring the concrete. The Contractor shall notify the city Street Department of a needed inspection of the repair area twenty-four (24) hours in advance of pouring the concrete.
- d. The finished street surface shall provide a smooth ride over the repair area without humps or depressions that would create a jolt in a passing vehicle. Rough repairs will not be accepted.
7. Sidewalks, storm drainage pipe or structures, driveways and curb and gutter removed or damaged by the work shall be reconstructed by the contractor. Open drainage ditches shall be shaped and graded to their original grade and shape.
8. For trenches running along the length of the street for distances in excess of one-hundred (100) feet, the city may require that the entire lane along the restored trench be paved with a two (2) inch thickness of asphalt.
9. The Contractor shall notify the city Street Department that the pavement restoration has been completed and request a final inspection for review of the work closure of the permit.

II-10.2. EXCAVATION IN PAVED AREAS OTHER THAN STREETS

All excavation within the limits of any paved private drive, parking lot or walk shall be restored in accordance with the applicable portions of II-8 and subpart II-8.1. Paragraph 6 above, unless otherwise directed by the Engineer.

II-10.3. EXCAVATION IN GRAVEL-SURFACED AREAS

All granular fill material placed within the limits of any gravel-surfaced road-way, private drive, parking lot or walk shall be Class 7 Aggregate Base Course at optimum moisture content and compacted with a sheeps foot vibratory roller to a minimum of ninety-five percent (95%) modified proctor density in six (6) inch maximum lifts. Finished compacted ditch lines must be free of any surface dips where ponding water could occur.

During construction operations, the gravel on the remainder of the road not occupied by the trench may be disturbed and covered with dirt from the excavation. After completion of the backfill, such dirt shall be removed as completely as possible and additional gravel placed on the road as directed by the Engineer until the road is satisfactorily restored to its original condition.

Gravel surfacing cut and replaced will be measured and paid for as the tons of gravel actually used in replacing such surfacing.

II-10.4. EXCAVATION IN UNDEVELOPED ROAD-WAYS

All granular fill material placed within the limits of any undeveloped road-way, private drive, parking lot or walk shall be Class 7 Aggregate Base Course at optimum moisture content and compacted with a sheeps foot vibratory roller to a minimum of ninety-five percent (95%) modified proctor density in 6-inch maximum lifts to the subgrade elevation and to a width of two (2) feet beyond the limits of the proposed curb. Finished compacted ditch lines must be free of any surface dips where ponding water could occur.

Flowable select material may be specified for backfilling ditch lines within the limits of road-ways, private drives, parking lots, walks or other uses as approved by the Engineer. The material shall be placed in close conformity with the lines, grades, dimensions, and details shown on the plans and to a width of two (2) feet beyond the limits of the proposed curb or as directed by the Engineer. Backfill of said trenches shall be in accordance to Arkansas State Highway Commission and City of Conway rules and regulations.

The unit prices for gravel and or Flowable Select Material as stipulated in the List of Variable Quantities shall include materials, placement, and all work incidents thereto.

II-10.5. SLOPE/DITCH BANK PROTECTION

GENERAL:

Certain areas where the construction involves drainage ditch embankments will require slope protection. This slope protection shall be provided at locations shown on the plans and / or as directed by the Engineer.

This slope protection shall consist of stone riprap of the types designated below. All work shall be in accordance with details shown on the Plans and as directed by the Engineer.

Riprap Type:

Riprap shall be furnished as follows:

Dumped Riprap – Dumped Riprap shall be in accordance with the Arkansas Highway and Transportation Department Standard Specifications for Highway Construction, Section 816, and 2014 or the latest edition thereof, and consist of a layer of dumped stones graded to a minimum thickness of two (2) feet, unless otherwise approved by the Engineer.

Materials:

Stone for Dumped Riprap shall be obtained from an approved source and be in accordance with the Arkansas Highway and Transportation Department Standard Specifications for Highway Construction 2014 Edition.

Construction:

Stone for Dumped Riprap shall be placed in such a manner as to produce a reasonably well graded mass of stone with the minimum practicable percentage of voids, and shall be constructed to the lines and grades shown on the Plans and as directed by the Engineer. Material shall be placed to its full course thickness in one operation and in such a manner as to avoid displacing the underlying material. Hand placing to a limited extent may be required but only that amount necessary to secure the results specified herein.

Geotextile Fabric:

Geotextile fabric shall be installed under Riprap for slope protection and around C-ballast and French drains for drainage and between C-ballast and fill around the structures as directed in the Soils and Foundation Recommendations or as directed by the Engineer.

Materials:

Geotextile fabric shall be a woven or non-woven synthetic fiber fabric complying with AASHTO M 288 (Type 1-french drain, Type 5-Riprap) with the requirements for Subsurface drainage and be in accordance with the Arkansas Highway and Transportation Department Standard Specifications for Highway Construction Section 816, 2014 Edition.

Construction Requirements:

The filter fabric shall be installed in such a manner that all splice joints are provided with a minimum lap according to the manufacture's recommendations or as approved by the Engineer.

Care shall be taken during the placement and installation of the material to prevent damage to the fabric. Damaged material shall be repaired by placing a piece of fabric large enough to cover the damage area and lapping beyond the damage area by a minimum of 0.6m (2 feet).

C-BALLAST:

All C-Ballast shall be size number 5 as noted in Table Number2 in the American Railway Engineering Association Manual for Railway Engineering, 1994.

Measurement and Payment:

Sheeting, shoring, bracing, dewatering, excavation and backfill, fills, C-ballast and crushed stone for structures and drainage, French drains, and Geotextile fabric will not be measured for separate payment but shall be considered subsidiary work pertaining to the several items of the Contract.

Dumped Riprap shall be measured and paid by the ton as noted on the List of Variable Quantities.

II-11. GRAVEL

Gravel for subgrade (Ballast) material in trench shall be clean washed gravel or crushed stone of one and one-half (1 ½) inch maximum size and approved by the Engineer.

For replacement of street or driveway surfacing, only crushed stone material is to be used. Crushed stone shall conform to the standard specifications for Class 7 Aggregate (SB-2) as published by the Arkansas Highway and Transportation Department.

Base course material for Asphalt or Concrete Surfacing Replacement shall be Class 7 Aggregate (SB-2), conforming to standard specifications of the AHTD.

Payment for gravel shall be by the ton.

II-12. FLOWABLE SELECT MATERIAL

Flowable Select Material used for backfill within the limits of roadways, private drives, parking lots or other uses as approved by the Engineer shall conform to Section 206 of the Standard Specifications for Highway Construction, Edition of 1996.

The Contractor shall provide sufficient supervision, labor, equipment, tools, and materials to assure proper production, delivery, and placement.

When deemed necessary by the Engineer, the flowable select material shall be contained within the designated area by metal or wood forms that are sufficiently tight as to keep the loss of material to a minimum, or by other means as approved by the Engineer. The Flowable Select Material should generally be extended to a width of two (2) feet beyond the limits of the proposed curb, edge of the roadway, private drive or parking lot.

The Flowable Select Material shall be brought up uniformly to the subgrade line or as directed by the Engineer. Placing of other material over Flowable Select Material may begin after the Flowable Select Material has taken its initial set, is stable, and does not displace under equipment.

The mix design for Flowable Select Material shall be proportioned to produce a flowable mixture without segregation. Material for one (1) cubic yard shall be as follows:

| | <u>Volume</u> | <u>Weight</u> |
|---------|---------------|---------------|
| Cement | 0.48 cft | 94 lbs |
| Fly Ash | 3.13 cft | 250 lbs |

| | | |
|-------|-----------------|----------------|
| Sand | 14.70 cft | 2,425 lbs |
| Water | <u>8.69 cft</u> | <u>542 lbs</u> |
| Total | 27.00 cft | 3,311 lbs |

When unsatisfactory results or other conditions make it necessary, a new mix design may be established.

Flowable Select Material will be measured and paid for by the cubic yard.

II-13. CONCRETE

All concrete shall be composed of aggregates, cement and water and shall be proportioned by weight in such manner as to obtain a plastic workable mix. Concrete for pipe backing, thrust restraints, encasements, replacement of concrete surfacing, etc. shall be Class “B” Concrete, 3000 psi as obtained from a local Redi-Mix Plant in accordance with ASTM C-94. Concrete aggregates shall conform to ASTM C-33.

Class “B” concrete shall contain not more than six (6) gallons of water to the sack of cement, including water in the aggregates, and not less than five (5) sacks of cement per cubic yard of concrete and have a twenty-eight (28) day compressive strength of at least 3000 psi.

Water for mixing with concrete or mortar shall be clean and free from injurious amounts of oils, acids, alkalis, salt, organic matter, or other deleterious substances. Test specimens of mortar made from the materials and the water to be used shall develop not less than ninety-five percent (95%) of the seven (7) day tensile or compressive strength of the same materials and distilled water.

Concrete shall be mixed in an approved mixer for not less than one and one-half (1 ½) minutes after all materials are in the drum and shall be deposited within thirty (30) minutes after mixing. Hand-mixed concrete will not be allowed.

All concrete shall be properly protected from too rapid curing or from freezing while green. If the weather is hot or dry, all freshly placed concrete shall be covered with matting or other suitable material and kept moist for at least twenty-four (24) hours after pouring.

In placing concrete, care shall be taken that the freshly placed mass is so placed and vibrated that there is no tendency for the coarse aggregate to segregate from the mortar, that no rock pockets are left, and the whole freshly placed mass becomes a plastic jelly-like mass but without free water in appreciable quantity on its surface. The free fall of concrete shall be held to a minimum.

Portland cement shall conform to the requirements of the Standard Specifications for Portland Cement, ASTM C-150, Type 1.

Masonry cement shall conform to the requirements of the Standard Specifications for Masonry Cement, ASTM C-91.

Concrete for backing of bends, tees and hydrants, and encasement shall be measured and paid for as Class “B” concrete. The concrete shall be contained within the designated area by metal or wood forms that are sufficiently tight as to keep the loss of material to a minimum, or by other means as approved by the Engineer. These fittings shall be wrapped in a polyethylene material before concrete is poured.

Pre-bagged concrete (SAKRETE, QUICRETE, etc.) may be used for pipe backing and thrust restraints in some instances at the approval of the Engineer. Concrete bag mix must not be used to “dry pack” behind fittings, hydrants, etc., with the bag placed into position unopened. If used, concrete mix must be opened, contents mixed with water in a mortar box or wheelbarrow; and then the “mixed” concrete properly placed in position where permitted.

The prices for concrete shall include materials, form work, mixing, placing, curing, finishing, and all other work incident thereto.

The lump sum contract price shall include the quantity of Class “B” concrete given in the List of Variable Quantities and the appropriate contract unit prices will be used to adjust the contract price for variation of actual quantities from those estimated.

II-13.1 CONCRETE FORM WORK

SCOPE

Work in this section includes all labor, plant and material necessary to furnish and install all concrete formwork required by the project. Concrete formwork shall conform to all requirements of current editions of ACI 301 "Specifications for Structural Concrete for Buildings" and ACI 318 "Building Code Requirements for Reinforced Concrete" and ACI 347 "Recommended Practice for Concrete Formwork" except as modified herein.

MATERIALS

Forms:

Forms shall be of wood, metal, highly water resistant plywood, or other material approved by the Engineer. Forms for sections greater than 18" thick shall be of wood. Form surfaces shall be smooth and free from irregularities, dents, sags, or holes when used for permanently exposed surfaces. Bolts and rods used for internal ties shall be so arranged that, when the forms are removed, all metal will not be less than two (2) inches from any concrete surface. Wire ties will not be permitted where concrete surface will be exposed to weathering, and discoloration would be objectionable. Exposed concrete shall have approved form liners of masonite or plywood, or shall be constructed of smooth surfaced plywood.

Corner Forms:

Corner forms forming 3/4 inch chamfers or as otherwise specified on plans, shall be used on all outside corners that are to be exposed in the finished structure. Chamfer forms shall be of molded plastic or polyvinyl chloride chamfer strips. Use one style of form throughout the project. The type to be used shall be submitted to the Engineer for approval.

Rustication and Score Line Strips:

Rustication and Score Line Strips shall be a non-absorbent material such as extruded polyvinyl chloride, plastic, fiberglass or metal or they may be milled from a good quality lumber and well sealed to prevent

moisture absorption, wood strips may not have protruding splinters which may become embedded in the concrete. Sealing wood shall be accomplished by emersion or brushing on two coats of form coating.

Form Ties:

Form Ties for concrete shall have an approved waterstop barrier to prevent seepage of moisture along the ties. The ends of the metal after breaking off shall be minimum of 2 inches from the finished wall face. Submit samples to the Engineer for review.

Form Coatings:

Provide commercial formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds.

Cylindrical Columns and Supports:

Form round-section members with paper or fiber tubes, constructed of laminated plies using water-resistant type adhesive with wax-impregnated exterior for weather and moisture protection. Provide units with sufficient wall thickness to resist loads imposed by wet concrete without deformation.

Inserts:

Provide metal inserts, anchor bolts and other embedded items for anchorage of materials or equipment to concrete construction, not supplied by other trades and as required for the work.

Provide sheet metal reglets:

Provide sheet metal reglets formed of the same type and gage as the flashing metal to be built into the reglets, unless otherwise indicated. Where resilient or elastomeric sheet flashing or bituminous membranes are terminated in reglets, provide reglets of not less than 26 gage galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.

Stay-in-Place Corrugated Steel Forms:

Fabricate of galvanized steel sheets complying with AISC "Specification for Design of Light Gauge Cold-Formed Steel Structures". Depth of ribs and metal gage as indicated or, if not indicated, not less than 22 ga. unless heavier gage required due to project conditions.

Side forms of footings:

Side forms of footings may be omitted and concrete placed directly against excavation only when requested by Contractor and accepted by Engineer. When forms are omitted, provide additional concrete required beyond the minimum design profiles and dimensions of the footings as indicated to provide minimum concrete coverage for reinforcement. Contractor shall maintain the earth form to proper alignment with no sloughing of material into the minimum design profile shown on the drawings.

Forms:

Forms shall be built true to line and grade, and be mortartight and sufficiently rigid to prevent displacement or sagging between supports. All formwork and shoring shall be designed for the construction loads to be placed on them, and the design and construction of said forms shall be in accordance with ACI Standard "Recommended Practice for Concrete Formwork" (ACI 347). The structural adequacy of the formwork shall rest with the Contractor. All forms shall be so constructed that they can be removed without hammering or prying against the concrete.

Before concrete placement:

Before concrete placement check the lines and levels of erected formwork. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.

During concrete placement:

During concrete placement check formwork and related supports to ensure that forms are not displaced and that completed work will be within specified tolerances.

Provide temporary openings:

Provide temporary openings in wall forms, columns forms and at other locations necessary to permit inspection and clean-out.

Embedded Items:

Before placing concrete, care shall be taken to determine that any embedded metal or wood parts are firmly and securely fastened in their correct location as indicated. Use setting drawings, diagrams, instruction and directions provided by suppliers of items attached thereto. They shall be thoroughly clear and free from coating, rust, scale, oil, or any foreign matter. Embedding of wood in concrete shall be avoided whenever possible, metal being used instead. If wood is allowed, it shall be thoroughly wetted before concrete is placed.

Form Removal:

Forms shall not be removed without approval of the Engineer. Forms shall not be removed before the minimum times given below, or longer if job control tests indicate the concrete has not attained strength specified below, except when specifically authorized by the Engineer.

| | |
|---|---|
| Beams and Slabs | 14 days |
| Walls up to 12" Thick and Vertical Surfaces | 1 day if minimum daily temperature is above 50°F., 3 days otherwise |
| Columns | 5 days |
| Walls greater than 12" Thick | 3 days if minimum daily temperature is above 50°F., 7 days otherwise. |

In general, forms or shores for supported slabs and beams shall not be removed until the concrete, so supported, has acquired 70% of its design strength; except where loads other than the dead weight of the concrete are added, the shores shall not be removed until 24 hours after the concrete has obtained 90% of its design strength. Forms shall be removed immediately after expiration of the lapsed times specified above or sooner, if required by the Engineer, where concrete is to receive a rubbed finish.

II-13.2 CONCRETE REINFORCEMENT

SCOPE

The extent of concrete reinforcement is shown on the drawings and in schedules.

The work includes fabrication and placement of reinforcement for cast-in-place concrete, including bars, welded wire fabric, ties and supports.

Codes and Standards:

Comply with requirements of current edition of the following codes and standards, except as herein modified:

American Welding Society (AWS), AWS D1.4 "Recommended Practices for Welding Reinforcing Steel, Metal Inserts and Connections in Reinforced Concrete Construction".

Concrete Reinforcing Steel Institute (CRSI), "Manual of Standard Practice".

American Concrete Institute (ACI), ACI 318 "Building Code Requirements for Reinforced Concrete".

Mill Certificates; Concrete Reinforcement:

Submit steel producer's certificates of mill analysis, tensile and bend tests for reinforcing steel.

Delivery, Handling and Storage:

Deliver reinforcement to the project site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams.

Store concrete reinforcement materials at the site to prevent damage and accumulation of dirt or excessive rust.

MATERIALS

Steel reinforcement:

Steel reinforcement shall conform to the "Specification for Deformed Billet Steel Bars for Concrete Reinforcement," ASTM A615, Grade 60.

Wire fabric reinforcement:

Wire fabric reinforcement shall conform to the current "Specifications for Welded Steel Wire Fabric for Concrete Reinforcement," ASTM A-185, or "Specifications for Welded Deformed Steel Wire Fabric for Concrete Reinforcement," ASTM A-497.

Supports for Reinforcement:

Supports for Reinforcement shall be bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place. Use only wire bar type supports complying with CRSI recommendations, unless otherwise indicated. Do not use wood, brick, and other unacceptable materials.

SPLICES

No splices of bars, except when shown on the Plans, will be permitted without the approval of the Engineer. Minimum lap splice shall be 40 bar diameters unless specifically detailed or noted otherwise on drawings. Splices in adjacent bars shall be staggered a minimum distance equal to the lap splice length. Bars shall be rigidly clamped or wired at all splices in a manner approved by the Engineer. Welding may not be used except with the specific approval of the Engineer. Welding, when approved, shall conform to the AWS D1.4. Welded wire fabric shall be lap spliced a minimum of 2 inches plus the wire spacing at edge laps and end laps.

DETAILING & FABRICATION

Furnish Shop Detail and Field Placing Drawings for all reinforcing steel for approval of the Engineer. Shop Drawings shall include reinforcing, placing plans and details indicating size, location, arrangement, splice locations, bending diagrams, placing sequence, etc. Placing Drawings shall be in sufficient detail to allow field personnel to accurately place reinforcing. Shop and Placing Drawings shall be prepared in accordance with "Manual of Standard Practice for Detailing Reinforced Concrete Structures" ACI 315, current edition. Photographic copies of engineering drawings shall not be used as placing drawings.

Reinforcement bars shall be bent cold to the shapes indicated on the Plans. Fabrication tolerances, fabrication, and detailing of steel reinforcement shall conform to the "Manual of Standard Practice for Detailing Reinforced Concrete Structures" (ACI-315).

Steel reinforcement shall be of the type and size, cut to lengths and bent to shapes as indicated on the Plans. Unless otherwise indicated, hooks, lap splices, embedment lengths, and other details of reinforcement shall be provided as set forth in the ACI Building Code (ACI 318) to develop the full tensile strength of the bar.

PLACING REINFORCEMENT

All reinforcement at the time concrete is placed shall be free from mud, oil, paint, excessive rust and excessive mill scale or any other coating that would destroy or reduce its bond with the concrete.

All reinforcement shall be secured in place true to lines and grades indicated by use of metal or concrete supports, spacers, or ties as approved by the Engineer. The bars and mesh shall be tightly secured against displacement by ties of annealed wire, or suitable clips at intersections. Wall reinforcement shall be supported

and held securely against displacement in its proper position clear of the forms as indicated on the Plans. Placing tolerance shall conform to ACI 318.

Nails shall not be driven into the wall forms to support reinforcement nor shall any other device used for this purpose come in contact with the form on the liquid side of any liquid containing structure. Metal devices used to provide the required clear distances from reinforcing steel to liquid side of concrete surfaces shall be galvanized, or shall be as approved by the Engineer.

The main reinforcement of slabs in contact with the ground shall be supported in its proper position, as indicated on the Plans, by means of precast cement mortar blocks, of approved dimensions, resting on the slabs' subbase. Such precast blocks shall be made of mortar composed of 1 part cement to 2 parts sand and shall have a loop of No. 16 black annealed wire cast into each block. The length of the wire loop shall be sufficient to allow the block to be tied to the reinforcement. Blocks shall be spaced at the intervals required to maintain the reinforcement in its required position in the slab during the placing of the concrete. The slab reinforcement shall not be used to support planking or runways used in placing concrete.

Bending of bars embedded in hardened concrete will not be permitted except when specifically approved by the Engineer for the field condition encountered. Field cutting of bars will only be permitted when specifically approved by the Engineer.

In the case of exposed finish surfaces of floor slabs, galleries, deck slabs, and beams, metal chairs, spacers and other metal accessories necessary to provide the required clear distances and proper alignment and spacing between bars shall be galvanized or shall have plastic protective covering over portions in contact with forms.

CONCRETE PROTECTION FOR REINFORCEMENT

Steel reinforcement shall be placed and held in position so that the concrete cover, as measured from the surface of the bar shall be the following, except as otherwise shown, on the drawings:

Slabs and joists:

Top and bottom bars for dry conditions:

| | |
|----------------------|-----------|
| #14 and #18 bars | 1½ inches |
| #11 bars and smaller | ¾ inches |

Formed concrete surfaces exposed to earth, water, or weather, and over or in contact with sewage and for bottoms bearing on work mat, or slabs supporting earth cover:

| | |
|---------------------|-----------|
| #5 bars and smaller | 1½ inches |
| #6 through #18 bars | 2 inches |

Footings and base slabs:

At formed surfaces and bottoms
bearing on concrete work mat: 2 inches

At unformed surfaces and bottoms
in contact with earth: 3 inches

Top of footings: Same as slabs

Over top of piles: 2 inches

Walls:

For dry conditions:

#11 bars and smaller 3/4 inches

#14 bars and #18 bars 1½ inches

Formed concrete surfaces exposed to earth, water, sewage, weather, or in contact with ground:

Circular tanks with ring tension 2 inches

All others 2 inches

Beams and Columns:

For dry conditions:

Stirrups, spirals, and ties 1 inches

Principal reinforcement 2 inches

Exposed to earth, water, sewage, or weather:

Stirrups and ties 2 inches

Principal reinforcement 2½ inches

ADDITIONAL REINFORCEMENT

The Contractor shall provide on the job site additional reinforcement to be used at locations as directed by the Engineer. The contract price shall include all labor and material charges for handling, field bending, bar supports, and placing of said reinforcement. Additional reinforcement shall be ASTM A615, Grade 60. Bars shall not be field bent unless approved by the Engineer. Additional steel shall be as follows:

No. 4 bars - 3 pieces 20'-0" long

No. 5 bars - 3 pieces 20'-0" long

II-13.3 CAST-IN-PLACE CONCRETE

GENERAL

Standards:

Concrete work shall conform to all requirements of current edition of ACI 301 "Specifications for Structural Concrete for Buildings", ACI 318 "Building Code Requirements for Reinforced Concrete" except as modified herein. All ASTM and ACI Standards shall be the latest editions.

Scope:

Work consists of furnishing all plant, labor, materials, equipment and appliances, and performing all operations in connection with installation of the concrete work, complete, in strict accordance with the Specifications and Drawings.

Inspection:

Embedded items must be inspected and tests for concrete and other materials shall have been completed and approved by the Engineer before concrete is placed.

Slab on Earth:

Before proceeding to construct concrete slabs on earth, all pipes under concrete floor on earth shall have received the required tests. All backfill and fill material under slabs on grade shall be compacted in 6" layers to 95% maximum density as measured by AASHTO T99 test method. Unsuitable material encountered in subgrade shall be removed and replaced with material approved by the Engineer. Subgrade shall be brought to true, even plane and compacted to solid bearing. Gravel drainage fill shall be placed and compacted where shown on Drawings.

MATERIALS

All concrete materials shall conform to the latest revised ASTM Designations listed below and shall be subject to the approval of the Engineer:

Coarse Aggregate:

Coarse Aggregate shall be crushed stone conforming to ASTM C-33 with a maximum size of 1½".

Fine Aggregate:

Fine Aggregate shall conform to ASTM C-33 and shall be washed river sand composed of clean, uncoated grains of strong materials.

Cement:

Cement shall be Portland cement conforming to ASTM Specification C-150, Type I, Type IA, Type III, or Type IIIA. Only one brand of cement shall be used for exposed concrete.

Water:

Clean, fresh and free from oil, acids, alkali, vegetable, sewage, organic or other deleterious matter.

Cement admixture:

Cement admixture may be used for all concrete at the contractor's option. Admixtures shall be a cement dispersing agent used in conformance with manufacturer's directions. This shall be, or equal to, "No. 3

Pozzolith", as manufactured by Master Builder's Co. Contractor shall notify Engineer that he is taking this option. No other admixtures shall be used without the written permission of the Engineer.

Air-Entraining Admixtures:

Air-Entraining Admixtures shall conform to ASTM C-260.

Premolded Expansion Joint Filler Strips:

Premolded Expansion Joint Filler Strips shall be non-extruding type conforming to the current AASHTO Designation M213.

Non-Shrink Grout:

Non-Shrink Grout shall be Pre-mixed "Embeco" as manufactured by Master Builder's, "Ferrolith G" as manufactured by Sonneborn-Contech, or approved equal. Type as recommended by the manufacturer for the particular applications.

Liquid Curing Compound/Sealer:

Liquid Curing Compound/Sealer shall be "MC 429" as manufactured by Master Builder's, "Kure-N-Seal" as manufactured by Sonneborn-Contech, "Thompson's Water Seal" as manufactured by E. A. Thompson, Inc. or approved equal.

Granular Drainage Fill:

Required under all interior building concrete slabs on grade and where noted on the drawings. It shall be either:

- (1) Clean, washed gravel with particle sizes grading from maximum of 1½" down to not more than 5% passing a No. 4 sieve.
- (2) Clean, washed coarse sand with particular sizes ranging from pea gravel down to largest grains permitted in concrete sand.

Joint Waterproofing:

Joint Waterproofing for existing structures or as required on the plans shall be Ironite (Metallic) Waterproofing as manufactured by the Ironite Company of Chicago, Illinois or approved equal.

Vapor Barrier:

Vapor Barrier required under all interior concrete slabs on grade and where noted in Drawings shall be polyethylene sheet, 6 mil thickness conforming to ASTM No. 154.

Liquid Chemical Hardener:

Liquid Chemical Hardener shall be the magnesium fluosilicate and zinc fluosilicate type "Lapidolith" as manufactured by Sonneborn-Contech, Inc., "Symons Quad Cure" as manufactured by Symons Corp., "Hornolith" as manufactured by W. R. Grace & Co., or approved equal.

II-13.3.2.14 Cementous Waterproofing and Finish Compound:

Cementous Waterproofing and Finish Compound shall be "ThoroSeal Plaster Mix" and "Acryl 60" as manufactured by Standard Dry Wall Products or equal.

QUALITY AND CONTROL

Design:

Concrete shall be composed of Portland cement, fine aggregate, coarse aggregate and water. All concrete shall be designed by an independent testing laboratory, approved by the Engineer, in accordance with the A.C.I. Standard "Recommended Practice for Selecting Proportions for Concrete" (ACI 211) to produce the strength for each class of concrete specified, and with slumps and maximum sizes of coarse aggregate in accordance with the requirements outlined below. The concrete shall be so designed that the concrete materials will not segregate and excessive bleeding will not occur. Submit laboratory trial mix designs and test results for each class of concrete to be used to the Engineer for approval before any concrete is placed. Any costs of the testing laboratory for designing concrete mixes shall be borne by the Contractor. Concrete strengths shall be as follows:

Class A Concrete - 4000 psi @ 28 days (Air entrained) - six (6) sacks cement minimum

Class B Concrete - 3000 psi @ 28 days - five (5) sacks cement minimum

Class C Concrete - 2000 psi @ 28 days

Class D Concrete - 3000 psi @ 28 days (3/8" Max. Aggregate Size "Pea Gravel")

MAXIMUM SLUMPS FOR VARIOUS TYPES OF CONSTRUCTION

| <u>Types of Construction</u> | <u>Hand Placed Maximum</u> | <u>High Frequency Vibrator Used---Maximum</u> |
|---|--------------------------------|---|
| Reinforced Foundation, Walls and Footings | 5" | 3" |
| Slabs, Beams and Reinforced Walls | 6" | 5" |
| Building Columns | 5" | 5" |
| Pavements | 3" | 3" |

The slump shall not exceed the maximum specified above for the type of construction for which it is to be used. The 28 day compressive strength determined in accordance with current ASTM Specifications C-39 and C-31 and with specimens cured in accordance with C-31 shall not be less than that shown above for the specified class of concrete. No water will be added after the amount specified by the mix design.

Production of Concrete:

All ready-mix concrete shall be batched, mixed and transported in accordance with "Specifications for Ready-Mixed Concrete (ASTM C-94)". Plant equipment and facilities shall conform to the "Check List for Certification of Ready-Mixed Concrete Production Facilities" of the National Ready-Mixed Concrete Association. Site mixed concrete shall conform to the requirements of "Specifications for Structural Concrete" (ACI 301). The Contractor may elect to use either ready-mixed or site mixed concrete for this project provided he informs the Engineer of his choice.

Laboratory Testing:

The Owner shall engage an independent testing laboratory to conduct concrete tests. Contractor will be responsible for sampling concrete for test cylinders, recording, and delivering them to the laboratory, providing all materials required, and for making all slump tests in the field directed by the Engineer. **All costs in connection with work performed by the laboratory will be directed to and paid by the Contractor.** All test results shall be directed to the Engineer. The Contractor shall be responsible for the costs of work performed by the laboratory required for redesign of concrete proportions and additional testing of in place concrete when cylinders indicate low strength concrete has occurred.

At least one test shall be made on fresh concrete for each sixty (60) cu. yds. of each class of concrete (or fraction thereof) placed on any one day and in any event, not less than one test for each class of concrete each day it is used. Testing shall be done in accordance with the following ASTM Specifications, latest edition:

- C172 - Standard Method of Sampling Fresh Concrete
- C31 - Standard Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Field
- C39 - Standard Method of Test of Compressive Strength of Molded Concrete Cylinders
- C143 - Standard Method of Slump Test for Consistency of Portland Cement Concrete

Before any concrete is poured, the Contractor shall construct a storage box in accordance with ASTM Specification C31. Each set of tests shall consist of one slump test and four compression test cylinders. All cylinders shall be kept in the storage box for the first 24 hours. The four cylinders shall be laboratory cured and tested for adequacy of the design for strength of the concrete in accordance with ASTM Specification C31. One cylinder shall be tested at 7 days and two at 28 days. The fourth cylinder will be retained for subsequent testing if required by the Engineer.

Failure of Concrete to Meet Strength Requirements:

The concrete shall be considered acceptable if, for any one class of concrete, the average of all tests of any five consecutive sets is equal to or greater than the specified strength, provided that no more than one test in ten falls between 90% and 100% of the specified strength. The only cylinders to be used for determination of concrete acceptability will be those laboratory cured and tested at 28 days. When it appears the tests of laboratory-cured cylinders will fail to meet these requirements, the Engineer may require changes in the proportions of concrete for the remainder of the work in order to meet the strength requirements. In addition, the Engineer may also require additional curing on portions of the concrete already poured.

The Engineer may also require tests in accordance with Methods of Securing, Preparing and Testing Specimen from Hardened Concrete for Compressive and Flexural Strengths (ASTM Specifications C42) when the concrete cylinder tests fail to meet strength requirements. In the event there still is question as to the quality of the concrete in the structure, the Engineer may require load tests for that portion where the

questionable concrete has been placed. Such load tests will be made as outlined in American Concrete Institute Building Code, (ACI 318), and shall be at the expense of the Contractor. In-place testing shall be at the expense of the Contractor.

Removal of Under Strength Concrete:

If the above tests indicate that a particular batch of previously placed concrete is under strength, the Engineer may direct that the under strength batch be removed and replaced. The removal of the under strength concrete shall also include the removal of concrete that has obtained the required strength if the Engineer deems this necessary to obtain structural or visible continuity when the concrete is replaced.

The removal, and replacement of any under strength concrete, shall be made at no additional cost to the Owner. This shall include any new formwork required or any reinforcing steel that may be required. The Owner shall not be charged any additional costs for any extra work that is required because of the failure of any concrete to meet the minimum test requirements.

Concrete Strengths:

The various strengths of concrete shall be installed as follows:

- (1) Class A, 4000 psi, Air-Entrained shall be used for all liquid containing structures, (footings, base slabs, walls and roofs.)
- (2) Class B, 3000 psi shall be used for all non-liquid containing structures.
- (3) Class C, 2000 psi shall be used for all non-structural fill concrete, mud slabs, overexcavation concrete, etc.
- (4) Class D, 3000 psi pea gravel concrete (maximum aggregate size of 3/8") shall be used for all masonry fill, masonry columns, and masonry bond beams.

INSTALLATION

Preparation Before Placing:

Water shall be removed from excavations before concrete is deposited. Hardened concrete, wood chips, shavings, and other debris shall be removed from interior of forms and inner surfaces of mixing and conveying equipment. Wood forms shall be oiled or, except in freezing weather, wetted with water in advance of pouring. Reinforcement shall be secured in position, inspected and approved by the Engineer before starting pouring of concrete.

Conveying:

Concrete shall be conveyed from mixer to forms as rapidly as practicable and by methods which will prevent segregation or loss of ingredients. It shall be deposited as nearly as practicable in its final position. Chutes used shall be such that concrete slides in them and does not flow. Chutes, if permitted, shall have a slope of less than 1 on 2. Where a vertical drop greater than five (5) feet is necessary, placement shall be through elephant trunks or similar devices to prevent segregation. Ready-mixed concrete shall be delivered with a load ticket showing mix proportions and the time mixing began for each load. The load ticket shall be furnished to the Engineer.

Placing:

Concrete shall be placed before initial set has occurred and in no event after it has contained its water content for more than 30 minutes for site mixed concrete or 1 hour for ready-mixed concrete. Unless otherwise specified, all concrete shall be placed upon clean, damp surfaces free from running water, or upon properly consolidated fills, but never upon soft mud or dry, porous earth. Deposit concrete continuously or in layers of such thickness that no concrete will be placed on concrete which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. The concrete shall be compacted and worked in an approved manner into all corners and angles of the forms and around reinforcement and embedded fixtures as to prevent segregation of the coarse aggregate. Construction of forms for the lifts of vertical walls shall be such as to make all parts of the walls easily accessible for the placement, spading, and consolidation of the concrete as specified herein.

Vibration:

All concrete shall be placed with the aid of mechanical vibration equipment as approved by the Engineer. Vibration shall be transmitted directly to the concrete; in no case shall it be transmitted through forms. The duration of vibration at any location in the forms shall be held to the minimum necessary to produce thorough compaction. Vibrations shall be supplemented by forking or spading by hand, and adjacent to the forms on exposed faces in order to secure smooth, dense and even surfaces, with particular care being taken to prevent coarse aggregate from becoming set too near any surfaces that are to receive rubbed finish.

Construction Joints:

Construction joints shall be formed as indicated on the Drawings or as approved or directed by the Engineer. Contractor shall submit a joint location plan for each structure to the Engineer for approval 28 days prior to commencing concrete operations on that structure. Where indicated or required, dowel rods shall be used. All concrete at the joints shall have been in place not less than 12 hours, and longer if so directed by the Engineer, before concrete resting thereon is placed. Before placing is resumed, or commenced, excess water and laitance shall be removed, and concrete shall be cut away, where necessary, to insure a strong dense concrete at the joint. In order to secure adequate bond, the surface of concrete already in place shall be cleaned, roughened, and then spread with a one-half (1/2) inch layer of mortar of the same cement-sand ratio as is used in the concrete, immediately before the new concrete is deposited. The unit of operation is not to exceed 40 feet in any horizontal direction, unless otherwise required by the Drawings. Construction joints, if required, shall be located near the mid-point spans for slabs, beams or girders. Joints in columns or piers shall be made at the underside of the deepest beam or girder at least five (5) hours before any overhead work is placed thereon. Joints not shown or specified shall be so located as to least impair strength and appearance of work. Vertical joints in wall footings shall be reduced to a minimum. Placement of concrete shall be at such a rate that surfaces of concrete not carried to joint levels will not have attained initial set before additional concrete is placed thereon. Girders, beams and slabs shall be placed in one operation. To insure a level straight joint in exposed vertical surfaces, a strip of dressed lumber may be tacked to the inside of the forms at the construction joint. The concrete shall be poured to a point one (1) inch above the underside of the strip. The strip shall be removed one (1) hour after concrete has been placed and any irregularities in the joint line leveled off with a wood float and all laitance removed. Waterstops shall be installed in all construction joints below grade or in liquid containing structures as noted on the Plans. Install as per Manufacture Recommendations.

Patching:

Any concrete which is not formed as shown on the Plans, or for any reason is out of alignment or level or shows a defective surface shall be considered as not conforming with the intent of these Specifications and shall be removed from job by Contractor at his expense, unless the Engineer grants permission to patch defective area, which shall be done in accordance with the following procedure. Permission to patch any such area shall not be considered a waiver of the Engineer's right to require complete removal of defective work if patching does not, in his opinion, satisfactorily restore quality and appearance of surface. Suitable non-shrink, latex or epoxy mortar shall be used for patching and repairing defective surface if directed by the Engineer.

After removing forms, all concrete surfaces shall be inspected and any poor joints, voids, stone pockets, all tie holes, or other defective areas shall be patched, if permitted by the Engineer. Where necessary, defective areas shall be chipped away to a depth of not less than one (1) inch with edges perpendicular to the surface. Area to be patched and a space at least six (6) inches wide entirely surrounding it shall be wetted to prevent absorption of water from the patching mortar. A grout of equal parts Portland cement and sand, with sufficient water to produce a brushing consistency, shall then be well brushed into the surface followed immediately by the patching mortar. The patch shall be made of the same material and of approximately the same proportions and shall not be richer than 1 part cement to 3 parts sand. White Portland cement shall be substituted for a part of the gray Portland cement to match color of the surrounding concrete. The proportion of white and gray cements shall be determined by making a trail patch. The amount of mixing water shall be as little as consistent with the requirements of handling and placing. The mortar shall be retempered without the addition of water by allowing it to stand for a period of one (1) hour during which time it shall be mixed occasionally with a trowel to prevent setting.

The mortar shall be thoroughly compacted into place and screeded off so as to leave patch slightly higher than surrounding surface. It shall then be left undisturbed for a period of 1 to 2 hours to permit initial shrinkage before being finally finished. The patch shall be finished in such a manner as to match the adjoining surface. On surfaces where unlined forms have been used, the final finish shall be obtained by striking off the surface with a straightedge spanning the patch and held parallel to the direction of the form marks.

Tie holes left by withdrawal of rods or the holes left by removal of ends of ties shall be filled solid with mortar after first being thoroughly wetted.

SLAB FINISHES

Exterior Concrete Walks:

The concrete shall be deposited in the forms upon the wetted subgrade to such depth that when it is compacted and finished, the top shall be at the required elevation. It shall be thoroughly consolidated and the edges along the forms spaded to prevent honeycomb. The top shall then be struck off with a straightedge and tamped or vibrated sufficiently to flush mortar to the surface, after which it shall be finished with a wood float to a smooth and even surface and lightly broomed. Edges shall be rounded with a ¼" radius, including edges at joints.

Install ½" thick, full depth premolded expansion joints where walks abut adjacent construction or change direction and at intervals not to exceed 25 feet o.c. Provide dummy grooved joints spaced not more than 5'-0" o.c. in all walks unless otherwise indicated. Dummy joints shall be 1/3 depth of slab and 3/8" wide at top.

Slope independent walks ¼" per foot across the width of the walk in the direction of slope of finish grading or crown in the center. Walks adjacent to the building shall slope ¼" per foot away from the building. Walks adjacent to concrete curbs shall slope ¼" per foot to drain across the curb into the gutter.

Interior Slabs:

Interior slabs that are to be exposed in finish work shall be finished by tamping the concrete with special tools to force the coarse aggregate below the surface, then screeding and floating with straightedges to bring the surface to the required finish level. While the concrete is still green but sufficiently hardened to bear a man's weight without deep imprint, it shall be wood floated to a true and even plane with no coarse aggregate visible. Sufficient pressure shall be used on the wood floats to bring moisture to the surface. After surface moisture has disappeared, surfaces shall be steel-trowelled to a smooth, even, impervious finish, free from trowel marks. After cement has set enough to ring the trowel, surface of all slabs shall be given a second steel trowelling to a burnished finish. Surface plane tolerance shall not exceed 1/8" in 10 feet when measured with a 10 foot straight edge.

Interior Slabs Receiving Grout

Interior slabs to receive grout fill or mortar setting bed shall be finished by tamping concrete with special tools to force coarse aggregate below the surface, and screeded with straightedges to bring surface to finish plane with a tolerance not exceeding ¼" in 2 feet. Surface shall be left roughened sufficiently to produce good bond with topping material. Use stiff brushes, brooms or rakes as necessary.

Top and Bottom Slabs:

Top and bottom slabs of all structures and water carrying conduits except as noted otherwise on the Plans shall be finished as follows: The top of the slab shall be screeded to grade and cross section; lightly tamped as required to bring up a good bed of mortar for finishing and re-screeded as necessary. The surface shall then be finished with a wood float and leveling darby. No further finish will be required on top slabs of structures or conduits which are to be buried. In the case of all exposed top slabs of structures and conduits, they shall be given a final wood float and a lightly broomed, slip resistant finish to a uniform surface which conforms with accuracy to required shape, slope and grade. Slabs shall be edged as appropriate. No liquid hardener is to be applied to these surfaces.

Interior Floor Slabs Not Receiving Floor Covering:

Interior floor slabs that are not to receive any finish floor covering shall be "slip resistant finish" as follows: The top surface shall be steel trowelled as noted in (G6.5.2) above and have a final finish applied by brushing lightly with a soft bristle brush to form a slightly roughened surface.

Basin Floor Surfaces:

The floor surfaces of basins in which raking mechanisms are to be installed shall be finished, as indicated on the Drawings, by sweeping in cement grout with the mechanism. The cement grout to be used shall be composed of one part Portland cement and two parts sand.

The sweeping-in process shall be performed under the supervision of a factory representative of the equipment manufacturer.

The slab upon which the grout is to be applied shall be finished in accordance with the provisions of paragraph (G6.5.4) above except that after leveling and floating, it shall be raked in such a manner as to provide a good bond for the grout. Raking shall develop a pattern with a depth of ¼" every 2 inches. Before grout is deposited on the slab, it shall be thoroughly cleaned, wet down with clean water and lightly dusted with neat cement immediately prior to placement of the grout.

Liquid Hardener:

Liquid Hardener shall be applied to the floors where scheduled to be exposed concrete. Concrete surfaces to be treated must be thoroughly set and dry, clean and free of dust. Three applications of the liquid hardener are required, using one gallon per 100 square feet for the complete treatment. Apply hardener strictly according to the manufacturer's printed instructions. Liquid floor hardener is not required when a minimum of two (2) coats of Thompson's Waterseal or equal has been used as a curing and/or separating compound. Submit material and method to be used for Engineer's approval.

FINISH OTHER THAN SLABS

Top Surfaces, Other Than Slabs:

All top surfaces, other than slabs, not covered by forms, and which are not to be covered by additional concrete or fill shall receive a wood float finish without additional mortar. Care shall be taken that no excess water is present when the finish is made. Other surfaces shall be brought to finished elevations and left true and regular. All exposed top surface interior concrete shall be grouted smooth and given a cement wash of one part light colored Portland cement and two parts fine aggregate mixed with water to consistency of thick paint. Grout shall be cork or wood floated to fill all pits, air bubbles, and surface holes. Excess grout shall be scraped off with a trowel and rubbed with burlap to remove any visible grout film. Surface shall be kept damp during setting period. The finish for any area shall be completed in the same day and the limits of a finished area shall be made at natural breaks in finished surface.

Cementous Waterproofing and Finish:

Unless otherwise indicated, all faces (except top surfaces of slab) exposed to view, such as walls, grade beams, columns, beams, canopy soffits and facias, etc., shall be finished using either "ThoroSeal" by Thoro System Products or equal.

CURING

General:

Immediately following placing, all Class A and Class B concrete shall be protected from premature drying, hot and cold temperatures, rain, flowing water and mechanical injury. Maintain above 50° F. and in moist condition for at least seven (7) days after placing for normal concrete and three (3) days for high early strength concrete. Comply with "Recommended Practice for Curing Concrete" ACI 308, unless otherwise indicated. Curing compound of satisfactory composition and characteristics may be used except on surfaces to which new concrete is to be bonded or surfaces scheduled to be painted or to receive other coating and provided such compound does not stain or discolor any surface which will be exposed. Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

Cold Weather Procedures:

Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306, "Cold Weather Concreting", and as herein specified.

- (a) When air temperature has fallen to or is expected to fall below 40° F., uniformly heat water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 50° F., and not more than 80° F. at point of placement.
- (b) Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
- (c) Do not use calcium chloride, salt and other materials containing antifreeze agents or chemical accelerators, unless otherwise accepted in mix designs.
- (d) Contractor shall obtain and keep on the Project site a copy of the current edition of ACI 306, "Recommended Practice for Cold Weather Concreting", for reference during all concrete operations in cold weather.

Hot Weather Procedures:

When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305, "Hot Weather Concreting", and as herein specified.

- (a) Cool ingredients before mixing to maintain concrete temperature at time of placement below 90° F. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing.
- (b) Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
- (c) Wet forms thoroughly before placing concrete.
- (d) Do not use retarding admixtures unless otherwise accepted in mix designs.
- (e) Contractor shall obtain and keep on the project site a copy of ACI 305R, "Hot Weather Concreting" for reference during all concreting operations in hot weather.

Protection from the Sun:

All concrete shall be adequately protected from injurious action of sun in a manner satisfactory to the Engineer.

Temperature Control:

During and at the conclusion of the specified curing period, means shall be provided to insure that the temperature of the air immediately adjacent to the concrete does not fall more than 3° F. in any 1 hour nor more than 30° F. in any 24 hours.

NON-SHRINKING GROUT

Where non-shrinking grout is called for on the Plans, it shall be mixed in strict accordance with the manufacturer's directions. It shall be of a type as recommended by the manufacturer for the particular application.

II-13.4 CONSTRUCTION JOINTS, EXPANSION JOINTS, AND WATERSTOPS

GENERAL

This section covers construction joints, expansion joints, and the placing of waterstops where such are indicated on the Plans.

Construction joints shall be of the type indicated on the Drawings and shall be located as shown on the Plans unless otherwise approved by the Engineer. Contractor shall submit a joint location plan as specified in SECTION

II-13.3 CAST-IN-PLACE CONCRETE.

POLYVINYL PLASTIC WATERSTOP

Waterstops shall be installed in all construction joints as required by the Plans. All waterstops shall be continuous throughout their length.

The waterstops shall be heavy duty polyvinyl waterstop conforming to Corps of Engineers Specification CRD-C-572, latest edition, as manufactured by Serviced Products Division of W.R. Grace and Company: Vinylstops by Sonneborn-Contech; Sealtight Duo-PVC Waterstops by W. R. Meadows, Inc.; Vinylex Corporation; "labyrinth" waterstop, Type B-2 as manufactured by Water Seals, Inc.; or an approved equal of the same type and material and approximately equal in dimensions and weight but not necessarily of exactly the same shape. Waterstops shall be of the size and type designated on the Plans.

"Rib Type" waterstops shall be of ribbed construction with a center bulb, 4" wide, capable of resisting a maximum pressure load of 65 feet of water.

All waterstops shall be installed so that one-half its width will be embedded on one side of the joint and one-half on the other. The Contractor shall employ a method of holding the waterstop in position for the first pour that is satisfactory to the Engineer. The method selected must insure that the waterstop will be held securely in true vertical or horizontal position and in straight alignment in the joint.

Care shall be exercised to insure that the waterstop is completely encompassed in good mortar.

PREFORMED WATERSTOP SEALANTS

Preformed Waterstop Sealants, when approved by the Engineer, shall meet or exceed all requirements of Federal Specifications SS-S-00210, "Sealing Compound, Preformed Plastic for Expansion Joints", Type I or Type II. Such waterstop sealant shall be equal to CS231 as manufactured by Concrete Sealants Inc., New Carlisle, Ohio, and shall meet the following requirements:

JOINTS IN WATERSTOPS

All waterstops shall be continuous and so joined at all points of contact in the same plane, or at intersections with waterstops in different planes, as to form a complete barrier to the passage of water through any construction or contraction joint.

Joints in the waterstops, whether made for the purpose of continuity in a straight strip or for the purpose of securing a watertight junction between strips in different planes, shall be made by heat welding as herein-after specified.

Joints in PVC waterstops shall be made by heating the two surfaces to be jointed until the material has softened to the point where it is just short of being fluid and then bringing the two softened surfaces together with a slight rubbing motion followed by firmly pressing them together so that a solid and tight bond is made.

The joints in strips of waterstop made in the above manner shall be such that the entire cross section of the joint shall be dense, homogeneous and free of all porosity. All finished joints shall have a tensile strength of not less than 75 percent of the material of the strip as extruded.

The heating of the surfaces to be joined shall be done by means of an electric splicing iron designed for the specified purpose and controlled by means of a voltage regulator.

In use, the heat of the hot plate shall be so regulated as to prevent too rapid melting and accompanying charring of the waterstop material.

The use of makeshift hot plates will not be permitted nor will other means of heating the strips to be joined be allowed except in a case of emergency, as determined by the Engineer.

The Contractor shall provide such jigs as will assist in making the joints in a proper and workmanlike manner and in holding the strips so that the alignment of jointed strips is correct and angles are true to those required.

Prior to embedment all joints in the waterstop strips will be inspected by the Engineer and any found defective shall be remedied without delay.

PROTECTION OF WATERSTOP BETWEEN POURS

The Contractor shall take such steps as are necessary to protect exposed waterstops in the interim period between concrete pours.

EXPANSION JOINTS

Expansion joints of the size and type shown on the Plans, or specified herein, shall be placed in concrete pavement or structure as shown on the Plans.

Materials:

(1) Preformed Asphalt Fiber Joint Material

Asphalt fiber sheet filler shall consist of preformed strips of inert material impregnated with asphalt. It shall be of the thickness shown on the Plans or indicated in these Specifications.

The sheet filler shall conform to the requirements of AASHTO Specification M-213 with the following additional provisions.

The sheet filler shall be of such character that it will not be deformed by ordinary handling during hot weather nor become hard and brittle in cold weather. It shall be of a tough, resilient, durable material not affected by weathering.

(2) Hot Poured Rubberized Tar Joint Sealer

Hot poured rubberized mastic joint sealer shall consist of a mixture of durable, elastic rubber, coal tar pitch and other materials that will form a resilient and adhesive compound capable of effectively sealing concrete joint surfaces against repeated expansion and contraction. The material shall be installed in accordance with the manufacturer's directions. Hot poured tar sealer shall be used for pavement and sidewalk expansion joints.

Joint Surface Preparation:

Clean joint surfaces immediately before installation of sealant or caulking compound. Remove dirt, insecure coatings, moisture and other substances that would interfere with bond of sealant or caulking compound.

For all sealant, do not proceed with installation of sealant over joint surfaces which have been painted, lacquered, waterproofed or treated with water repellent or other treatment or coating unless a laboratory test for durability (adhesion), in compliance with Paragraph 4.3.9 of FS TT-S-00227, has successfully demonstrated that sealant bond is not impaired by coating or treatment. If laboratory test has not been performed, or shows bond interference, remove coating or treatment from joint surfaces before installing sealant.

Etch concrete and masonry joint surfaces to remove excess alkalinity, unless sealant manufacturer's printed instructions indicate that alkalinity does not interfere with sealant bond and performance. Etch with 5% solution of muriatic acid; neutralize with diluted ammonia solution, rinse thoroughly with water and allow drying before sealant installation.

Installation:

Comply with sealant manufacturer's printed instructions except where more stringent requirements are shown or specified and except where manufacturer's technical representative directs otherwise.

Prime or seal joint surfaces where shown or recommended by sealant manufacturer. Do not allow primer/sealer to spill or migrate onto adjoining surfaces.

Employ only proven installation techniques, which will insure that sealant will be deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on

opposite sides. Except as otherwise indicated, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.

Install sealant to depths as shown or, if not shown, as recommended by sealant manufacturer but within the following general limitations measured at center (thin) section of bead.

For sidewalks, pavements and similar joints sealed with elastomeric sealant and subject to traffic and other abrasion and indentation exposures, fill joints to a depth equal to 75% of joint width, and neither more than 5/8" deep nor less than 3/8" deep.

For normal moving joints sealed with elastomeric sealant, but not subject to traffic, fill joints to a depth equal to 50% of joint width, but neither more than 1/2" deep nor less than 1/4" deep.

Do not allow sealant or compounds to overflow or spill onto adjoining surfaces, or to migrate into voids of adjoining surfaces. Use masking tape or other precautionary devices to prevent staining of adjoining surfaces, by either primer/sealer or the sealant.

Remove excess and spillage of compounds promptly as the work progresses. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage, without damage to adjoining surfaces or finishes.

Cure and Protection:

Cure sealant in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Do not cure in a manner that would significantly alter material's modulus of elasticity or other characteristics.

Installer shall advise Contractor of procedures required for curing and protection of sealant during construction period, so that they will be without deterioration or damage (other than normal wear and weathering) at time of Owner's acceptance.

II-14. ASPHALT

Asphalt for permanent pavement restoration in road-ways, drives, parking lots, and walks shall be Hot Mix Asphalt conforming to the requirements of the specifications of the Arkansas Highway and Transportation Department. Asphalt shall be subject to the approval of the Engineer prior to the placement of any material. The lump sum contract price shall include the quantity of Asphalt given in the List of Variable Quantities and the appropriate contract unit prices will be used to adjust the contract price for variation of actual quantities from those estimated. The prices for Asphalt shall include materials, form work, placing, and all other work incident thereto.

Asphalt for temporary pavement restoration in road-ways, drives, parking lots, and walks shall be Cold Mix Asphalt or Asphaltic Concrete Hot Mix conforming to the requirements of the specifications of the Arkansas Highway and Transportation Department. Temporary Asphalt shall be subject to the approval of the Engineer prior to the placement of any material. Temporary Asphalt shall, in most cases, be included in the cost of permanent pavement restoration. Where Temporary Asphalt is listed in the List of Variable Quantities the lump sum contract price shall include the quantity of Temporary Asphalt given in the List of Variable Quantities and the appropriate contract unit prices will be used to adjust the contract price for variation of actual quantities from those estimated.

II-15. BORING HIGHWAYS, STREETS AND RAILROADS

Where applicable Arkansas State Highway Commission, Railroad or City ordinances or standards and specifications are more stringent than the procedures laid out in this section the applicable ordinances, standards or specifications shall be adhered to. If the resulting changes create appreciable changes in the cost of boring highways, streets or railroads a change order will be issued.

Conway Corporation will provide necessary State Highway and Railroad permits. A copy of which must be maintained on the job site at all times while work is in process within the above mentioned right-of-ways. The acquisition and cost of all other permits required will be the responsibility of the contractor. The notification, to the Authority of the right-of-way, of work within any right-of-way is the responsibility of the contractor.

The highway, street and railroad crossings for Water and Sewer Lines will be made in accordance with details as shown on the Plans and the requirements of the Authority whose right-of-way is being crossed.

Bores, with the exception of services, will be accomplished by the dry-bored technique and installing encasement pipe of the size specified.

Unless otherwise shown on the Plans, mains shall be installed in such a manner that there is a minimum of three (3) feet of cover over the pipe at any point within the right-of-way. Where encasement pipe is required, the minimum coverage as specified above or shown on the Plans shall be measured from the top of the encasement pipe.

Sewer Mains shall be installed as shown on the Plans in strict accordance with applicable Specifications. Where encasement pipe is required, the pipe shall be kept on grade and line as shown on the Plans.

Encasement pipe will be measured and paid for by the linear footage installed. The appropriate contract unit price shall include bore, encasement pipe, casing seals, and pipe supports.

II-15.1. ENCASEMENT PIPE AND ACCESSORIES

Steel encasement pipe shall be furnished in the size and length as detailed on the Plans; and shall be welded steel pipe, uncoated and unlined, conforming to ASTM A-139. Salvaged pipe may be used for encasement if in good condition, unpitted, and approved by the Engineer. Steel encasement pipe shall have at least one-quarter (1/4) inch weld thickness. Joints in encasement pipe to be made by full penetration butt-welding.

Minimum encasement thickness requirements follow. Casing pipe greater than 48" shall be submitted to Engineer for review and consideration.

| <u>Casing Pipe Diameter</u> | <u>Minimum Thickness</u> |
|-----------------------------|--------------------------|
| 0 to 12" | 0.2500" |
| >12" to 18" | 0.3125" |
| >18" to 22" | 0.3750" |
| >22" to 28" | 0.4375" |
| >28" to 34" | 0.5000" |
| >34" to 42" | 0.5625" |

| | |
|-------------|---------|
| >42" to 48" | 0.6250" |
| >48" to 60" | 0.844" |

Casing seals for sealing both ends of the encasement pipe shall be Innerlynx, APS, Link-Seal, or equal seals or approved equal product. In gravity sewer pipe (non-concentric) applications pull on end seals (APS or equal) are acceptable.

Unless otherwise specified carrier pipe supports are to be installed, they shall be Model S8G-2 (Carrier Pipe O.D.)x(Casing Pipe I.D.)-CR for carrier pipes up to 16-inch diameter and S12G-2 (Carrier Pipe O.D.)x(Casing Pipe I.D.)-CR for carrier pipes over 16-inch diameter casing insulators as manufactured by PIPELINE SEAL & INSULATOR, Inc., or approved equal product. Bands shall be a minimum of 14 gauge 304 stainless steel, provided in semi-circular segments to fit over barrel of carrier pipe, fitted with a flexible PVC liner, secured by stainless steel bolts. Risers shall be a minimum of 10 gauge 304 stainless steel with runners of high pressure molded Glass Reinforced Polymer material. Risers and runners shall be sized to support carrier pipe in approximate alignment with casing centerline, with minimum practical skid resistance.

Support (insulator) shall be provided at a maximum distance of twelve (12) inches from each joint in the carrier pipe. In addition, supports shall be provided at a maximum interval of ten (10) feet along the length of the carrier pipe. A support shall be provided at a distance no greater than twelve (12) inches from the ends of the encasement pipe.

Approved joint restraint assembly shall be used on all carrier pipe. Contractor shall certify pipe type/casing spacer configuration such that pipe damage/over-bell does not occur.

Encasement pipe will be measured and paid for by the linear foot installed. The appropriate contract unit price shall include encasement pipe, casing seals, and pipe supports.

II-16. CLEANING UP

It shall be specifically understood that the clean - up operation shall be maintained as closely as possible to the progressing project operation. The Engineer may stop the project if the clean - up operation is not being maintained satisfactorily, in the opinion of the Engineer. Project – stop for clean - up shall not justify Contractor claim(s) for additional contract time.

All debris, waste, concrete, piping, lumber, trees, brush or other refuse resulting from the work shall be cleaned up, disposed of and or removed from the site to the satisfaction of the Engineer, and in accordance with all applicable regulations. The site shall be left neat, clean, and workmanlike.

All excavated material, which is unsuitable or not needed for backfill, shall be wasted or disposed of to the satisfaction of the Engineer. Surfaces shall be cleaned up, all hummocks and piles leveled, graded, and dressed up until the site is neat, smooth, and workmanlike.

Where existing drainage ditches are disturbed or obstructed with excavated material such material shall be entirely removed and the ditch left true to original line and grade.

The cost of clean - up work shall be considered subsidiary to the closest contract unit price item and will not be paid for separately.

II-17. FENCING

This item covers the construction of new fence as shown on the Plans and in accordance with these Specifications.

II-17.1 CHAIN LINK MATERIAL

New fence materials shall conform to the following:

- (a) Chain link galvanized fence fabric.
 - (1) The base metal of the fabric shall be a good commercial quality of steel wire, Number 9 gage. The fabric shall be zinc-coated. The weight of the zinc-coating shall be not less than 1.2 ounces per square foot of actual surface covered.
 - (2) The fabric shall be 72 inches (72") in height with 2-inch mesh. There shall be no splice in any roll. All selvages shall be twisted and barbed.
 - (3) The chain link fence fabric shall be made of high grade material with good workmanship. The zinc-coating shall be applied in a continuous process and shall not be applied to the fabric in roll form. Excessive roughness, blisters, sal ammoniac spots, bruises or flaking shall be considered a basis for rejection.
- (b) Posts, gate frames, braces, rails, stretcher bars, and truss rods shall be of steel; reinforcing wires shall be of high carbon steel; and gate hinges, post caps, barbed wire supporting arms, stretcher bar bands, and other parts shall be of steel, malleable iron, ductile iron or equal except that ties and clips may be of aluminum.
 - (1) Posts, gate frames, rails, and braces shall conform to the dimensions and weights shown in the following Table:

| Use and Section | Outside Diameter or Dimensions Nominal (in.) | Weight Per Foot, Nominal (lb.) |
|---|--|--------------------------------------|
| End, corner and pull posts (tubular) for fabric heights: 6 feet around | 3.0 | 5.79 |
| <hr/> | | |
| Gates posts for nominal width of gate, single, or one leaf of double: | | |
| Gate width 13 feet and less: Round | 4.00 | 9.10 |
| Gate width over 13 feet to 18 feet, including: Round | 6.625 | 18.97 |
| <hr/> | | |

| | | |
|--|-------|------|
| Gates: exterior frames for fabric heights: 6 feet and less: Round | 1.660 | 2.27 |
| Internal gate bracing (tubular): For Fabric Heights: 6 feet and less: Round | 1.055 | 1.68 |
| Rails and post braces (tubular): Round | 1.660 | 2.27 |
| Intermediate posts for fabric heights: 6 feet and less: Tubular (round) | 2.50 | 5.79 |

- (2) All steel and iron parts shall be zinc-coated after fabrication. The weight of the zinc-coating per square foot of actual surface area shall be not less than 1.2 ounces.
- (3) Gates shall be swing type, complete with latches, stops, keepers, hinges, with provisions for three strands of barbed wire above the fabric.
 - (a) Gate frames shall be constructed of tubular members and shall be constructed in a manner such as to provide a rigid frame and ample strength and gate shall be free from sag and twist. The end members of gate frames shall be extended approximately one foot above the top member and arranged for attaching three uniformly-spaced strands of barbed wire and furnished with bands or other suitable method for securely attaching the wire.
 - (b) Fabric shall be the same type as used in the fence construction. The fabric shall be attached securely to the gate frame at intervals not exceeding 15 inches.
 - (c) Hinges shall be of adequate strength for gate, and with large bearing surfaces for clamping in position. The hinges shall not twist or turn under the action of the gate. The gates shall be capable of being opened and closed easily by one person.
 - (d) Latches, stops, and keepers shall be provided for all gates. Latches shall have the plunger-bar and arranged to engage the gate stop, except that for single gates of openings less than 13 feet wide, a forked latch may be provided. Latches shall be arranged for locking. Center stops shall consist of a device arranged to be set in concrete and to engage a plunger-bar of the latch of double gates. No stop is required for single gates. Keepers shall consist of a mechanical device for securing the free end of the gate when in the full open position.
- (4) Posts shall be of the lengths specified and shall be tubular.
- (5) Post braces shall be provided for each gate, corner, pull, and end post, and shall consist of a round tubular brace extending to each adjacent line post at approximately midheight of the fabric, and a truss consisting of a rod not less than 3/8 inch in nominal diameter from the line post back to the gate, corner, pull, or end post, with a turnbuckle or other equivalent provision for adjustment. Fabric shall be attached to brace at 15-inch centers.

- (6) Post tops shall consist of combination tops and barbed wire supporting arms. The top shall be provided with a hole suitable for the through passage of the top rail. The post tops shall fit over the outside of posts and shall exclude moisture from tubular posts. Post tops without supporting arms shall be provided for gate frames, gate posts, terminal posts and others, if required.
- (7) Barbed-wire supporting arms shall be at an angle of approximately 45° or vertical as required, and shall be fitted with clips or other means for attaching three strands of barbed-wire. With 45° arms the top wire shall be approximately twelve inches horizontally from the fence line and other wires spaced uniformly between the top of the fence fabric and the outside strand. Barbed-wire arm shall be of sufficient strength to withstand a weight of 200 lbs. applied at the outer strand of barbed-wire.
- (8) Top rails shall be round (tubular) and shall be in lengths not less than 18 feet, and shall be fitted with couplings for connecting the lengths into a continuous run. The couplings shall be not less than 6 inches long, with .070 minimum wall thickness, and shall allow for expansion and contraction of the rail. Open seam outside sleeves shall be permitted only with a minimum wall thickness of .100 inches. Suitable ties or clips shall be provided in sufficient number for attaching the fabric securely to the top rail at intervals not exceeding 2 feet. Means shall be provided for attaching the top rail to each gate, corner, pull, and end post.
- (9) Stretcher bars shall not be less than 3/16" x 3/4" and shall be of lengths one inch less than the full height of the fabric with which they are to be used. The stretcher bars shall be arranged for attaching the fabric to all terminal posts by threading through the fabric, by band, or by other positive mechanical means. One stretcher bar shall be provided for each gate, and end post, and two for each corner and pull post.
- (10) Ties or clips of adequate strength shall be provided in sufficient number for attaching the fabric to all line posts at intervals not exceeding 15 inches. Minimum wire size is Number 9 gage.
- (11) Bands of clips of adequate strength shall be provided in sufficient number for attaching the fabric and stretcher bars to all terminal posts at intervals not exceeding 15 inches. Tension bands and brace bands shall be formed from flat or beveled steel and shall have a minimum thickness of .115±.005 after galvanizing with a minimum width of 7/8 of an inch ±015.
- (12) Spiraled or crimped tension wire shall be not less than Number 7 gage plus or minus 0.005 inch in diameter. Ties or clips shall be provided for attaching each wire to the fabric at intervals not exceeding 2 feet. Zinc-coating shall be a minimum coating of .80 ounces per square foot of surface area.
- (13) Barbed-Wire shall consist of two strands of 12-1/2 gage wire with 14-gage, 4-point barbs spaced approximately 5 inches apart. All wire shall be zinc-coated with a minimum coating of .80 ounces per square foot of surface area on 12-1/2 gage wire and .65 ounces per square foot of surface area on 14-gage wire.
- (14) A suitable padlock with two keys shall be furnished for each gate. The Contractor shall coordinate lockset cylinders with the Owner to match the Owners' keyed system.
- (15) All materials shall be furnished new.

(c) Chain Link Construction Methods

Construction methods shall be as follows:

(1) Post Setting.

- (a) All posts shall be placed in a vertical position unless otherwise directed by the Engineer. Prior to setting the posts, the trace of the fence shall be smoothed to remove humps or depressions and loose material in order to permit proper construction.
- (b) All posts shall be set in Class B concrete as specified in section herein. Concrete mow strip shall be placed along all fence as shown on the Plans.
- (c) Pull post assemblies shall be placed at intervals of not more than 330 feet in straight fence on level or uniform sloping ground and at any sharp vertical angle point on the line.
- (d) Corner post assemblies shall be placed at intervals of not more than 330 feet in straight fence on level or uniform sloping ground and at any sharp vertical angle point on the line.
- (e) Top rails shall pass through the bases of the combination post tops and barbed-wire supporting arms, and shall be fastened securely to end posts, to form a continuous brace to each end of each section of fence.
- (f) Attachment chain link fabric. Chain link fence shall be placed on the side away from the treatment facilities. The fabric shall be stretched taut approximately two (2) inches above the ground, and securely fastened to the posts. The fabric shall be cut and each span shall be attached independently at all terminal posts. Fastening to terminal posts shall be with stretcher bars and fabric bands spaced at maximum 15-inch intervals. Fastening to line post shall be with tie wire, metal bands, or other approved method, attached at maximum 15-inch intervals. The top edge of the fabric shall be fastened to the top rail with wire ties at intervals not exceeding 24 inches. The bottom edge of fabric shall be fastened to the bottom tension wire with wire ties at intervals not exceeding two feet.

Rolls of wire fabric shall be joined by weaving a single strand into the ends of the rolls to form a continuous mesh.

(2) Attachment to Barbed-Wire.

- (a) Barbed-wire shall be attached to gate corner pull and terminal post by a band clip. The wire shall be stretched taut before fastening.
- (b) Tie wires, bolts, tension wire and other fastening shall be properly tightened. Erection shall provide a fence firmly secured in proper position.

- (d) Gates of the type and size shown on the Plans shall be constructed at locations shown on the Plans.

II-17.2. NEW WOOD FENCE

1. Wood fence material

- (a) All Wood Materials shall be treated wood, or wood of natural resistance to decay. Materials shall be free from loose knots, cracks, and other imperfections.
- (b) Wood boards or slats shall be of cedar, redwood, combed spruce or similar wood acceptable to Owner.
- (c) Wood boards or slats shall be between 3/8 inches and 5/8 inches thick and be no greater than 6 inches wide.

2. Post

- (a) Fence and Man Gate post shall be 4-inch by 4-inch.
- (b) Truck gate post shall be at minimum dual 6-inch by 6-inch or as recommended by manufacturer.
- (c) Post shall be pressure treated redwood, douglas fir-larch, cedar or similar wood acceptable to Owner.
- (d) Buried post ends should be treated with an approved wood preservative product.
- (e) Post shall be set true to line and grade.
- (f) Set post in 12-inch diameter concrete footings extending at least 24-inches into undisturbed natural ground or properly compacted fill.

3. Gates

- (a) Provide additional horizontal, vertical, and diagonal members to ensure proper gate operation and for attachment of wood, hardware and accessories. Consult manufacturer as necessary.
- (b) Accessibility: Gate stops, latches and locks shall be accessible from either side of gate.
- (c) Openings:
 - 1. Man gate openings shall be a minimum of 3 feet wide.
 - 2. Truck gate openings shall be a minimum of 12 feet wide.
- (d) Gate designs shall be approved by Owner prior to installation.
- (e) Gate hardware including, but not limited to, latches, hinges, stops and bolts shall be stainless steel powder coated black or galvanized. Size and configuration as per manufacturer's recommendations.
- (f) Gates shall be lockable from both sides and shall have the ability to be daisy-chained so as to allow multiple locks if necessary.

- (g) Gates shall be installed plumb, level, and secure for full opening without interference. Ground set items shall be in concrete for anchorage as recommended by the fence manufacturer. Adjust hardware for smooth operation.

II-17.3. NEW WIRE FENCE

1. Wire Fence Material

(a) Barbed Wire:

Barbed Wire fences shall have a minimum of 4 wires for farm borders. A minimum of three wires shall be used for interior fencing, cross fencing, or excluding livestock from special areas such as wildlife areas, forested tracts, or other special use areas. Wires shall be placed approximately an equal distance apart. The top wire shall be at least 42 inches high and 2 inches below the top on wood post and 1 inch below the top on steel posts. The bottom wire shall be 18 inches or less above the ground level. Wire shall be spaced no more than 12 inches apart. Each barbed wire shall consist of 2 twisted strands of either 12-1/2 gauge wire or 15-1/2 gauge high tensile strength wire. All wire shall be galvanized (Class 3). The barbs shall be either 2-point barb or 4-point barb. Wire shall be stretched taut and attached after the post are properly set and backfilled. Attach wire to the side of the post closest to the livestock, except on corners and curves where the wire should be placed on the outside of the corner or curve. Barbed wire fences shall not be electrified.

(b) Woven Wire

Top and bottom strands of woven wire shall be a minimum of 12-1/2 gauge. Wire for intermediate strands shall be 14-1/3 gauge or heavier. Woven wire fences 32 inches or less in height shall have at least 2 barbed wires above the woven wire spaced 8 to 12 inches apart. Fences constructed with woven wire higher than 32 inches shall have at least 1 barbed wire 8 to 12 inches above the woven wire. The base of the woven wire shall be placed near the ground surface. The top wire shall be at least 42 inches above the ground level and 2 inches below the top of wood post and 1 inch below top of steel posts. All wire shall be galvanized (Class 3). Wire shall be stretched and attached after the post are properly set and backfilled. Attach wire to the side of the post closest to the livestock, except on corners and curves where the wire should be placed on the outside of the corner or curve.

2. Post, Bracing, & Hardware

(a) All wooden post (except red cedar, osage orange, or black locust) shall be treated with pentachlorophenol, or chromate copper arsenate (CCA) by a method that ensures complete penetration of the sapwood. Quality of treated wood shall provide sufficient strength and quality to last for the expected life of the fence. At least half the diameter of red cedar shall be heartwood.

(b) Corner post, Gate post, end post, pull post and brace post shall be wood with sufficient length for the construction of at least a 42 inch high fence and permit setting the post at least 36 inches deep. Earth backfill shall be thoroughly tamped. Where soil depth is restricted to less than 36 inches, additional anchors or deadman applied against the direction of pull may be needed. Wood post shall have a minimum top diameter of 5 inches. A 2-1/2 inch steel pipe with appropriate bracing or set in concrete

of sufficient depth also may be used. Reinforced concrete or metal post of equivalent strength may be substituted if they have suitable means of attaching wires and braces.

(c) Line post: The maximum spacing of line post shall be one rod (16.5 feet). Wood line post shall have a minimum 3 inch top diameter. Wood line post shall have a minimum length of 6-1/2 feet and shall be set or driven to a minimum depth of 24 inches where conditions permit. When post are set, earth backfill shall be thoroughly tamped. Steel line post shall not weigh less than 1.33 pounds per foot and shall have a steel anchor plate securely fastened to the post. The post shall be "T", "U", or "Y" shaped and have corrugations, knobs, studs, or grooves suitable for fastening fencing to the post. Steel post shall be rolled from high carbon steel and shall have a protective coating; either galvanized by the hot dip process, or painted with one or more coats of high grade weather resistant paint for steel, or enameled and baked. Steel line posts shall be at least 6 feet in length and shall be set in the ground a minimum of 20 inches. Steel posts shall be used as line post at least once every 6 rods (99 feet) to act as a ground for lightning protection. If steel posts are the primary post, every 4th post shall be wood.

(d) Bracing: end bracing will be installed at locations where the fence ends and on both sides of gate openings. Corner bracing should be installed where fence alignment changes 15 degrees or more. Bracing is required at all corner, gate, pull and end assemblies in a fence. The brace member shall be the equivalent of a wood post with a 4 inch diameter at the top or a 4"x4" timber or standard weight 2-1/2 inch diameter galvanized steel pipe. The brace shall be at least 3 feet above the ground and at least 8 inches below the top of the post. The brace member shall be 6 to 8 feet in length. A brace wire consisting of 2 complete loops of 9 gauge smooth wire, 2 loops of barbed wire or a single loop of 12-1/2 gauge high tensile strength wire shall be installed. The tensioner for bracing wire shall be of like material to the post used or steel. Tensioner shall be of sufficient length to hold tension on the wire loop when resting against the brace member. "H" braces or angle braces will be used in standard fences.

(e) Pull post assemblies consisting of three post with braces shall be installed in straight reaches of fence at intervals of 660 feet (40 rods), at any point where the vertical angle described by two adjacent reaches of wire is upward and exceeds 10 percent, and at the beginning and end of each curve.

(f) Staples shall be 9 gauge steel or heavier with a minimum length of 1-1/2 inches for soft woods and a minimum length of 1 inch for close grained hardwoods. Drive staples diagonal to the grain of the wood and at a slight downward angle. Space should be left between the staple and the post to permit free movement of the wire. Wires may be attached to steel post by the use of manufacturer's clips or by 14 gauge galvanized wire twisted at least two turns.

3. Gates and Crossings.

(a) Wire gates shall be made of the same materials as used for the fence. Panel gates shall be equivalent in quality to the fencing material and shall be fitted with at least two hinges and a latch or galvanized chain for fastening

(b) Crossings: for a narrow ditch or draw crossing with slopes steeper than 8 feet horizontal to 1 foot vertical, the fence shall be anchored with a concrete anchor weighing at least 150 pounds and buried with at least 18 inches of cover or a commercial screw-in type metal anchor 5 inches in diameter and not less than 48" long to position the fence to the contour of the ditch or draw.

II-17.4 MEASUREMENT AND PAYMENT

Fencing will be paid measure and paid by the linear foot as noted in the List of Variable Quantities, and / or Schedule of Values. Where not listed, fence removal and replacement shall be subsidiary to the closest representative item.

DETAILED SPECIFICATIONS

PART III - WATER CONSTRUCTION SPECIFICATIONS

III-1. EXCAVATION – WATER TRENCH

Contractor shall provide approved OSHA Safety Methods for the excavation. Such Methods take precedence over any procedures outlined in these Specifications or directions of the Engineer. See “Appendix A” Trench Excavation Safety. The Contractor is responsible for the design of excavation procedures, shoring design and placement, and any and all safety procedures.

Trenches for water lines shall be of the width and depth necessary for the proper installation of the pipe. All water lines shall be laid in trenches of such depth as to provide a minimum cover of thirty-six (36) inches over the pipe unless otherwise shown on the Plans, or directed by Engineer. The bottom of all pipe trenches for six (6) inch and larger pipe, except where encasement is required, shall be shaped as nearly as possible to conform to the outside of the pipe, providing adequate bell holes and taking care to support pipe throughout its entire length except at joints.

If the soil at the bottom of the trench for pipe lines is mucky or in such condition that it cannot properly support the pipe, the Contractor shall excavate below the normal subgrade elevation as directed by the Engineer. Wherever excavation is carried below the specified subgrade, at the direction of the Engineer, the Contractor shall provide and install a fill of gravel thoroughly tamped into place up to an elevation sufficient to prepare the subgrade as specified in the preceding paragraph.

Where water occurs in trenches for pipe lines they shall be excavated to a depth of approximately eight (8) inches below grade and backfilled with approved gravel. Pumps shall then be kept operating, taking suction out of a sump below the gravel so as to hold the water level well below the bottoms of all open joints.

Where rock occurs in trenches for pipe lines at the planned grade of the bottom of the pipe in such way that any portion of the pipe would rest on rock, or where in the opinion of the Engineer it is necessary, the excavation shall be carried to a depth of four (4) inches below the planned grade for the full width of the trench. The Contractor shall provide and install a fill of gravel thoroughly tamped into place from bottom of excavation up to the center of the pipe.

In trenches that are not in rock, but the soil in the bottom is hard and in the opinion of the Engineer, it cannot be excavated efficiently by hand prior to placing the pipe, as described above in the bedding of the pipe, the Contractor shall undercut the trench to a depth of four (4) inches and backfill the trench with gravel or sand. After the backfill of gravel or sand has been placed and tamped, the trench shall be prepared in the same manner as described in previous paragraphs.

The excavation of trenches for pipelines shall not advance more than four hundred (400) feet ahead of the completed pipe work and backfill except by permission of the Engineer.

The cost of all common excavation in trench for water lines shall be included in the contract prices for water pipe and fittings and will not be paid for separately.

Gravel or crushed stone authorized for payment as subgrade material for pipelines will be measured and paid for by the ton in place in the trenches.

The lump sum contract price shall include the quantity of gravel for subgrade given in the List of Variable Quantities and the appropriate contract unit price will be used to adjust the lump sum contract price for variation of actual quantity from that estimated.

The prices for gravel for subgrade shall include materials, placing, and all other work incident thereto, and gravel shall conform to PVC/GRP/FRP bedding/initial backfill specification.

Trench Excavation Safety shall be paid for on the final estimate as a lump sum at the appropriate contract unit price.

III-2. HANDLING AND LAYING DUCTILE IRON PIPE

In the transportation, unloading, and handling of pipe, the pipe shall not be dropped, let roll and collide with another pipe, or be subjected to any unnecessary jar, impact, or other treatment that might crack or otherwise damage the pipe.

Before laying pipe in trench, the bottom of the trench shall be carefully graded and prepared and bell holes excavated so the pipe shall have a uniform support along its entire length, except at bell holes, and shall not be allowed to rest on hard supports through a portion of its length only. Width of trench at the top of the pipe shall not exceed the OD of the pipe plus two (2) feet. All pipe shall have at least thirty-six (36) inches of cover over pipe bells.

Deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets, shall not exceed the maximum permissible for the type of pipe joint being installed as recommended by the pipe manufacturer. If the alignment requires deflections in excess of these limitations, special bends, or a sufficient number of shorter lengths of pipe shall be furnished to provide annular deflections. Such bends or short length of pipe shall be installed as directed by the Engineer at no additional cost to Conway Corporation.

The inside of pipe and all parts involved in jointing shall be cleaned of all dirt, mud, grease, and other foreign material before the pipe is laid or the joint started. Ends of pipe shall be temporarily plugged at the close of each day's work. The pipe will be plugged so that no water or mud may enter the pipe.

In laying mechanical joint or "push-on" joint pipe, the manufacturer's recommendations for securing good joints shall be rigidly followed. Proper lubricant as recommended by pipe manufacturer will be used on all pipe joints. Bolts will be pulled-up alternately to provide for a well-made and tight joint.

Adequate backing of Class "B" concrete shall be provided at all points of unbalanced pressure, such as bends, tees, dead end lines or fire hydrants. Minimum contact area of backing shall be three (3) square feet, unless otherwise directed by the Engineer. The concrete shall be contained within the designated area by metal or wood forms that are sufficiently tight as to keep the loss of material to a minimum, or by other means as approved by the Engineer. These fittings shall be wrapped in a polyethylene material before concrete is poured. Concrete for backing shall be measured by the cubic yard and paid for as Class "B" concrete.

Ductile iron water pipe and fittings, except as specifically shown on the Plans or hereinafter specified, will be measured and paid for as pipe. The quantity of pipe shall be determined by measurement along the top centerline of the pipe and fittings as laid. The lump sum contract price shall include the

quantities of ductile iron pipe given in the List of Variable Quantities and the appropriate contract unit prices will be used to adjust the contract price for variation of actual quantities from those estimated.

The unit prices for ductile iron water pipe listed in the variable quantities shall be for water pipe in place, that is, the unit price shall include the ductile iron pipe and fittings, polyethylene encasement, trenching and backfill, and all labor connected with laying it in the trench.

III-2.1 DUCTILE IRON WATER PIPE

All ductile iron pipe shall be designed in accordance with ANSI A21.50 and manufactured and tested in accordance with ANSI A21.51, latest revision. The thickness class of ductile iron pipe shall be a minimum of Class 50 for sizes six (6) inch and larger unless noted otherwise on the plans. All ductile iron pipe shall have “push on” joints with rubber gaskets conforming to ANSI A21.11, latest revision. All ductile iron pipe shall be cement mortar lined, normal thickness, with approved bituminous seal coat in accordance with ANSI A21.4, latest revision. All ductile iron pipe shall be manufactured in the United States.

| <u>Size</u> | <u>Nominal Wall Thickness, Inches</u> | <u>Minimum Class</u> | <u>Rated Water Working Pressure, Psi</u> |
|-------------|---------------------------------------|----------------------|--|
| 3" | 0.25 | 51 | 350 |
| 4" | 0.26 | 51 | 350 |
| 6" | 0.25 | 50 | 350 |
| 8" | 0.27 | 50 | 350 |
| 10" | 0.29 | 50 | 350 |
| 12" | 0.31 | 50 | 350 |
| 14" | 0.33 | 50 | 350 |
| 16" | 0.34 | 50 | 350 |
| 18" | 0.35 | 50 | 350 |
| 20" | 0.36 | 50 | 300 |
| 24" | 0.38 | 50 | 250 |
| 30" | 0.39 | 50 | 200 |
| 36" | 0.43 | 50 | 200 |

III-2.2 DUCTILE IRON PIPE FITTINGS

All fittings for D.I. Pipe shall be configured as shown on the Plans, or as required to effectively install the pipe under the conditions encountered without excessive deflection. All fittings shall be Mechanical Joint Fittings (MJ); furnished complete with full joint accessories and gaskets. **No swivel tees shall be allowed.**

Fittings shall be of either of the following standard specifications:

- (A) Ductile Iron Full Body Fittings in full conformance with ANSI/AWWA C110/A21.10 with joint meeting the requirements of ANSI/AWWA C111/A21.11 or latest revisions.
- (B) Ductile Iron Compact Fittings in full conformance with ANSI/AWWA C153/A21.53 with joint meeting the requirements of ANSI/AWWA C111/A21.11 or latest revisions.

All fittings shall be cement mortar lined, standard thickness, with bituminous seal coat; all in full accordance with AWWA C104/A21.4. All fittings shall be manufactured in the United States.

Retainer Glands. All MJ fittings, valves, and fire hydrants will be provided with Retainer Glands to prevent separation. Retainer Glands shall be EBAA Iron, Inc. Megalug Series 1100 or approved equal conforming to ANSI/AWWA C111/A21-11 latest edition and shall be manufactured in the United States.

III-2.3 POLYETHYLENE ENCASEMENT

Unless otherwise noted, special polyethylene encasement shall be used for protection of ductile iron and other metal piping and other places as noted on plans. The polyethylene encasement shall be installed in strict accordance with ANSI/AWWA C105/A21.5-88 (or latest revision) Section 5-4. Polyethylene encasement shall be V-Bio Enhanced Polyethylene Encasement or approved equal. Polyethylene encasement shall consist of three layers of co-extruded linear low density polyethylene (LLDPE), fused into a single thickness of not less than .008 (8mils). The inside surface of the polyethylene wrap to be in contact with the pipe exterior shall be infused with a blend of anti-microbial biocide to mitigate microbiologically influenced corrosion and a volatile corrosion inhibitor to control galvanic corrosion. Polyethylene encasement shall be manufactured in the United States. Polyethylene encasement and special tape shall, in all cases, be provided by the manufacturer or supplier of the pipe being encased.

The cost of work under this section shall be included in the contract prices for the pipe to be encased and will not be paid for separately.

III-3. HANDLING AND LAYING OF 2" COPPER WATER PIPE

In the transportation, unloading, and handling of pipe, the pipe shall not be dropped or subjected to any unnecessary jar, impact, or other treatment that might damage pipe. Any unnecessary indentations, marks, or bends in pipe will not be allowed by the engineer.

Before laying pipe in the trench, the bottom of the trench shall be carefully graded and four (4) inches of said subgrade prepared so that the pipe will have a uniform support the entire length. The pipe shall also have four (4) inches of sand subgrade cover before the initial backfill of material with loose dirt free from dirt clods and rocks larger than one-half (1/2) inch in diameter or any other object that in the opinion of the Engineer will damage the pipe. The width of the trench at one foot above the pipe shall not exceed two (2) feet, unless directed by the Engineer. All pipe shall have at least thirty-six (36) inches of cover over the top of the pipe, unless directed more or less by the Engineer.

The inside of the pipe and all fittings involved in jointing shall be cleaned of all dirt, mud, grease and other foreign matter before the pipe is welded or laid. Any pipe determined by the Engineer to be damaged and unsuitable for use shall be immediately removed from job site.

All joints of pipe, fittings, and connections must be spliced together using "sweat-type" coupling sleeves and fittings. All "sweat-type" fittings and connections shall be welded with "Silphos" or approved equal; no solder joints will be permitted.

Two (2) inch copper pipe and fittings, except as specifically shown on the plans or hereinafter specified, will be measured and paid for as pipe. The quantity of pipe shall be determined by measuring along the top centerline of the pipe and fittings as laid. The unit prices for two (2) inch copper shall include water pipe and fittings in place, trenching, and backfilling, and all labor and equipment connected with installation of pipe, backfilling, and dress-up.

III-3.1 TWO (2) INCH COPPER WATER TUBING

Domestic two (2) inch Copper tubing shall be “Type K” with a hard temper conforming to ASTM B-88, or latest revisions. Each joint shall be a straight, seamless twenty (20) foot section of tubing. Each joint shall be marked in green lettering attesting to the product specifications.

All joints shall be welded with “Silphos” or approved equal. There will be no solder joints permitted.

Each two (2) inch Resilient Wedge Valve used for two (2) inch Copper water mains and services shall have a 6”x 2” Schedule 40 brass nipple that contains no lead connecting valve to existing water main.

III-4. HANDLING AND LAYING 2” PVC WATER PIPE

In transportation of the pipe, any of the pipe that is subjected to exhausted fumes must be covered to prevent contamination of the pipe. Any pipe determined by the Engineer to be contaminated by exhaust fumes shall be rejected and removed from the job site. In the transportation, unloading, and handling of pipe, the pipe shall not be dropped or subjected to any unnecessary jar, impact, or other treatment that might crack or otherwise damage the pipe. The pipe shall not be handled by chains or cables and shall not be allowed to strike hard objects in loading and unloading. Pipes shall not be subjected to abrasion, gouging or cutting or stressing of bell joints and damage to beveled ends. Pipe shall be handled more carefully in cold weather to prevent impact damage. All PVC pipe and fittings must be stored out of direct sunlight and away from any heat source.

Before laying pipe in trench, the bottom of the trench shall be carefully graded and prepared and bell holes excavated so that the pipe shall have a uniform support along its entire length, except at bell holes. The pipe shall not be allowed to rest on hard and sharp objects through any portion of its length. The width of the trench at the top of the pipe shall not exceed two (2) feet, unless directed by the Engineer. All pipe shall have at least thirty-six (36) inches of cover over the top of the bell.

Deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets, shall not exceed the maximum recommended by the pipe manufacturer. If the alignment requires deflections in excess of these limitations, then special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide annular deflections. When pipe is cut, the end shall be beveled and the burrs shall be removed from the inside of the pipe. Such bends or short lengths of pipe shall be installed as directed by the Engineer at no additional cost to Conway Corporation.

The inside of the pipe and all parts involved in jointing shall be cleaned of all dirt, mud, grease and other foreign matter before the pipe is laid or the joint is started. The gasket, gasket groove, pipe spigot bevel and sealing surfaces shall be inspected for damage or deformation before being used. Any pipe determined by the Engineer to be damaged and unsuitable for use shall be immediately removed from the job site.

In laying two (2) inch PVC bell and gasket pipe, the manufacturer’s recommendations for securing good joints shall be rigidly followed. Use only the pipe lubricant specified and supplied by the pipe manufacturer. Apply lubricant to the clean spigot end just before pushing it into the clean spigot end just by hand using a slight twisting motion to the pipe until it slips through the bell gasket. Do not swing or stab the spigot end into the bell. The spigot end of the pipe is marked by the manufacturer to indicate the proper depth of insertion into the bell. Pipe shall be joined using manual force only, unless directed

otherwise by the Engineer. When laying pipe in temperatures below forty (40) degrees Fahrenheit, the rubber gaskets should be kept warm before being used.

The pipe shall be backfilled to one (1) foot above the top of the bell with loose dirt free of rocks larger than one-half (1/2) of an inch in diameter, dirt clods larger than three (3) inches in diameter or any other object that in the Engineer's opinion will damage the pipe. The backfill to a point six (6) inches above the top of the bell shall be tamped.

Two (2) inch PVC water pipe and DI fittings, except as specifically shown on the plans or hereinafter specified, will be measured and paid for as pipe. The quantity of pipe shall be determined by measuring along the top centerline of the pipe and fittings as laid. The lump sum Contract Price shall include the quantities of two (2) inch PVC pipe given in the List of Variable Quantities and the appropriate contract unit prices will be used to adjust the Contract Price for variation of actual quantities from those estimated. The unit prices for two (2) inch PVC water pipe listed in the variable quantities shall be for water pipe in place, that is, the unit price shall include two (2) inch PVC pipe and DI fittings, marker balls, trenching and backfilling, and all labor and equipment connected with laying the pipe and installing marker balls.

III-4.1 TWO (2) INCH PVC WATER PIPE

This specification covers the requirements for Polyvinyl Chloride (PVC) pressure pipes with integral bell and spigot gasketed joints in Iron Pipe Sizes (IPS) nominal sizes, one and one-half (1 ½) inch through two (2) inch. These pipes shall meet the requirements of American Society for Testing and Materials standard ASTM D-2241, Standard Specification for Polyvinyl Chloride (PVC) Pressure – Rated pipe (SDR Series).

Pipe shall be manufactured from virgin PVC compound meeting the requirements of cell class 12454-B as defined by ASTM D-1784, Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds. The compounds shall have a hydrostatic design rating of 4,000 psi for water at 73.4 degree F. The PVC compound shall be certified by NSF International to ANSI/NSF Standard 14 and Standard 61.

Pipes shall be manufactured to the Iron Pipe Size (IPS) nominal size series for use as a pressure conduit. Pipes shall have SDR-17 wall thickness class and be rated for 250 psi water service at 73.4 degree F, incorporate a 2:1 long term hydrostatic design safety factor. The pipe shall utilize a “locked in” integral gasket joint design meeting the requirements of ASTM D-3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals. The gaskets shall be reinforced with a steel band and conform to the requirements of ASTM F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipes. The standard laying length shall be twenty (20) feet.

All pipe shall be manufactured in the United States.

Chemical/organoleptic tests shall be performed on the pipe with copies being made available upon request. Toxicological tests shall be performed on PVC materials to verify the absence of chemicals in quantities which can be termed toxic, carcinogenic or mutagenic to an extent which can be expected to produce adverse physiological affect to man. Copies of the results of such tests shall be made available upon request.

III-5. INSTALLATION OF VALVES

All valves shall be set with operating stems in true vertical position, unless otherwise shown on the Plans. All valves shall have two (2) inch operating nuts and shall be provided with valve boxes adjusted so that the cover conforms to the adjacent finished grade. Where needed valve stem extensions shall be provided

so that the operating nut is within three (3) feet of finished grade. The valve stem extension, where needed, shall be factory made of round material with a centering device and shall be attached to the operating nut of the valve with set-screws.

All valves shall open left and be equipped with two (2) inch AWWA operating nut.

All valves shall be measured and paid for as the number of valves actually furnished and installed.

The contract unit price for valves shall include furnishing and installing valves with retainer glands, valve stem extensions (where needed), valve boxes and valve box extensions (where needed).

The lump sum contract price shall include the quantities of valves given in the List of Variable Quantities and the appropriate contract unit prices will be used to adjust the contract price for variation of actual quantities from those estimated.

III-5.1 RESILIENT WEDGE GATE VALVES

Resilient wedge gate valves shall be used for all valves shown on the plans, unless otherwise shown or herein specified.

Two (2) inch Resilient wedge gate valves shall be ductile iron-bodied, bronze-mounted, non-rising stem, type 304 stainless steel fasteners, valves equal to Clow Model 2639 with threaded ends conforming to AWWA C509 and latest revisions.

Resilient wedge gate valves (three (3) inch – twelve (12) inch) shall be ductile iron-bodied, bronze-mounted, non-rising stem, type 304 stainless steel fasteners, valves equal to Clow Model 2639 conforming to AWWA C509 and latest revisions.

Resilient wedge gate valves (fourteen (14) inch – twenty-four (24) inch) shall be ductile iron-bodied, bronze-mounted, non-rising stem, type 304 stainless steel fasteners, valves equal to Clow Model 2638 conforming to AWWA C515 and latest revisions.

All valves shall have a minimum working pressure of two-hundred (200) psi, and shall conform to the specifications of the AWWA. Valves shall have O-ring seals. All valves shall have two (2) inch square wrench nuts. All valves shall be assembled at the factory with type 304 stainless steel fasteners. All valves shall open “left”. All valves shall be made in the USA. All buried gate valves shall be provided with valve boxes.

III-5.2 4”-24” BUTTERFLY VALVES

All butterfly valves shall be of the rubber-seated tight-closing type. They shall meet or exceed AWWA Standard C504. All valves shall be CLOW 4500 butterfly valves, or approved equal and shall be rated for a working pressure of two hundred (200) psi.

Both valve ends shall be mechanical-joint per AWWA Standard C111. The valve manufacturer shall supply accessories (bolts, glands, and gaskets).

All valves must use full AWWA C504 Class 150B valve shaft diameter, and full Class 150B underground-service-operator torque rating throughout entire travel, to provide capability for operation in emergency service. All valves shall be NSF approved.

Valve body shall be high-strength cast iron ASTM A126 Class B with 18-8 Type 304 stainless steel body seat. Valve vane shall be high-strength cast iron ASTM A48 Class 40, having rubber seat mechanically secured with an integral 18-8 stainless steel clamp ring and 18-8 stainless steel self-locking screws.

Rubber seat shall be a full circle 360-degree seat not penetrated by the valve shaft. For valves 4"-12" the valve shaft shall be one piece, extending full size through the entire valve. Valve shaft shall be 304 stainless steel. Packing shall be O-ring cartridge designed for permanent duty in underground service. For 14" and larger valve shaft shall be 18-8 stainless steel stub shaft design keyed to the vane with stainless steel taper pins.

Valve operator shall be of the traveling nut type, sealed, gasketed, and lubricated for underground service. It shall be capable of withstanding an overload input torque of 450 ft. lbs. at full-open or full-closed position without damaged to the valve or valve operator. It shall be designed for submergence in water to 25-ft. head pressure for up to 72 hours. Number of turns to operate valve shall closely resemble conventional distribution valve practices to minimize water hammer. Valve shall be capable of easy closure by one man using standard valve key, even under emergency line-break conditions as severe as those that would cause a valve maximum opening torque requirement of as much as two times AWWA Class 150B.

All valves shall be made in the USA.

III-5.3 30"-48" BUTTERFLY VALVES

All butterfly valves shall be of the rubber-seated tight-closing type. They shall meet or exceed AWWA Standard C504. All valves shall be CLOW 4500 Style 1450 butterfly valves, or approved equal and shall be rated for a working pressure of two hundred (200) psi.

Valve body shall be high-strength cast iron ASTM A126, Class B, with 18-8 Stainless Steel Body Seat. Valve vane (Disc) shall be of cast or ductile iron, ASTM A-536, Grade 65-45-12 having rubber seat mechanically secured with a serrated 18-8 Stainless Steel Clamp Ring and 18-8 Stainless Steel self-locking screws. Rubber Seat shall be a full-circle 360-degree seat not penetrated by the valve shaft. The vane shall be of a "Flow-Through" design incorporating three integral flow passages, in order to provide low flow resistance and assurance of high quality. Valve shafts shall be of two-piece stub shaft type, made of 18-8 Type 204 stainless steel with a diameter equal to or larger than specified for applicable valve class as defined by AWWA Standard C-504, latest revision. Rubber Seats shall be capable of ready replacement or adjustment without the use of special tools. Shaft seals shall be of the "O-Ring" type.

The operator shall be of the traveling nut or worm gear type, self-locking in any position and sealed, gasketed and lubricated as needed.

All valves shall close by turning the operator nut in a clockwise direction (Open Left). The operator shall be capable of meeting the torque requirements for opening and closing the valve against the pressure and flow rate specified.

The minimum number of turns to close valve shall be no less than 2 turns per inch of valve size in order to minimize water hammer; and AWWA stops shall be provided capable of absorbing up to 450 foot pounds of input torque without damage to the valve or operator.

Mechanical joint end valves shall conform to AWWA Standard C-111 (ANSI B21.11). Mechanical joint bolts, glands and gaskets shall be supplied by the valve manufacturer.

All valves shall be tested for leakage rated at 200 psi working pressure, and tested hydrostatically at two times the rated working pressure-all in conformance with AWWA Standard C-504, latest revision.

All valves shall be made in the USA.

III-5.4 VALVE BOXES

All buried valves shall be provided with valve boxes. Valve boxes shall be the screw-type, of adequate length considering the cover over the pipe. Valve boxes for two (2) inch – twelve (12) inch valves shall be East Jordan Iron Works 8550 series, complete with lid marked CONWAY WATER. Valve boxes for fourteen (14) inch and larger shall be East Jordan Iron Works 8560 series, complete with lid marked CONWAY WATER.

Where valve boxes need to be extended to match finished grade, the box shall be extended by the addition of an East Jordan Iron Works 8550 series box extension or by replacing the valve box with an East Jordan Iron Works 8550 or 8560 series box of the correct height or as directed by the engineer.

Valve Boxes shall be made in the USA.

The cost of valve boxes and valve box extensions shall be included with the contract unit price of the valve and therefore will not be paid for separately

III-6. INSTALLATION OF TAPPING SLEEVES AND VALVES

Before installing tapping sleeves, the existing water line shall be thoroughly cleaned with a wire brush and then soap and clean water until there are no foreign products on the water line. No sleeve will be allowed installed until Engineer approves this process.

After installation of tapping sleeve and valve, solid concrete blocks shall be placed under tapping valve to prevent movement. Blocks shall be placed on dry, hard, undisturbed dirt or approved gravel base.

Tapping sleeve and valve shall be pressure tested to manufacturer's requirements and Engineer's approval before tapping begins.

Tapping sleeve shall be wrapped in polyethylene, then a Class "B" concrete backing poured behind sleeve.

Uncovered existing water line, tapping sleeve and valve, and "new" water line at valve shall be firmly embedded with gravel before backfilling.

Unit contract price shall be inclusive of the cost of the tapping sleeve, tapping valve, tapping procedure installation, valve box, and concrete block, etc., and all other work incident thereto. Concrete and gravel will be paid for separately.

III-6.1 TAPPING SLEEVES AND VALVES

Tapping Sleeves and Valves, as required for connection to existing water main, shall be sized as shown on the Plans and as called for in the List of Variable Quantities.

Tapping sleeves shall be ductile iron bodied, mechanical joint style, with duck-tipped gaskets, and ANSI B16.1, AWWA C110, Class 125 inlet flange; and shall be MUELLER H-615, or approved equal product unless otherwise specified by the Engineer. All Tapping sleeves and valves shall be made in the USA.

Valves used for tapping shall have the same specifications as previously stated except they shall be MJ x FL.

All Tapping Valves shall be provided with previous specified valve boxes, lids and, where needed, valve stem extensions.

III-7. INSTALLATION OF FIRE HYDRANTS

Fire Hydrants will be set plumb, resting on 8"x16"x4" concrete block, and backed with Class B concrete. All fire hydrants shall be attached to waterline with a solid by swivel adapter unless otherwise noted. If regular fire hydrant leads are specified, they shall be attached to waterline with retainer gland flanges with setscrews. Hydrants shall be backfilled with an envelope of clean washed gravel or crushed stone of at least seven (7) cubic feet to receive the drainage from the hydrant's weep holes. Hydrant weep holes will be left clean, open, and unobstructed.

Hydrants must be oriented such that hose and pumper connections are facing the adjacent street or roadway, or as directed by Engineer. If necessary, Contractor will break flanged connections on hydrant barrel and reorient the inlet of the hydrant so as to provide proper orientation of hose and pumper connections.

Hydrant locations are designated on the Plans, but location shall be subject to final determination by the Engineer during construction to best coordinate with property lines, street right-of-ways, terrain, and conditions existing at time of installation. Contractor should consult Engineer on grade to set fire hydrants so as to match the hydrant Bury-Line to finished grade.

The price for furnishing and installing fire hydrants shall include material, excavation, gravel base, concrete slab, backfill, solid by swivel adapters or hydrant lead and retainer glands, and all work incident thereto, except that Class "B" concrete for backing, hydrant lead valves (where required) and hydrant extensions (where required) will be measured and paid for separately. Where hydrant extensions are required they shall be paid for in six (6) inch increments.

III-7.1 FIRE HYDRANTS

Fire hydrants shall conform to AWWA C502 and latest revisions with a minimum valve opening of five and one-quarter (5 ¼) inch. Hydrants shall have a four (4) foot bury, unless shown otherwise on the plans, and shall be furnished with two, two and one-half (2 ½) inch, hose nozzles and one four and one-half (4 ½) inch pumper nozzle. Threads on pumper nozzles shall be Mueller Specifications B-304; and threads on hose nozzles shall be National Standard. Hydrants shall be furnished to open "Left" by means of a National Standard one and one-half (1 ½) inch pentagonal operating nut. All bonnet, safety flange and shoe fasteners shall be of Type 304 stainless steel.

Hydrants shall be Clow Medallion F-2545 or Mueller Super Centurion 250 A-423 with six (6) inch MJ Shoe and shall be furnished painted fire hydrant red. Hydrants shall be made in the USA.

Hydrant extensions shall be Clow R-1620 series or Mueller A-320 series and shall be furnished with Type 304 stainless steel fasteners.

Fire hydrant leads will be six (6) inch x eighteen (18) inch ductile solid by swivel adapters and conforming to ANSI/AWWA C-153-A21.53 (unless noted otherwise on the plans) and ANSI/AWWA C-111-A21.11 with cement lining C-104 and ANSI 21.4 will meet the same specifications as the pipe selected by Conway Corporation for the water main extensions.

III-8. BLOW OFF HYDRANT

Blow off hydrants shall be non-freezing, self-draining type with a four (4) foot bury unless otherwise noted on plans. These hydrants will be furnished with a two (2) inch FIP Inlet, a non-turning operating rod, and shall open to the left. The lower posts and the riser post shall be of cast iron. All of the working parts shall be of bronze-to-bronze design, and be serviceable from above grade with no digging. The outlet shall also be of bronze and be a two and one-half (2 ½) inch NST. Hydrants shall be lockable to prevent unauthorized use. Blow off hydrants shall be Kupferle Mainguard #77 or Eclipse #2 Post Hydrant, or approved equal and made in the USA. Type used shall be job specific and specified on the plans.

III-9 CONNECTION TO DISTRIBUTION SYSTEM

All connections to the existing distribution system must be accomplished in the presence of the **Engineer**.

In cases where completing the connection will disrupt service to customers, the Contractor shall notify the Engineer at least two (2) days in advance of the work. The **Contractor**, as directed by the Engineer, shall notify the customers whose service will be disrupted. The Contractor shall plan the work so that disruption of service is held to a minimum. The plan must be satisfactory to the Engineer.

After connections have been completed, the valves shall remain tightly closed until all testing and sterilization is complete. The Engineer shall place a locking lid on the valve box. Connecting valves shall remain closed until otherwise directed by the Engineer.

III-10. FILLING WATER MAINS

After the pipelines and appurtenances have been installed, all concrete thrust blocking has cured adequately and upon approval of the **Engineer**, the pipelines shall be filled with water.

In order to prevent circulation of water through the new pipelines back into the distribution system, new pipeline shall only be filled through approved “**fill connections**” installed and constructed by the Contractor as shown in the Standard Details or as directed by the Engineer.

Fill Connection valves shall remain closed until the Reduced Pressure Zone Assembly (RPZA) has been tested and approved for use by an approved certified testing technician.

Valves other than fill connection valves shall not be used to fill new pipelines without the specific approval of the Engineer. Any such valve shall be operated only in the presence of the **Engineer** and shall be slowly and only partially opened.

All air shall be expelled from the pipeline by opening fire hydrants and or other openings installed at the pipeline crests by the Contractor. The location and number of such openings shall be as shown on the Plans or as directed by the Engineer.

Fill assemblies, blow offs, and sampling point assemblies shall be disassembled to their below ground configuration within one week of final use.

Fill Connection, as a pay item shall include all piping, components, fittings, all equipment necessary for installation, labor, testing of RPZA and termination of Fill Connection.

III-10.1 FILL CONNECTION

Fill Connections shall consist of taps, saddles, valves, corporation stops, curb stops, Reduced Pressure Zone Assembly (RPZA), meter boxes, pipe, plugs and all fittings necessary to complete assembly. All components of Fill Connections must meet individual component specifications contained in this specification book.

III-11. TESTING WATER LINES

All water lines installed shall be subjected to a pressure test and leakage test at a minimum pressure of two-hundred (200) psi or double the working pressure, whichever the greater, by the Contractor. The Contractor will be required to determine the cause of failure, make all necessary repairs, and retest until found satisfactory; all at no additional cost to Conway Corporation.

Each isolated section of water lines as selected by the Contractor, with the consent of the Engineer, for test shall be slowly filled with water. Before applying the test pressure, all air shall be expelled from the pipe by blowing-off at fire hydrants. If necessary to properly expel air prior to test, Contractor will tap lines at high points and install corporation stops. Owner shall provide all water for test purposes without charge to Contractor.

Pressure shall be applied to the line by means of a pump capable of maintaining the required pressure, pipe connections, and all other necessary apparatus for applying pressure and measuring the resultant leakage from the line under pressure. All gauges and meters used shall be new and tested for accuracy. All such apparatus shall be furnished by the Contractor, unless the Engineer requires the use of Conway Corporation gauges and meters. The Contractor will make all the necessary connections to the pipe for making tests.

The leakage shall be measured for a period of two (2) hours. The test when so conducted shall indicate a leakage of not more than the number of gallons per hour as determined by the Formula $L = [(D) \times (P)^{-5}] / 25.2$ in which "L" = the allowable leakage in gallons per hour per mile of pipe; "D" is the nominal diameter of the pipe in inches; and "P" is the average test pressure during the leakage test, in pounds per square inch gauge. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any isolated section thereof, to maintain the specified leakage test pressure within five (5) psi of the specified test pressure, after the air in the pipe has been expelled and the line filled with water.

The following Table shows the allowable leakage for each pipe size, computed using the above formula:

Allowable Leakage Per 1000 Feet In
Gallons Per Hour At 200 PSI

| <u>Pipe Size</u> | <u>Allowable Leakage</u> |
|------------------|--------------------------|
| 2" | .21 |
| 4" | .43 |
| 6" | .64 |
| 8" | .85 |
| 10" | 1.06 |
| 12" | 1.28 |
| 14" | 1.49 |
| 16" | 1.70 |
| 24" | 2.55 |

Even though pipelines may pass the leakage test, any leaks apparent at the ground's surface, any leaking joints, fittings, or appurtenances that are detected shall be repaired to the satisfaction of the Engineer.

III-12. STERILIZING WATER LINES

The Contractor shall sterilize all new water lines with chlorine in accordance with AWWA C-651 before water lines shall be accepted by Conway Corporation and placed into service. Sodium or calcium hypochlorite (HTH) or liquid chlorine may be used in such amounts as to provide a dosage of not less than the required amount for the method used as specified in AWWA C-651. The sterilizing agent shall be introduced in accordance with any AWWA C-651 approved manner except the Tablet Method. For the purposes of these specifications, the Tablet Method as described in AWWA C-651 shall not be deemed an approved method. The Contractor shall open and close all in-line valves in water lines being sterilized several times during the sterilizing period so as to insure uniform distribution of the sterilizing agent along the pipelines. The Contractor will use extreme caution to be certain that the strong sterilizing agent is not flushed back into any part of the water distribution system in such a manner that it reaches water consumers. Following a contact period of at least twenty-four (24) hours, the Contractor shall completely flush the heavily chlorinated sterilizing water from all pipes, and the pipes shall be rinsed and thoroughly flushed with large quantities of clear water.

The Contractor, under the supervision of the Engineer, shall take samples from all water lines as directed by the Engineer. Said samples shall be analyzed for bacterial impurity by the State Department of Health. The Contractor, as necessary, shall repeat the sterilizing process, until all samples indicate that the water is safe and approved by the Arkansas Department of Health.

Two consecutive samples taken twenty-four (24) hours apart must be tested "safe" by the Arkansas Department of Health before the line being tested is considered acceptable.

Contractor will furnish all necessary chlorine, temporary pipe risers and blow-off valves at the ends of dead-end mains to facilitate this process. The cost of all work under this section shall be included in the contract unit price for water pipe and will not be paid for separately. Conway Corporation will furnish all the water necessary for testing and sterilizing under normal circumstances.

III-13. INSTALLATION OF COPPER WATER SERVICE PIPE

Meter locations are shown generally on the Plans, but this location may not be the final location required. The Contractor shall verify each location with the engineer before installation begins.

Each “meter setting” shall include copper (“Type K”) service tubing, ball corporation stop for connection to water main (saddle for two (2) inch PVC mains), meter setter with shut off valve, and meter box with a cast iron lid.

The copper service tubing from the ball corporation stop to the meter setter must be installed with a minimum of thirty (30) inches of cover, three (3) feet cover under pavement (existing or proposed), thirty (30) inches of cover below ditches, and one (1) foot of cover below all storm drains (existing or proposed).

Road-way, private drive, parking lot, and walk cuts for water services shall be excavated with the use of a trenching devise. The use of a one (1) foot bucket or less may be authorized by the Engineer.

All copper tubing shall have three (3) inches of sand subgrade and six (6) inches of sand backfill above the tubing free of dirt clods, rocks, or anything larger than one (1) inch in diameter or any object that, in the opinion of the Engineer, will damage the tubing. The backfill to a point six (6) inches above the top of the tubing shall be flowable select material unless otherwise specified by the Engineer where said backfill is within the limits of any roadway, private drive or parking lot. Care should be taken to ensure that the flowable select material does not come in contact with the copper tubing.

All copper tubing shall be unrolled and placed in excavated ditch in a manner that does not kink or warp the tubing. If tubing is damaged, it must be replaced with an undamaged roll of copper tubing. Tubing should be placed flat in ditch without any voids between the sand subgrade and tubing.

The ball corporation stop must be left “open” after installation, and the shut-off valve on the meter setter must be closed (except when flushing the service).

The top of the meter setter shall be set five (5) to seven (7) inches below the top of the meter box unless otherwise directed by the Engineer.

The meter box shall have a cast iron lid provided for metal detection purposes to facilitate locating water meters. Each meter box must be set in a clean and fully excavated hole, with meter box lid flush with the ground’s final finished surface.

Copper tubing for water services shall be a separate pay item, which includes the tubing, excavation of trenches, and installation of tubing.

Water meter systems as a pay item shall include the tapping of water main, ball corporation stop (saddle for two (2) inch PVC mains), meter setter, meter box with cast iron lid, two (2) inch blue marker pipe, all equipment necessary for installation and labor for complete installation of water service line, excluding the copper pipe.

The sand fill and subgrade is paid for as sand fill and subgrade. The unit price shall include the labor and equipment for placement in trench.

Where two (2) inch PVC encasement pipe is specified, it shall generally extend two (2) feet beyond the limits of the flowable select material, or the limit of the roadway, private drive or parking lot, where flowable fill is not specified. Two (2) inch encasement pipe shall be paid for by the linear foot. The lump sum contract price shall include the quantities of two (2) inch PVC encasement pipe given in the List of Variable Quantities and the appropriate contract unit prices will be used to adjust the contract price for variations of actual quantities from those estimated. The unit prices for two (2) inch PVC encasement pipe

listed in the variable quantities shall be for encasement pipe in place, all labor and equipment connected with laying the pipe in the ditch and inserting the water service pipe in the encasement pipe.

III-13.1 MATERIALS FOR WATER SERVICE LINES

Service Lines: Service lines shall be a single piece domestic copper, Type “K”, soft, in specified size. Service lines shall terminate with a meter yoke. The meter yoke shall be a Ford Meter Box Co. “Coppersetter”, VB72-7W-44-33 (¾”), VB74-10W-44-44 (1”), & VBB77-12B-11-77 (2”).

Connections of new service lines to existing service lines may be spliced using “sweat-type” coupling sleeves. All “sweat-type” fittings and connections shall be brazed with “Sil-phos” or approved equal; no solder joints will be permitted. No soft solder or low temperature solder joints will be permitted

Corporation Stops: Corporation stops shall be installed to constitute the junction of all service lines with the water main. Corporation stops shall be the specified size with threaded inlet and pack joint copper service outlet, and shall be Ford FB-1000.

Curb Stops: When curb stops are specified, they shall be Ford B44-333W (¾”), Ford B44-444W (1”) or Ford B44-777W (2”).

Meter Boxes: Meter boxes shall be installed over all meter setters on water service lines. Meter boxes for three-quarter (¾) inch services shall be East Jordan Iron Works MSBCF 1118-12 (Item# 32413700) with EJIW 1118-R Cast Iron Cover with Reader (Flip) Door (Item# 32131101). Meter boxes for one (1) inch services shall be East Jordan Iron Works MSBCF 1324-12 (Item# 32414001) with EJIW 1324-R Cast Iron Cover with Reader (Flip) Door (Item# 32131301). Meter boxes for two (2) inch services shall be East Jordan Iron Works MSBCF 1730-18 (Item# 32417301) with EJIW 1730-R Cast Iron Cover with Reader (Flip) Door (Item# 32131701).

Two (2) Inch Encasement Pipe: When two (2) inch PVC encasement pipe is specified, it shall be a minimum of Class 200.

All materials for water service lines shall be manufactured in the United States.

DETAILED SPECIFICATIONS

PART IV - SEWER CONSTRUCTION SPECIFICATIONS

IV-1. EXCAVATION – SEWER TRENCH

Contractor shall provide approved OSHA Safety Methods for the excavation. Such Methods take precedence over any procedures outlined in these Specifications or directions of the Engineer. See “Appendix A” Trench Excavation Safety. The Contractor is responsible for the design of excavation procedures, shoring design and placement, and any and all safety procedures.

The bottom of all pipe trenches for six (6) inch and larger pipe, except where encasement is required, shall be shaped as nearly as possible to conform to the outside of the pipe, providing adequate bell holes and taking care to support pipe throughout its entire length except at joints.

In order to avoid superimposed loading in excess of the designed and specified pipe strength and to provide sufficient room for proper installation and bedding of sewer pipe, the trench widths for the sewer pipe sizes used shall be kept within the limits specified as follows. Trench details for pipe (ID) greater than 36” diameter shall be submitted by the Contractor in accordance with the applicable manufacturer’s recommendations to the Engineer for review and consideration. Due consideration shall be given by the Contractor and Manufacturer to soil, hydraulic and site conditions, loading characteristics and other factors as required.

| <u>Inside Sewer Pipe Diameter</u> | <u>Max. Width of Trench @ Spring Line</u> |
|---------------------------------------|---|
| 4” | 24” |
| 6” – 10” | 30” |
| 12” – 16” | 36” |
| 18” – 21” | 42” |
| 24” – 30” | 48” |
| 36” | 54” |
| 42” | 60” |
| 48” | 72” |

If it becomes necessary to reduce the earth load on the trench banks of sewer lines to prevent sliding and caving, it will be permissible to cut the trench banks back on a slope above an elevation two (2) feet above the outside top of the pipe. Under no circumstances, however, shall the specified maximum width twenty – four (24”) inches above the outside top of the pipe be exceeded, except at points where the combined superimposed earth and live loads on the pipe are sufficiently low to permit an increase in the specified maximum trench width, and then only where such an increase in trench width is authorized by the Engineer.

Excavation for sewer pipes shall be carried to a depth of six (6) inches, below the planned grade, for the full width of the trench. The trench shall then be refilled with gravel, thoroughly compacted to a point approximately one-tenth (1/10) the nominal pipe diameter, or two (2) inches, whichever is the greater, above grade and the bottom of the trench hand graded as follows.

The bottom of the trench shall be generally shaped to fit the outside surface of the pipe in such a manner that the pipe will be in continuous contact with, and have a longitudinal bearing on the gravel subgrade for the full length of the pipe, except for such distance as is necessary for bell holes and the proper

sealing of the pipe joints. The pipe subgrade shall be accurately graded prior to excavating bell holes. The accuracy of the finished grade of the pipe shall be obtained in preparation of the subgrade. A bell hole for each joint shall be excavated by the pipe layer immediately prior to placing the pipe in the trench. Bell holes shall be of such depth that the pipe bell will not come in contact with the bottom of the bell hole. All trenches shall be so graded that the spigot end of the pipe will be accurately centered in the adjacent pipe bell when laid without raising or lowering the pipe after installation in the trench.

If the soil at the bottom of the trench for pipe lines is mucky or in such condition that it cannot properly support the gravel subgrade, the Contractor shall excavate below the normal excavation elevation as directed by the Engineer. Wherever excavation is carried below the specified excavation elevation, the Contractor shall provide and install a fill of gravel thoroughly tamped into place up to an elevation sufficient to prepare the subgrade as specified herein.

Where water occurs in trenches for pipe lines they shall be excavated to a depth of approximately eight (8) inches below grade and backfilled with gravel to a point approximately one-tenth (1/10) of the internal pipe diameter or two (2) inches, whichever is the greater, above grade. Pumps shall then be kept operating, taking suction out of a sump below the gravel so as to hold the water level well below the bottoms of all bells until the joints have been placed and allowed to set sufficiently so that water will not injure them.

Where rock occurs in trenches for pipe lines at the planned grade of the bottom of the pipe in such a way that any portion of the pipe would rest on rock, or where in the opinion of the Engineer it is necessary, the excavation shall be carried to a depth of six (6) inches below the planned grade for the full width of the trench. The trench shall then be refilled with gravel, thoroughly compacted to a point approximately one-tenth (1/10) the nominal pipe diameter, or two (2) inches, whichever is the greater, above grade and the bottom of the trench hand graded as previously specified.

Excavation for manholes and other accessories shall be sufficient to leave at least twelve (12) inches in the clear between their outer surfaces and the embankment or timber which may be used to protect them.

The excavation of trenches for pipelines shall not advance more than four hundred (400) feet ahead of the completed pipe work and backfill except by permission of the Engineer.

All excavation for **sewer main** trench, except as otherwise specifically noted, will be classified, measured, and paid for by the linear foot as **Sewer Trench**. Excavation of sewer trench for **sewer mains** will be paid for per linear foot of trench of the different depths for which unit prices are required in the Proposal. The length of sewer trench will be determined by horizontal measurement along the trench centerline, and depth by vertical measurement from the original ground surface to the pipe invert. The contract price shall include quantities of **Sewer Trench** excavation given for **sewer mains** in the List of Variable Quantities, and the appropriate contract unit price will be used to adjust the contract price for variation of actual quantities from those estimated.

All excavation of sewer trench for **sewer services** will be paid for with the sewer service pipe as **Approved Sewer Service Pipe**. The length of **sewer service** trench thus to be paid for will be determined by the horizontal measurement along the centerline of the sewer service pipe actually installed.

The prices for **all** sewer trench excavation shall include normal trench sloping and trench dewatering, backfilling, maintenance of backfill, disposal of waste materials, and all other work incident thereto.

The cost of all excavation for manholes shall be included in the contract unit prices for manholes and will not be paid for separately.

Gravel or crushed stone authorized for payment as subgrade / bedding material for sewer pipes will be measured and paid for by the ton in place in the trenches. The contract price shall include the quantity of gravel for subgrade / bedding given in the List of Variable Quantities and the appropriate contract unit price will be used to adjust the contract price for variation of actual quantity from that amount estimated.

The prices for gravel for subgrade shall include materials, placing, and all other work incident thereto.

Trench Excavation Safety shall be paid for on the final estimate as a lump sum at the appropriate contract unit price.

IV-2. HANDLING AND LAYING OF SEWER PIPE

All pipe shall be transported, unloaded, stored, stacked, and handled using precautions and methods recommended by the pipe manufacturer to prevent damage to the pipe. Pipes shall not be allowed to strike hard objects in loading and unloading. Pipes shall not be subjected to abrasion, gouging or cutting or stressing of bell joints and damage to beveled ends. Each joint of pipe shall be carefully inspected immediately before laying and any pipe found to be faulty or damaged shall be marked in an obvious and permanent manner and removed from site. A faulty or damaged joint of pipe may be used in the work if the fault or damaged area is removed by cutting the pipe leaving a shortened section of sound pipe approved by the Engineer.

Poly Vinyl Chloride (PVC) pipe shall not be handled by chains or cables. PVC pipe and fittings shall be stored out of direct sunlight and away from any heat source. PVC pipe greater than or equal to one year old is not acceptable.

At no time shall pipe be laid or backfilled without an Engineer on site or without the approval of Engineer. No sewer service connections will be covered until they are inspected and the Engineer obtains the location.

Sewer service pipe shall be installed from the sewer main to the property to be served in locations to be designated by the Engineer. All service pipe shall be plugged or capped with an approved watertight plug or cap to seal it off before the terminal pipe is placed in the trench. The end of each service pipe shall be 3'-5' below finished grade (depth as required to adequately serve the intended property, questions should be directed through the Engineer) and clearly marked with a piece of green two (2) inch PVC pipe placed directly in front of sewer service or wye branch extending straight up out of the ground a minimum of four (4) feet. The PVC marker pipe shall generally be 10' in length and shall be placed plumb from the service stub invert up to and above grade.

Pipe joints shall be assembled in accordance with procedures recommended by the pipe manufacturer, using proper gaskets, lubricants, tools, and jointing techniques. The inside of a pipe and all parts involved in joining shall be cleaned of all dirt, mud, grease or other foreign matter before the joint is started. The pipe spigot bevel and sealing surfaces shall be inspected for damage or deformation before using. Bevels and pipe cuts shall be free of burrs.

Before laying the pipe, the trench subgrade and pipe foundation shall be carefully graded and prepared and bell holes excavated so that the pipe shall have a uniform support along its entire length and settlement will not subsequently occur. Accuracy of the installed grade of the pipe shall be obtained in the

preparation of the pipe foundation. Each pipe section shall be laid on proper line and grade using a laser grade light. The laser grade light shall be a late model light that has been recently calibrated for accuracy and is in good working condition. Calibration certification documentation shall be submitted to the Engineer immediately upon request. Sewer main pipes shall be laid at the grade specified on the appropriate cut sheet. Four (4) inch sewer service pipe shall be laid at a slope of 1.5% unless otherwise instructed by the Engineer.

The grade light used shall be braced so that it is not jarred off grade or alignment during excavation of the trench or other related work. A fan shall be kept blowing in the sewer pipe at all times, when the grade light is being used inside the pipe, and the Contractor shall have a man responsible for checking the grade light and fan as often as necessary to assure that the grade light remains level and on grade. The grade light shall be checked for level at least every fifty (50) feet and more often if conditions warrant it, or if directed by the Engineer. The Contractor shall be required to check the pipe for grade and alignment at a point fifty (50) feet out from the grade light and at other points as required by the Engineer. If at any point the pipe is found to be off alignment and/or off grade in excess, in the judgment of the Engineer, the contractor shall relay said sewer pipe to the correct alignment and grade.

The Contractor shall make sure that the grade light is set up to the correct elevation, alignment, and percent grade prior to laying any sewer pipe.

All sewer pipe will be bedded in accordance with details, specifications, as shown in submittals, or as designated by Engineer.

All sewer pipe shall be installed with bell-end upgrade unless otherwise authorized by the Engineer. Care shall be taken that each spigot is properly centered on the bell of the preceding pipe and that each pipe is solidly bedded so as to prevent displacement during subsequent backfill and settlement.

As pipe work progresses, the interior of the pipe shall be cleared of all dirt and superfluous material of every description. Any mud, silt, sand, gravel, or other material accumulating inside the pipe during construction shall be removed; such materials shall not be flushed downstream for disposal.

The ends of all sewer pipes terminating at manholes not yet constructed shall be plugged with an approved plug until manholes are poured. The sewer main being laid shall be temporarily closed at the end of each workday with an approved plug.

Laying and backfilling of all sewer lines laid in trenches shall follow the excavation of trenches as closely as practicable. Not more than four hundred (400) feet of trench shall be opened in advance of pipe laying without authorization by the Engineer. Water shall not be allowed to accumulate in trenches while pipe is being laid. Work on sewers crossing roads shall be done in such a manner as to interfere as little as possible with the movement of traffic on the roads.

All sewer pipe of the various sizes as stated on the Drawings and in the Bid Form will be measured and paid for separately by the linear feet of pipe as finally installed and approved by the Engineer and acceptable to Conway Corporation. Measurement will be along the centerline of sewer pipe as finally installed. Measurement for sewer main pipe will be continuous through manholes and sewer wyes. Measurement for sewer service pipe will be from the upstream end of the wye branch or manhole stub-out through bends to the terminal end of the pipe. The unit price includes: the pipe (of various sizes), laying of pipe, testing of pipe, backfill, and all cleanup operations, together with all other incidental items of work and materials as may be required to satisfactorily complete the installation of the sewer pipe; except those elements of work for which separate unit prices are stated in the Bid Form. In addition sewer service pipe price shall also include all excavation for said pipe.

IV-3. PIPE APPROVED FOR USE IN PUBLIC SEWER MAINS

Conway Corporation reserves the right to specify which approved pipe shall be laid. All pipe shall be manufactured in the United States. The pipe stiffness/classification shall conform the manufactures minimum requirements, or exceed the requirements as specified, as a function of depth of bury, bedding, backfill, and loading conditions.

IV-3.1 POLYVINYL CHLORIDE (Solid Wall PVC) GRAVITY SEWER PIPE

Polyvinyl Chloride (PVC) Gravity Sewer Pipe as conforming to ASTM D 1784 and have a minimum pipe stiffness of 115 PSI, according to the latest revision of ASTM D 2412 Standard Test Method for External Loading Properties of Plastic Pipe by parallel-plate loading at an arbitrary datum of 5 percent (5%) deflection. **Standard Dimension Ratio (SDR) PVC Sewer Pipe shall not exceed 26** and shall conform to the latest revision of ASTM D 3034 (ASTM F679 for pipe greater than 12” in diameter). The SDR 26 Pipe must be Bell and Spigot Pipe using an elastometric gasket meeting requirements of the latest revision of ASTM D 3212. Each joint of pipe shall be clearly marked showing size, date of manufacture, ASTM Number and SDR Number. When pipe is laid in the trench, said markings shall be facing up so that they may be clearly seen. No blue colored pipe shall be allowed. Jointing of dissimilar pipe materials shall be accomplished with the appropriate adapter fittings manufactured for the purpose used and approved by Conway Corporation.

Concrete manhole adapters shall be installed where PVC pipe penetrates manhole walls. Concrete manhole adapters shall be Fernco, Model CMA or approved equal.

Where PVC sewer pipe transitions to clay pipe, a Mission Rubber Company, MR02 Series, Flex-Seal Coupling, or approved equal, shall be used. Said coupling shall have stainless steel flanged bushings and a stainless steel shear ring.

Where PVC sewer pipe transitions to ductile iron pipe, a Mission Rubber Company, MR51 Series, Flex-Seal Coupling, or approved equal, shall be used. Said coupling shall have stainless steel flanged bushings and a stainless steel shear ring.

IV-3.2 EPOXY LINED DUCTILE IRON SEWER PIPE

For Depth of Bury less than or equal to 4 feet above top of pipe, or as directed by Engineer, Ductile iron sewer pipe shall conform to ANSI/AWWA C150/A21.50 or latest revision, and ANSI/AWWA C151/A21.51 or latest revision. The pipe shall be lined with a high-build, multi-component Amine-cured Novalac epoxy lining that shall be **Protecto 401 Ceramic Epoxy** that is 40 mils thick when dry. Ductile iron sewer pipe shall have “push on” rubber gasketed joints in full compliance with ANSI/AWWA C111. Gaskets and joint lubricant will be furnished with pipe by the pipe manufacturer. Ductile Iron Sewer Pipe shall be a minimum of PC 150, or as required by depth of cover in accordance with manufacturer’s recommendations. Polyethylene Encasement conforming to ANSI/AWWA C105/A21.5 or latest revision and has a minimum thickness of 0.008 (8 mils) shall be used on all ductile iron sewer pipe.

Concrete manhole adapters shall be installed where ductile iron pipe penetrates manhole walls. Concrete manhole adapters shall be Fernco, Model CMA or approved equal.

Where ductile iron sewer pipe transitions to clay pipe, a Mission Rubber Company, MR03 Series, Flex-Seal Coupling, or approved equal, shall be used. Said coupling shall have stainless steel flanged bushings and a stainless steel shear ring.

Where ductile iron sewer pipe transitions to PVC pipe, a Mission Rubber Company, MR51 Series, Flex-Seal Coupling, or approved equal, shall be used. Said coupling shall have stainless steel flanged bushings and a stainless steel shear ring.

IV-3.3 PVC (24" and larger closed profile) GRAVITY SEWER PIPE

PVC closed profile pipe and fittings shall be manufactured in accordance with the requirements of ASTM F794 and ASTM F1803, both latest edition. PVC closed profile pipe shall be made from a compound meeting the requirements of cell classification 12364 as defined by ASTM D1784. Manufacture shall be in accordance with ASTM F1803.

Maximum long term deflection is 5%
Lag factor of 1.5
Soil modulus of 500 psi
Factor of safety of 2.5
Minimum stiffness factor of 46psi

All subject to review and approval prior to installation by the Engineer. Pipe orifices at manhole penetrations shall be sealed in a manner acceptable to the Engineer.

IV-3.4 FIBERGLASS GRAVITY SEWER PIPE

Fiberglass pipe shall conform to the requirements of ASTM 3262 latest edition. The minimum pipe stiffness shall be 46psi, and shall meet or exceed the manufacturer's recommendations. Pipe bedding shall be in accordance with requirements of PVC Pipe as noted herein.

All subject to review and approval prior to installation by the Engineer.

IV-3.5 VITRIFIED CLAY PIPE

All vitrified clay sewer pipe shall conform to the latest specifications for extra strength clay pipe, A.S.T.M. Designation C 700-07a, latest edition. Vitrified clay pipe joints using materials having resilient properties shall conform to and be tested and inspected in accordance with A.S.T.M. Designation C 425-04, latest edition.

Any and all vitrified clay sewer wyes and fittings shall comply with the above specifications. Wyes will be true Y branches, with 4 inch branch. Tees are not acceptable. Provisions of c 828-06 shall apply with reference to testing.

If clay pipe is used, epoxy coated ductile iron will be required through bores and ten feet minimum each side of manholes.

IV-3.6 (NOT USED) RESERVED

IV-3.7 GRAVITY FIBERGLASS REINFORCED PIPE

Fiberglass reinforced pipe gravity mains shall be of the nominal diameter(s) shown on the Plans and shall have wall thicknesses consistent with pipe stiffness 46 (PS 46) for burial depths of up to 20'. For burial depths greater than 20' a wall thickness consistent with pipe stiffness 72 (PS 72) shall be used. All fittings for gravity main pipe shall be ductile iron mechanical joint ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53. FRP pipe shall have push-on gasketed joints meeting the performance requirements of ASTM D4161. All pipe and fittings to be used as gravity mains shall be of sufficient pressure rating (PN) to meet a test pressure of 150 psi.

FRP for gravity lines shall meet the requirements of ASTM D3262.

Other standards references that apply include:

ASTM D3262 – Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.

ASTM D3754 – Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe.

ASTM D4161 – Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.

ASTM D2412 – Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.

FRP pipe for this project shall be supplied in nominal lengths of 20 feet.

IV-4. APPROVED 4” AND 6” PIPE FOR SEWER SERVICES

Conway Corporation reserves the right to specify which approved pipe shall be laid. All pipe shall be manufactured in the United States.

IV-4.1 CAST IRON SOIL PIPE

Cast Iron Soil Pipe conforming to the latest revision of ASTM A 74-69 (Bell and Spigot Pipe with rubber gaskets ASTM C 564-70).

Concrete manhole adapters shall be installed where cast iron soil pipe penetrates manhole walls. Concrete manhole adapters shall be Fernco, Model CMA or approved equal.

IV-4.2 CEMENT LINED DUCTILE IRON SEWER PIPE

Ductile Iron Cement Lined Pipe conforming to the latest revision of ANSI/AWWA C150/21.50 and ANSI/AWWA C151/A21.51, with “push-on” or “mechanical” type joints utilizing rubber gaskets.

Concrete manhole adapters shall be installed where ductile iron pipe penetrates manhole walls. Concrete manhole adapters shall be Fernco, Model CMA or approved equal.

IV-4.3 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE

Polyvinyl Chloride (PVC) Gravity Sewer Pipe as approved by the Arkansas Department of Health and have a minimum pipe stiffness of 115 PSI, according to the latest revision of ASTM D 2412 Standard Test Method for External Loading Properties of Plastic Pipe by parallel-plate loading at an arbitrary datum of 5 percent (5%) deflection. **Schedule 40 PVC** Drain, Waste and Vent Pipe shall conform to the latest revision of ASTM D 2665 manufactured with Type I, Grade 1 Compound conforming to the latest revision of ASTM D 2665. **Standard Dimension Ratio (SDR) PVC Sewer Pipe shall not exceed 21** and shall

conform to the latest revision of ASTM D 2241. Solvent weld joints may be used on the Schedule 40 pipe only and the solvent cement must meet the requirements of the latest revision of ASTM D 2564. All joints shall be watertight and have sufficient strength within five minutes after assembly to permit normal installation, handling and moving. The SDR 21 Pipe must be Bell and Spigot Pipe using an elastometric gasket meeting requirements of the latest revision of ASTM D 3139. Each joint of pipe shall be clearly marked showing size, ASTM Number and SDR Number or Schedule Number. When pipe is laid in the trench, said markings shall be facing up so that they may be clearly seen. No blue colored pipe shall be allowed. Jointing of dissimilar pipe materials shall be accomplished with the appropriate adapter fittings manufactured for the purpose used. Where a dissimilar Bell and Spigot joint is utilized, a “rubber donut” of the proper size shall be used. Where a dissimilar Spigot joint is utilized, a Fernco rubber coupling or equal of the proper type and size shall be used. The end of all four (4) inch PVC sewer services and stub outs shall be plugged with expandable pipe plugs equal to ETCO ST-402 or glue type schedule 40 cap.

Where PVC sewer pipe penetrates a manhole wall, a concrete manhole adapter shall be used. Said adapter shall be a Fernco Model CMA or approved equal.

IV-5. APPROVED SEWER SERVICE PIPE LARGER THAN 6”

Conway Corporation reserves the right to specify which approved pipe shall be laid. All pipe shall be manufactured in the United States.

IV-5.1 CEMENT LINED DUCTILE IRON SEWER PIPE

Ductile Iron Cement Lined Pipe conforming to the latest revision of ANSI/AWWA C150/21.50 and ANSI/AWWA C151/A21.51, with “push-on” or “mechanical” type joints utilizing rubber gaskets.

Concrete manhole adapters shall be installed where ductile iron pipe penetrates manhole walls. Concrete manhole adapters shall be Fernco, Model CMA or approved equal.

IV-5.2 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE

Polyvinyl Chloride (PVC) Gravity Sewer Pipe as conforming to ASTM D 1784 and have a minimum pipe stiffness of 115 PSI, according to the latest revision of ASTM D 2412 Standard Test Method for External Loading Properties of Plastic Pipe by parallel-plate loading at an arbitrary datum of 5 percent (5%) deflection. **Standard Dimension Ratio (SDR) PVC Sewer Pipe shall not exceed 26** and shall conform to the latest revision of ASTM D 3034. The SDR 26 Pipe must be Bell and Spigot Pipe using an elastometric gasket meeting requirements of the latest revision of ASTM D 3212. Each joint of pipe shall be clearly marked showing size, ASTM Number and SDR Number. When pipe is laid in the trench, said markings shall be facing up so that they may be clearly seen. No blue colored pipe shall be allowed. Jointing of dissimilar pipe materials shall be accomplished with the appropriate adapter fittings manufactured for the purpose used and approved by Conway Corporation.

Where PVC sewer pipe penetrates a manhole wall, a concrete manhole adapter shall be used. Said adapter shall be a Fernco Model CMA or approved equal.

IV-6. SEWER WYES AND BENDS

Wyes shall be placed in locations to be designated by the Engineer. In shallow trenches, wyes shall be laid horizontal but in most trenches eight (8) feet deep and deeper wyes shall be inclined at forty-five (45) degrees from the horizontal or as directed by the Engineer. An adequate amount of angular ballast

encasement shall be placed around the wye branch and bend, with Class B concrete below for support, so that wyes and bends will not be disturbed by backfilling. No wyes shall be covered until they have been inspected and located by the Engineer.

Wyes will be true Y branches, with four (4) inch or six (6) inch branch. (Tees will not be acceptable in any size.)

The lump sum contract prices shall include the quantities of wyes given in the List of Variable Quantities and the appropriate contract unit prices will be used to adjust the contract prices for variation of actual quantities from those estimated. The prices for wyes shall include materials, plugs and all other work incident thereto. Two (2) inch green marker pipe, shall also be included in the price of wyes where no sewer service pipe is to be connected to said wye.

Connection to the Wye shall be made with a bend of the proper degree to make the house connection run perpendicular to the sewer main or lateral.

Bends shall be paid for as pipe at the appropriate contract unit price.

IV-6.1 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER WYES AND BENDS

Polyvinyl Chloride (PVC) Gravity Sewer Wyes as conforming to ASTM D 1784 and have a minimum pipe stiffness of 115 PSI, according to the latest revision of ASTM D 2412 Standard Test Method for External Loading Properties of Plastic Pipe by parallel-plate loading at an arbitrary datum of 5 percent (5%) deflection. **Standard Dimension Ratio (SDR) PVC Sewer Wyes shall not exceed 26** and shall conform to the latest revision of ASTM D 3034. The SDR 26 wyes must be Bell and Spigot using an elastometric gasket meeting requirements of the latest revision of ASTM D 3212. The Service Branch shall have a Schedule 40 gasket type bell. Each wye shall be clearly marked showing size, ASTM Number and SDR Number. All wyes must be approved by Conway Corporation and shall be manufactured in the United States.

All PVC bends must meet or exceed the specifications of the approved sewer service pipe connected to said bends. All bends must be approved by Conway Corporation.

IV-6.2 EPOXY LINED DUCTILE IRON

All fittings for D.I. Pipe shall be configured as shown on the Plans, or as required to effectively install the pipe under the conditions encountered. All fittings shall be Mechanical Joint Fittings (MJ); furnished complete with full joint accessories and gaskets. All fittings shall be manufactured in the United States.

Fittings shall be of either of the following standard specifications:

- (A) ANSI/AWWA C110/A21.10 with joint meeting the requirements of ANSI/AWWA C111/A21.11 or latest revisions.
- (B) Ductile Iron Compact Fittings in full conformance with ANSI/AWWA C153/A21.53, or latest revisions.

All ductile iron in sewer applications shall be lined with a high-build, multi-component Amine-cured Novalac epoxy lining that shall be **Protecto 401 Ceramic Epoxy** that is 40 mils thick when dry.

Polyethylene Encasement conforming to ANSI/AWWA C105/A21.5 or latest revision and has a minimum thickness of .008 (8 mils) shall be used on all ductile iron sewer wyes.

IV-7. POLYETHYLENE ENCASEMENT

Unless otherwise noted, special polyethylene encasement shall be used for protection of all ductile iron piping and other places as noted on plans. The polyethylene encasement shall be installed in strict accordance with ANSI/AWWA C105/A21.5-88 (or latest revision) Section 5-4. Polyethylene encasement shall have a minimum thickness of .008 (8mils). Polyethylene encasement and special tape shall, in all cases, be provided by the manufacturer or supplier of the pipe being encased.

The cost of work under this section shall be included in the contract prices for the pipe to be encased and will not be paid for separately.

IV-8. CONCRETE ENCASEMENT FOR SEWER PIPE

Wherever the cover over any sewer pipe is less than two (2) feet, at points where special hazards exist as shown on the plans, and at other points as determined by the Engineer, the pipe shall be encased in concrete in accordance with details shown on the plans or as instructed by the Engineer. Care shall be exercised in laying the pipe true to line and grade.

Concrete for encasement will be measured and paid for by the cubic yard as concrete encasement as shown on the plans.

IV-9. SEWER SERVICE CONNECTION TO EXISTING SEWER MAIN

Where it is required that a 4" or 6" sewer service line be connected (tapped) to an existing sewer main the tap to the existing sewer main shall be accomplished by using an IPS/Sch 40 Gasketed Bell **Inserta Tee** as manufactured by Inserta Fittings Co., or **Romac Style "CB" Sewer Saddle** as manufactured by Romac Industries, Inc. A Hole Saw Core Bit shall be used to core an existing PVC sewer main for the installation of an **Inserta Tee or Romac Saddle**. A Diamond Core Bit shall be used to core an existing clay or ductile iron sewer main for the installation of an **Inserta Tee or Romac Saddle**.

Taps shall be placed in locations to be designated by the Engineer. An adequate block of Class "B" concrete shall be placed under the tap to support the service so that taps will not be disturbed by backfilling. This concrete shall be allowed to set before backfilling to a depth of more than one (1) foot. No taps shall be covered until they have been inspected and located by the Engineer.

The lump sum contract prices shall include the quantities of taps given in the List of Variable Quantities and the appropriate contract unit prices will be used to adjust the contract prices for variation of actual quantities from those estimated. The prices for taps shall include coring, materials, plugs, Class "B" concrete and all other work incident thereto. Two (2) inch green marker pipe, shall also be included in the price of taps where no sewer service pipe is to be connected to said tap.

IV-10. CONNECTION TO EXISTING MANHOLES

Where it is required that a new sewer line enter an existing manhole, an opening shall be cut (core drilled) in the wall of the existing manhole of sufficient size to permit the proper installation of the new sewer pipe at the proper line and grade. The new pipe shall be installed extending through the wall of the manhole; and the opening around the new pipe shall be fitted with link seal (SS, approved for wastewater application) and filled (both sides) with non-shrink grout and properly finished inside and outside so that leakage does not occur around the perimeter of the pipe or the perforation. If the new pipe is PVC or ductile iron, the pipe shall be fitted with a gasket positioned around the pipe at the midpoint of the manhole wall. The bottom of the existing manhole shall be chipped-out, then grouted smooth with cement mortar so as to provide a smooth transition between the invert of the new pipe and the existing manhole invert.

The flow of sewage through the existing manhole shall be controlled by temporary plugs or by-pass pumping as necessary to facilitate the new connection and grouting of the manhole invert. The flow of sewage in the existing manhole shall be maintained in such a manner as to prevent overflow onto the ground's surface and to prevent the hazards of excessive surcharge into "upstream" sewer service connections. Prevention of damage to public and private property is the responsibility of the Contractor. Damage resulting from surcharging shall be repaired at the expense of the Contractor.

The inlets and outlets of existing sewers to be abandoned shall be properly sealed with concrete or mortar and the inside wall of the manhole shall be smoothly plastered over the opening.

The contract price shall include the number of connections to existing manholes given in the List of Variable Quantities and the appropriate contract unit price will be used to adjust the contract price for variation of actual number from that estimated.

IV-11. CONSTRUCTION OF MANHOLES

The construction of manholes shall follow closely the progress of pipe laying. If at anytime pipe is laid as much as 800 linear feet ahead of completed manhole construction, then pipe laying will be discontinued. Manholes shall be constructed in accordance with the details shown on the drawings.

The ends of all sewer pipes terminating at manholes not yet constructed shall be plugged with an approved plug until manholes are poured.

Manholes are to be constructed using special purpose manhole forms specifically designed for manhole construction and pouring them with concrete. The manholes shall be poured of the proper mixture of concrete and vibrated so as to prevent honeycombing and leaks. The Contractor shall make sure the pipes coming into and going out of the manholes are secure on line and grade so that they will not be moved while pouring the manhole. Should the pipe be found to have moved off alignment and/or grade in excess, in the judgment of the Engineer, the Contractor shall be required to adjust the pipe grade. If, in pouring the manhole, the forms should shift and cause the manhole to lean in excess, in the judgment of the Engineer, the Contractor shall be required to tear out the manhole and re-pour it.

All manhole invert channels shall be smooth and accurately shaped to a semicircular bottom conforming to the inside of the adjacent sewer section. Inverts shall be formed directly in the concrete of the manhole base, which shall have a minimum of eight (8) inch concrete under sewer pipe or as directed by the Engineer. Inverts shall extend up at least half of the diameter of the pipe. Where necessary, invert channels and manhole bottoms shall be shaped and smoothed with one (1) part Portland cement to two (2) parts sand.

Changes in the direction of the sewer and entering branches shall have a true curve of as large a radius as the size of the manhole will permit.

Manhole walls are to be six (6) inches to eight (8) inches thick at all points of the manhole, or greater as required by the manhole configuration.

Manhole rings and covers shall be poured in place when manhole is poured and firmly bedded, carefully leveled and placed so as to conform to the finished grade unless otherwise shown on the Plans or instructed by Engineer.

Where a construction joint is necessary in job-cast manholes, reinforcing bars and a formed keyway shall be provided in the top of the wall lift, at least four (4) feet above the invert of the outlet sewer pipe, or one manhole form ring above pipe top, whichever is greater. Immediately before the second lift is placed, the hardened surface shall be cleaned and wetted, and a minimum two (2) inch layer of fresh mortar placed over the surface. Bars shall be No. 4 bars on maximum twelve (12) inch centers along the center of the walls and embedded a minimum eight (8) inches in each lift.

Pipe penetrations through manholes with PVC or ductile iron pipe shall be provided with a watertight gasket or coupling system suitable for the prevention of leakage. Manhole gaskets shall be Fernco CMA or equal.

There shall be a flexible joint within two (2) feet of the manhole wall on all clay inlet and outlet pipes. The standard PVC sleeve (PEP coupling) shall be considered a flexible joint. Where the standard PVC sleeve cannot be positioned within two (2) feet of the manhole wall, a Mission Rubber Company, MR01 Series, Flex-Seal Coupling, or approved equal, shall be used. Said coupling shall have stainless steel flanged bushings and a stainless steel shear ring.

Manholes will be measured by the distance between the outlet invert of the manhole and the top of the manhole ring.

The contract price shall include the quantities of manholes given in the List of Variable Quantities and the appropriate contract unit prices will be used to adjust the contract price for variation of actual quantities from those estimated.

The price for manholes shall include all materials (concrete, ring and cover, stub-outs, plugs, flex-seal couplings, etc.) and all work incident thereto, including excavation, backfilling and testing.

Where manhole cover grade adjustments must be made riser rings may be permitted to raise the cover elevation up to one (1) foot. Said riser rings shall be installed with Adeka Ultra Seal P201 sealant. Where a manhole cover must be lowered six (6) inches or less the standard ring may be removed and a top flanged ring and cover installed. Where grade adjustments of more than one (1) foot rise or more than six (6) inch lowering is required the manhole wall shall be saw-cut and the necessary wall and or cone section shall then be repoured to the proper grade. Immediately before the repour, the saw-cut wall shall be cleaned and wetted, and a minimum two (2) inch layer of fresh mortar placed over the surface. The Engineer shall direct all adjustment of manholes. A vacuum test shall be performed on all adjusted manholes.

The price for grade adjustment of manholes shall be paid for in two (2) inch increments, from the original elevation. Adjustment of manholes shall be listed in the List of Variable Quantities and paid for as "Adjust Manholes" which shall include raising and lowering of manholes. The price shall include all materials

(concrete, riser ring, top flanged ring and cover, Adeka Ultra Seal, etc.) and all work incident thereto, including excavation, backfilling and testing.

IV-11.1 MANHOLES

Manholes shall be job-cast concrete manholes conforming to details shown on the Drawings.

Job-cast manholes shall be made with special purpose forms of steel or plastic specifically designed for manhole construction. Concrete for manholes shall have minimum compressive strength of 3,500 psi when tested at 28 days in accordance with ASTM C 39.

IV-11.1 PRE-CAST MANHOLES

Pre-cast manholes are acceptable if greater than 5' in diameter, and as approved by Engineer. Pre-cast manholes are subject to submittal review and engineer approval. Precast manholes shall conform to the following: Latest requirements of ASTM C478. Never transport sections to the site until they have cured for at least ten (10) days, subject to review and approval at site. Mark each piece plainly with manhole numbers and date of manufacture so it can be installed in the proper location, as shown on the plans. Ensure factory installed cutouts in the bottom section are appropriate for the pipe being laid. Pipe connection cut-outs shall be equipped with rubber boots to ensure a watertight connection. Material shall be equal to Kor-N-Seal connector, as manufactured by NPC, Inc. Flexible rubber sealant for joints in precast manhole sections shall provide permanently flexible watertight joints, shall remain workable over a wide temperature range and shall not shrink, harden or oxidize upon aging. Material shall be equal to Tylox Superseal and shall meet ASTM C443 and ASTM C361 requirements. The frame for the lid shall be installed when cone section is cast. Heat shrinkable encapsulation shall be Wrapid Seal as manufactured by Canusa CPS, BIDCO Wrap as manufactured by NPC, or approved equal.

IV-11.2 MANHOLE CASTINGS

Standard (unsealed) manhole rings and covers shall be of cast iron, nominal twenty (24) inch diameter, with combined weight not less than two-hundred fifty (250) lbs. Covers shall be the solid type. Pattern shall be concentric circles with the words CONWAY ARKANSAS SANITARY SEWER and MADE IN THE USA cast in the pattern (see detail drawings, this spec book). The manhole covers shall have two edge indentations (Closed Pickholes) for lifting tool. Rings shall have at least a twenty-two (22) inch diameter clear opening. Standard rings and covers shall be No. 1348-1 by East Jordan Iron Works, Inc., or approved equal product. Standard rings and covers shall be made in the USA.

Sealed manhole rings and covers shall be of cast iron, Covers shall be the solid type. Pattern shall be concentric circles with the words CONWAY ARKANSAS SANITARY SEWER and MADE IN THE USA cast in the pattern (see detail drawings, this spec book). The manhole covers shall have two edge indentations (Closed Pickholes) for lifting tool and two (2) locking lugs (1/4 turn cam lock). Rings and covers shall be sealed with round neoprene rubber gaskets. Sealed rings and covers shall be East Jordan Iron Works, Inc., Series 1500, or approved equal product. Sealed rings and covers shall be made in the USA.

Manholes greater than or equal to six feet diameter shall include thirty inch water tight ring and cover.

IV-11.2.1 MANHOLE COATING

Zebron Lining, or equal, as follows:

QSR Patching Material to be used for filling joints, voids or rough concrete areas to provide a substrate suitable for Zebron 386 liner. Zebron low temperature epoxy to be used as primer coat applied at 1 to 3 mills thick prior to Zebron 386 lining. Zebron 386 final protective liner to be applied as per specification and manufacturers recommendations at a minimum of 125 mills thick. Application certification required.

IV-12. TESTING FOR GRAVITY SEWER LINES

All sewer lines shall be laid so that infiltration is held to a minimum and shall be subject to any or all of the following determinations for leakage. The Contractor shall provide all test equipment, and perform all testing under witness by the Engineer. All gauges used shall be oil filled, new and or tested recently for accuracy. Any sewer found deficient under test criteria shall be repaired or replaced, as determined by the Engineer, and retested until satisfactory test results are obtained.

No sewer testing will be measured or paid for separately; and the cost thereof will be included in the cost of "pipe".

IV-12.1 AIR TEST

Low-pressure air test of gravity sewer lines shall be performed at the sole expense of the contractor and in accordance with the following procedures:

- a. Plug all pipe outlets with suitable test plugs. Brace each plug securely to prevent hazard of plug blow-out. Air control connections, valves, and gauges shall be located above ground, outside of manhole. No one shall be permitted to enter a manhole where a plugged line is under pressure.
- b. Pipe air supply to pipe to be tested so that air supply may be shut off, pressure observed and air pressure released from the pipe without entering a manhole. A valved branch should be provided in the supply line past the supply shut off valve for installation of the test gauge. The test gauge shall have a pressure range of 0 – 5 psi, minimum divisions of 0.10psi and an accuracy of +/-1% full scale.
- c. Add air slowly to the section of pipe under test until test gauge reads at least four (4) psig, but less than five (5) psig.
- d. Shut off air supply and allow at least two minutes for internal pressure to stabilize.
- e. Observe drop in pressure and determine time in minutes and seconds for the pressure to drop one (1.0) psig from three and one-half (3.5) psig to two and one-half (2.5) psig.
- f. Where ground water level is above crown of pipe being tested, the test pressure should be increased accordingly. Increase one (1.0) psig for each two and three-tenths (2.3) feet of water above crown. The height of the groundwater above the sewer pipe shall be determined by a method approved by the Engineer.
- g. The observed time for one (1.0) psig pressure drop shall equal or exceed the minimum allowable time given in the following applicable table. Minimum allowable time values for intermediate lengths of pipe may be determined by interpolation between the given values.

- h. For testing of long sections or sections of large diameter pipe and as approved by the Engineer, a timed pressure drop of 0.5psig may be used in lieu of a 1.0psig timed pressure drop, in which case the appropriate required time shall be exactly one-half the value shown in the table below.

TABLE FOR LEAKAGE TESTING OF PVC AND DI SEWERS BY LOW PRESSURE AIR LOSS
Minimum Time In Min. And Sec. For 1.0 psig Drop (3.5 psig to 2.5 psig)

| Distance Between | Nominal Pipe Diameter (Inches) Manholes (Feet) | | | | | | | | | | |
|------------------|---|-------|-------|-------|-------|-------|--------|--------|--------|--------|--------|
| | 8" | 10" | 12" | 15" | 18" | 21" | 24" | 30" | 36" | 42" | 48" |
| 100 | 7:34 | 9:26 | 11:20 | 14:10 | 17:00 | 19:50 | 22:47 | 35:37 | 51:17 | 69:48 | 91:10 |
| 150 | 7:34 | 9:26 | 11:20 | 14:10 | 19:13 | 26:10 | 34:11 | 53:25 | 76:55 | 104:42 | 136:45 |
| 200 | 7:34 | 9:26 | 11:24 | 17:48 | 25:38 | 34:54 | 45:34 | 71:13 | 102:34 | 139:37 | 182:21 |
| 250 | 7:34 | 9:53 | 14:15 | 22:15 | 32:03 | 43:37 | 56:58 | 89:02 | 128:12 | 174:30 | 227:55 |
| 300 | 7:36 | 11:52 | 17:05 | 26:42 | 38:27 | 52:21 | 68:22 | 106:50 | 153:50 | 209:24 | 273:31 |
| 350 | 8:52 | 13:51 | 19:56 | 31:09 | 44:52 | 61:00 | 79:46 | 124:38 | 179:29 | 244:19 | 319:06 |
| 400 | 10:08 | 15:49 | 22:47 | 35:36 | 51:16 | 69:48 | 91:10 | 142:26 | 205:07 | 279:13 | 364:42 |
| 450 | 11:24 | 17:48 | 25:38 | 40:04 | 57:41 | 78:31 | 102:33 | 160:15 | 230:46 | 314:07 | 410:17 |
| 500 | 12:40 | 19:47 | 28:30 | 44:31 | 64:06 | 87:15 | 113:58 | 178:03 | 256:24 | * | * |

*For times other than lengths shown, engineer shall provide calculations.

IV-12.2 EXFILTRATION TEST

At the option of the Engineer, the Contractor may be required to test any section of sanitary sewer between two successive structures by exfiltration.

The allowable leakage shall not exceed twenty five (25) gallons per inch of internal pipe diameter per mile of pipe per day. Lines will be filled with water, marking the water level in the upper manhole, and allowed to sit for a minimum of one hour or as directed by the Engineer. At the end of the waiting period, the contractor will replace the water, if any, that has been lost, measuring the amount required through an approved water meter.

During exfiltration testing the maximum internal pipe pressure at the lowest end should not exceed twenty five (25) feet of water or 10.8 psi and the water level inside the manhole should be two (2) feet higher than the top of the pipe or two (2) feet higher than ground water level, whichever is greater.

The cost water used for testing and all other costs associated with testing shall be paid by the Contractor. Only water from a source approved by the Engineer shall be used to perform the test. Wastewater is unacceptable. No one shall be permitted to enter a manhole where a plugged line is under pressure.

IV-12.3 INFILTRATION TEST

Where sewer lines are below the ground water table, and therefore subject to infiltration, the Contractor may be required to measure the infiltration at points designated by the Engineer. The Contractor shall use a weir or other approved measuring device. The infiltration for any portion of the system shall not exceed twenty five (25) gallons per inch of internal pipe diameter per mile of pipe per day below the water table, including manholes.

IV-12.4 MANDREL TEST

The mandrel (go/no-go) deflection test must be performed on all PVC sewer mains prior to acceptance and no less than 30 days after installation. The Engineer may at his discretion require a second mandrel test be performed at any time prior to the expiration of the maintenance bond. The Contractor shall supply the mandrel used for this performance test. The mandrel device shall be cylindrical in shape having a minimum of 9 possible contact points with the pipe. The mandrel's outside diameter shall be 5% smaller than the inside diameter of the pipe to be tested, and shall be subject to the Inspector's approval. The mandrel shall be hand pulled. Should the mandrel hang or otherwise fail to pass through the sewer, the sewer pipe shall be uncovered, the defect corrected and the sewer line air (where applicable) and deflection tests performed again. Any sewer pipe which fails applicable tests prior to the expiration of the maintenance bond will be corrected by the Contractor at the Contractor's expense. If the Contractor fails to correct these defects after a reasonable time, the Conway Corporation will correct the defects and bill the Contractor for said corrections.

No sewer testing will be measured or paid for separately; and the cost thereof will be included in the cost of "pipe".

IV-13. TESTING MANHOLES

Manholes shall be constructed such that leakage of water into or out of the structure is eliminated, as determined by the Engineer. Constructed manholes shall be vacuum tested. Any manhole that has been tested prior to any required work on said manhole including but not limited to rim adjustment shall be retested.

Vacuum testing equipment shall be the type manufactured for manhole testing, and be in reliable working order, satisfactory to the Engineer. Vacuum test head shall be positioned at the inside surface of the concrete at the top of the cone section and the seal inflated in accordance with the equipment manufacturer's instructions. A vacuum of ten (10) inches of mercury shall be drawn and the vacuum pump isolated by the shut-off valve on the test head connection. When valve is closed, time measurement shall commence, and time required for vacuum drop to nine (9) inches of mercury shall be observed and recorded. The minimum acceptable time for vacuum drop from ten (10) inches to nine (9) inches of mercury is one (1) minute.

The Contractor shall provide all vacuum testing equipment, pump, hosing, seal, and other incidentals at no additional cost to Conway Corporation.

Manholes may, at the Engineer's option, be tested using the water exfiltration testing procedure outlined herein.

The inlet and outlet of the manholes to be tested shall be properly plugged and the structure filled with water to a depth of at least six (6) feet above the invert of the outlet pipe, or to the top of the vertical wall section, whichever is lesser. The water level shall be allowed a stabilizing period of fifteen (15) minutes, following which the drop in water level during a minimum fifteen (15) minute period shall be measured and the volume of water lost calculated. The rate of leakage determined under this test shall not exceed 0.152 gallons per hour per foot of water depth above the outlet invert for four (4) foot diameter manholes or 0.190 gallons per hour per foot of water above the outlet invert for five (5) foot diameter manholes.

Manholes showing greater than allowable leakage shall be repaired and re-tested until a satisfactory leakage result is obtained. The Contractor shall provide all equipment, plugs, fittings, gauges, and water required for testing. The means and methods of repair shall be submitted to the Engineer in writing for review and consideration.

The optional use of the water test procedure on manholes in lieu of the vacuum test procedure does not invalidate any other provisions of this section.

IV-14. EXCAVATION – PRESSURE SEWER TRENCH

Contractor shall provide approved OSHA Safety Methods for the excavation. Such Methods take precedence over any procedures outlined in these Specifications or directions of the Engineer. See “Appendix A” Trench Excavation Safety. The Contractor is responsible for the design of excavation procedures, shoring design and placement, and any and all safety procedures.

Trenches for pressure sewer lines shall be of the width and depth necessary for the proper installation of the pipe. All pressure sewer lines shall be laid in trenches of such depth as to provide a minimum cover of thirty-six (36) inches over the pipe unless otherwise shown on the Plans, or directed by Engineer. The bottom of all pipe trenches for six (6) inch and larger pipe, except where encasement is required, shall be shaped as nearly as possible to conform to the outside of the pipe, providing adequate bell holes and taking care to support pipe throughout its entire length except at joints.

If the soil at the bottom of the trench for pipe lines is mucky or in such condition that it cannot properly support the pipe, the Contractor shall excavate below the normal subgrade elevation as directed by the Engineer. Wherever excavation is carried below the specified subgrade, at the direction of the Engineer, the Contractor shall provide and install a fill of gravel thoroughly tamped into place up to an elevation sufficient to prepare the subgrade as specified in the preceding paragraph.

Where water occurs in trenches for pipe lines they shall be excavated to a depth of approximately eight (8) inches below grade and backfilled with gravel. Pumps shall then be kept operating, taking suction out of a sump below the gravel so as to hold the water level well below the bottoms of all open joints.

Where rock occurs in trenches for pipe lines at the planned grade of the bottom of the pipe in such way that any portion of the pipe would rest on rock, or where in the opinion of the Engineer it is necessary, the excavation shall be carried to a depth of four (4) inches, below the planned grade, for the full width of the trench. The Contractor shall provide and install a fill of gravel thoroughly tamped into place up to an elevation sufficient to prepare the subgrade as specified in preceding paragraphs.

In trenches that are not in rock, but the soil in the bottom is hard and in the opinion of the Engineer, it cannot be excavated efficiently by hand prior to placing the pipe, as described above in the bedding of the pipe, the Contractor shall undercut the trench to a depth of four (4) inches and backfill the trench with gravel or sand. After the backfill of gravel or sand has been placed and tamped, the trench shall be prepared in the same manner as described in previous paragraphs.

The excavation of trenches for pipelines shall not advance more than four hundred (400) feet ahead of the completed pipe work and backfill except by permission of the Engineer.

All excavation not included under the classification of rock excavation shall be common excavation.

Common excavation shall include normal trench sloping and trench dewatering, backfilling, maintenance of backfill, disposal of waste materials, and all other work incident thereto.

The cost of all common excavation in trench for lines shall be included in the contract prices for pressure sewer pipe and fittings and will not be paid for separately.

Gravel or crushed stone authorized for payment as subgrade material for pipelines will be measured and paid for by the ton in place in the trenches.

The contract price shall include the quantity of gravel for subgrade given in the List of Variable Quantities and the appropriate contract unit price will be used to adjust the lump sum contract price for variation of actual quantity from that estimated.

The prices for gravel for subgrade shall include materials, placing, and all other work incident thereto.

Trench Excavation Safety shall be paid for on the final estimate as a lump sum at the appropriate contract unit price.

IV-15. HANDLING AND LAYING DUCTILE IRON PIPE

In the transportation, unloading, and handling of pipe, the pipe shall not be dropped, let roll and collide with another pipe, or be subjected to any unnecessary jar, impact, or other treatment that might crack or otherwise damage the pipe.

Before laying pipe in trench, the bottom of the trench shall be carefully graded and prepared and bell holes excavated so the pipe shall have a uniform support along its entire length, except at bell holes, and shall not be allowed to rest on hard supports through a portion of its length only. Width of trench at the top of the pipe shall not exceed the OD of the pipe plus two (2) feet. All pipe shall have at least thirty-six (36) inches of cover over pipe bells.

Deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets, shall not exceed the maximum permissible for the type of pipe joint being installed as recommended by the pipe manufacturer. If the alignment requires deflections in excess of these limitations, special bends, or a sufficient number of shorter lengths of pipe shall be furnished to provide annular deflections. Such bends or short length of pipe shall be installed as directed by the Engineer at no additional cost to Conway Corporation.

The inside of pipe and all parts involved in jointing shall be cleaned of all dirt, mud, grease, and other foreign material before the pipe is laid or the joint started. Ends of pipe shall be temporarily plugged at the close of each day's work. The pipe will be plugged so that no water or mud may enter the pipe.

In laying mechanical joint or "push-on" joint pipe, the manufacturer's recommendations for securing good joints shall be rigidly followed. Proper lubricant as recommended by pipe manufacturer will be used on all pipe joints. Bolts will be pulled-up alternately to provide for a well-made and tight joint.

Adequate backing blocks of Class "B" concrete shall be provided at all points of unbalanced pressure, such as bends, tees, or fire hydrants, as shown on the Plans. Minimum contact area of backing shall be three (3) square feet. The concrete shall be contained within the designated area by metal or wood forms that are sufficiently tight as to keep the loss of material to a minimum, or by other means as approved by the Engineer. These fittings shall be wrapped in a polyethylene material before concrete is poured. Concrete for backing shall be measured and paid for as Class "B" concrete.

Epoxy lined ductile iron pressure sewer pipe and fittings, except as specifically shown on the Plans or hereinafter specified, will be measured and paid for as pipe. The quantity of pipe shall be determined by

measurement along the top centerline of the pipe and fittings as laid. The lump sum contract price shall include the quantities of ductile iron pipe given in the List of Variable Quantities (or Schedule of Values) and the appropriate contract unit prices will be used to adjust the contract price for variation of actual quantities from those estimated.

The unit prices for epoxy lined ductile iron pressure sewer pipe and fittings listed in the variable quantities shall be for pressure sewer pipe in place, that is, the unit price shall include the ductile iron pipe and fittings, polyethylene encasement (buried), trenching and backfill, and all labor connected with laying it in the trench.

IV-15.1 DUCTILE IRON SEWER PIPE

(Refer to section on Epoxy Lined Ductile Iron Pipe)

IV-15.2 DUCTILE IRON PIPE FITTINGS

(Refer to III-6.2. Epoxy Lined Ductile Iron Sewer Wyes and Bends)

IV-15.3 POLYETHYLENE ENCASEMENT

Unless otherwise noted, special polyethylene encasement shall be used for protection of ductile iron and other metal piping and other places as noted on plans. The polyethylene encasement shall be installed in strict accordance with ANSI/AWWA C105/A21.5-88 (or latest revision) Section 5-4. Polyethylene encasement shall have a minimum thickness of .008 (8mils). Polyethylene encasement shall be manufactured in the United States. Polyethylene encasement and special tape shall, in all cases, be provided by the manufacturer or supplier of the pipe being encased.

The cost of work under this section shall be included in the contract prices for the pipe to be encased and will not be paid for separately.

IV-16. HANDLING AND LAYING PVC PRESSURE SEWER PIPE

In transportation of the pipe, any of the pipe that is subjected to exhausted fumes must be covered to prevent contamination of the pipe. Any pipe determined by the Engineer to be contaminated by exhaust fumes shall be rejected and removed from the job site. In the transportation, unloading, and handling of pipe, the pipe shall not be dropped or subjected to any unnecessary jar, impact, or other treatment that might crack or otherwise damage the pipe. The pipe shall not be handled by chains or cables and shall not be allowed to strike hard objects in loading and unloading. Pipes shall not be subjected to abrasion, gouging or cutting or stressing of bell joints and damage to beveled ends. Pipe shall be handled more carefully in cold weather to prevent impact damage. All PVC pipe and fittings must be stored out of direct sunlight and away from any heat source.

Before laying pipe in trench, the bottom of the trench shall be carefully graded and prepared and bell holes excavated so that the pipe shall have a uniform support along its entire length, except at bell holes. The pipe shall not be allowed to rest on hard and sharp objects through any portion of its length. All pipe shall have at least thirty-six (36) inches of cover over the top of the bell.

Deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets, shall not exceed the maximum recommended by the pipe manufacturer. If the alignment requires

deflections in excess of these limitations, then special bends or a sufficient number of shorter lengths of pipe shall be furnished to provide annular deflections. When pipe is cut, the end shall be beveled and the burrs shall be removed from the inside of the pipe. Such bends or short lengths of pipe shall be installed as directed by the Engineer at no additional cost to Conway Corporation.

The inside of the pipe and all parts involved in jointing shall be cleaned of all dirt, mud, grease and other foreign matter before the pipe is laid or the joint is started. The gasket, gasket groove, pipe spigot bevel and sealing surfaces shall be inspected for damage or deformation before being used. Any pipe determined by the Engineer to be damaged and unsuitable for use shall be immediately removed from the job site.

In laying all PVC bell and gasket pipe, the manufacturer's recommendations for securing good joints shall be rigidly followed. Use only the pipe lubricant specified and supplied by the pipe manufacturer. Apply lubricant to the clean spigot end just before pushing it into the clean spigot end just by hand using a slight twisting motion to the pipe until it slips through the bell gasket. Do not swing or stab the spigot end into the bell. The spigot end of the pipe is marked by the manufacturer to indicate the proper depth of insertion into the bell. Pipe shall be joined using manual force only, unless directed otherwise by the Engineer. When laying pipe in temperatures below forty (40) degrees Fahrenheit, the rubber gaskets should be kept warm before being used.

PVC pressure sewer pipe and fittings, except as specifically shown on the plans or hereinafter specified, will be measured and paid for as pipe. The quantity of pipe shall be determined by measuring along the top centerline of the pipe and fittings as laid. The Contract Price shall include the quantities of PVC pipe given in the List of Variable Quantities and the appropriate contract unit prices will be used to adjust the Contract Price for variation of actual quantities from those estimated. The unit prices for PVC pressure sewer pipe listed in the variable quantities shall be for pressure sewer in place, that is, the unit price shall include PVC pipe and fittings, tracer wire, tracer wire lugs and ground rods, trenching and backfilling, and all labor and equipment connected with laying the pipe and tracer wire in the trench.

IV-16.1 PVC PRESSURE SEWER PIPE (COLLECTION SYSTEM)

This specification covers the requirements for Polyvinyl Chloride (PVC) pressure pipes with integral bell and spigot gasketed joints in Iron Pipe Sizes (IPS) nominal sizes, one and one-half (1 1/2) inch through ten (10) inch. These pipes shall meet the requirements of American Society for Testing and Materials standard ASTM D-2241, Standard Specification for Polyvinyl Chloride (PVC) Pressure – Rated pipe (SDR Series).

Pipe shall be manufactured from virgin PVC compound meeting the requirements of cell class 12454-B as defined by ASTM D-1784, Standard Specification for Rigid Polyvinyl Chloride (PVC) Compounds. The compounds shall have a hydrostatic design rating of 4,000 psi for water at 73.4 degree F. The PVC compound shall be certified by NSF International to ANSI/NSF Standard 14 and Standard 61.

Pipes shall be manufactured to the Iron Pipe Size (IPS) nominal size series for use as a pressure conduit. Pipes shall have SDR-21 wall thickness class and be rated for 200 psi water service at 73.4 degree F, incorporate a 2:1 long term hydrostatic design safety factor. The pipe shall utilize a "locked in" integral gasket joint design meeting the requirements of ASTM D-3139, Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals. The gaskets shall be reinforced with a steel band and conform to the requirements of ASTM F477, Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipes. The standard laying length shall be twenty (20) feet.

All pipes shall be manufactured in the United States.

Chemical/organoleptic tests shall be performed on the pipe and fittings with copies being made available upon request. Toxicological tests shall be performed on PVC materials to verify the absence of chemicals in quantities which can be termed toxic, carcinogenic or mutagenic to an extent which can be expected to produce adverse physiological affect to man. Copies of the results of such tests shall be made available upon request.

IV-16.2 PRESSURE SEWER PIPE (FORCE MAIN)

AWWA C909 Molecularly Oriented Class 150 PVC pipe up to 12-inch diameter shall meet the ANSI/NSF Standard 61 requirements Ultra Blue, or approved equal (UNLESS OTHERWISE SPECIFIED ON THE PLANS). Each piece of 20' length pipe and fitting shall be clearly labeled to identify its size, pressure class and manufacture date. Fittings shall be epoxy lined DI. All push-on fittings with bells and gaskets must be specifically designed for cast iron outside diameter (C.I.O.D.) pipe.

AWWA C900 Class 200 PVC pipe up to 12-inch diameter shall meet the ANSI/NSF Standard 61 requirements, or approved equal (UNLESS OTHERWISE SPECIFIED ON THE PLANS). Each piece of 20' length pipe and fitting shall be clearly labeled to identify its size, pressure class and manufacture date. Fittings shall be epoxy lined DI. All push-on fittings with bells and gaskets must be specifically designed for cast iron outside diameter (C.I.O.D.) pipe.

Pipe greater than 12-inch diameter up to 24-inch diameter shall be PR200 DR21 made in accordance with AWWA C905 from a compound conforming to a cell classification of 12454 as defined by ASTM D1784. Integral bells shall incorporate gaskets meeting the requirements of ASTM F477 and be locked into the bell. The assembled joint shall meet the requirements of ASTM D3139. The laying length of the pipe shall be 20 feet. Fittings shall be epoxy lined DI. The pipe and gasket must be tested and approved for contact with potable water in accordance with ANSI/NSF 61. The pipe and gasket shall be listed by Underwriters Laboratory.

IV-16.2.1 PRESSURE FIBERGLASS REINFORCED PIPE (FORCE MAIN)

Fiberglass reinforced pipe force mains shall be of the nominal diameter(s) shown on the Plans and shall have wall thicknesses consistent with pipe stiffness 46 (PS 46) for burial depths of up to 20'. For burial depths greater than 20' a wall thickness consistent with pipe stiffness 72 (PS 72) shall be used. All fittings for force main pipe shall be ductile iron mechanical joint ANSI/AWWA C110/A21.10 or ANSI/AWWA C153/A21.53. FRP pipe shall have push-on gasketed joints meeting the performance requirements of ASTM D4161. All pipe and fittings to be used as force main shall be of sufficient pressure rating (PN) to meet a test pressure of 150 psi.

FRP for force mains shall meet the requirements of ASTM D3754.

Other standards references that apply include:

ASTM D3262 – Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.

ASTM D3754 – Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer and Industrial Pressure Pipe.

ASTM D4161 – Standard Specification for “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe Joints Using Flexible Elastomeric Seals.

ASTM D2412 – Standard Test Method for Determination of External Loading Characteristics of Plastic Pipe by Parallel-Plate Loading.

FRP pipe for this project shall be supplied in nominal lengths of 20 feet.

IV-16.3 PRESSURE SEWER ISOLATION VALVES (FORCE MAIN)

General

Plug valves shall be of the non-lubricating, eccentric type and shall be designed for a working pressure of 175 psi for valves 12” and smaller, 150 psi for valves 14” and larger. Valves shall provide tight shut-off at rated pressure. Valve shall be manufactured by Henry Pratt.

Valves 20” and smaller shall have round port design. 24” and larger valves shall have rectangular port design. Minimum port area for all valves shall be 80% of corresponding pipe area.

Valve Body

The plug valve body shall be cast iron ASTM A126 Class B with welded-in overlay of 90% nickel alloy content on all surfaces contacting the face of the plug. Sprayed, plated, nickel welded rings or seats screwed into the body are not acceptable.

Valve Plug

The valve plug shall be cast iron ASTM A126 Class B, with Buna N resilient seating surface to mate with the body seat.

Valve Flanges

Valve flanges shall be in strict accordance with ANSI B16.1, Class 125.

Valve Bearings

Plug valve shall be furnished with permanently lubricated sleeve type bearings conforming to AWWA C504. Bearings shall be of sintered, oil impregnated type 316 stainless steel ASTM A-743 Grade CF-8M or bronze ASTM B-127.

Valve Shaft Seals

Valves shaft seals shall be of the “U” cup type, in accordance with AWWA C504. Seals shall be self adjusting and repackable without moving the bonnet from the valve.

Valve Actuators

6” and smaller exposed valves shall be provided with wrench actuators. 8” and larger exposed valves shall be provided with worm gear type manual actuators. All buried valves shall be provided with worm and gear actuators suited for the intended service.

IV-16.4 PVC PRESSURE SEWER CHECK VALVES (FORCE MAIN)

The check valve(s) (4” – 12”) shall be Mueller or approved equal swing – type lever and weight check valves with the following features.

1. A-2602-6-01 flanged ends, with rubber disc facing
2. Meets all applicable parts of ANSI/AWWA C508 Standard
3. Flanged end dimensions and drilling comply with ANSI B16.1, class 125
4. Iron body, bronze mounted (IBBM)
5. rubber disc facing ASTM D2000
6. O-ring sealed stuffing box

7. Adjustable weight to control opening and closing of clapper, lever can be installed on either side of valve
8. 175 psig (1207 kPa) maximum working pressure, 350 psig (2414 kPa) test pressure
9. Epoxy Coating
10. Stainless Steel Nuts & Bolts
11. Tapped Bosses

IV-16.5 1 ¼” PVC PRESSURE SEWER SERVICE PIPE

The one and one-quarter (1 ¼) inch SDR 21 Service pipe shall conform to the requirement as call for in III-16.1 All one and one-quarter (1 ¼) inch service lines shall be bedded in 6 inches of five-eighths (5/8) inch Chips above and below the service pipe, with select fill free of debris and rocks making up the remainder of the trench. A tracer wire shall be installed as specified herein.

IV-16.6 PVC PRESSURE SEWER ENCASEMENT (COLLECTION SYSTEM)

Residential pressure sewer encasement shall be installed in the locations as shown on the Plans and called for in the Specifications. The pressure sewer pipe shall be encased on all street crossings and any other locations shown in the Plans. Encasement pipe shall be two (2) sizes larger SDR21 Class 200 PVC (where open cut is allowed). The carrier pipe shall then be sealed at each end with a material acceptable to the engineer and owner.

All sewer encasement pipe of the various sizes as stated on the Drawings and in the Bid Form will be measured and paid for separately by the linear feet of pipe as finally installed and approved by the Engineer and acceptable to Conway Corporation. Measurement will be along the centerline of sewer pipe as installed.

IV-17. HANDLING AND LAYING OF VITRIFIED CLAY SEWER PIPE

All pipe shall be transported, unloaded, stored, stacked, and handled using precautions and methods recommended by the pipe manufacturer to prevent damage to the pipe. Each joint of pipe shall be carefully inspected immediately before laying and any pipe found to be faulty or damaged shall be marked in an obvious and permanent manner and removed from site. A faulty or damaged joint of pipe may be used in the work if the fault or damaged area is removed by cutting the pipe leaving a shortened section of sound pipe approved by the Engineer.

At no time shall pipe be backfilled without an Engineer’s approval. Pipe joints shall be assembled in accordance with procedures recommended by the pipe manufacturer, using proper gaskets, lubricants, tools, and jointing techniques. All surfaces of the joint shall be cleaned before the pipe is laid and the joint started.

Gravel bedding of clay pipe shall conform to the bedding requirements for PVC pipe, except the depth of bedding below the clay pipe shall be 12” minimum. Before laying pipe, the trench sub grade and pipe foundation shall be carefully graded and prepared and bell holes excavated so that the pipe shall have a uniform support along its entire length and settlement will not subsequently occur. Accuracy of the installed grade of the pipe shall be obtained in the preparation of the pipe foundation. Each pipe section shall be laid on proper line and grade using a laser grade light. The laser grade light shall be a late model light that has been tested recently for accuracy and is in good working condition. Refer to A.S.T.M. C 12-08; Standard Practice for Installing Vitrified Clay Pipe Lines. Jacking pipe is unacceptable. Epoxy Coated Ductile Iron shall be required on all bores as carrier pipe where clay pipe is used, with acceptable transition material as required.

IV-18. INSTALLATION OF VALVES

All valves shall be set with operating stems in true vertical position, unless otherwise shown on the Plans. All valves shall have two (2) inch operating nuts and shall be provided with valve boxes adjusted so that the cover conforms to the adjacent finished grade. Where needed valve stem extensions shall be provided so that the operating nut is within three (3) feet of finished grade. The valve stem extension, where needed, shall be factory made of round material with a centering device and shall be attached to the operating nut of the valve with set-screws.

All valves shall open left and be equipped with two (2) inch AWWA operating nut.

All valves shall be measured and paid for as the number of valves actually furnished and installed.

The contract unit price for valves shall include furnishing and installing valves with retainer glands, valve stem extensions (where needed), valve boxes and valve box extensions (where needed).

The lump sum contract price shall include the quantities of valves given in the List of Variable Quantities and the appropriate contract unit prices will be used to adjust the contract price for variation of actual quantities from those estimated.

IV-18.1 RESILIENT WEDGE GATE VALVES

Resilient wedge gate valves shall be used for all valves shown on the plans, unless otherwise shown or herein specified.

Two (2) inch Resilient wedge gate valves shall be ductile iron-bodied, bronze-mounted, non-rising stem, type 304 stainless steel fasteners, valves equal to Clow Model 2639 with threaded ends conforming to AWWA C509 and latest revisions.

Resilient wedge gate valves (three (3) inch – twelve (12) inch) shall be ductile iron-bodied, bronze-mounted, non-rising stem, type 304 stainless steel fasteners, valves equal to Clow Model 2639 conforming to AWWA C509 and latest revisions.

Resilient wedge gate valves (fourteen (14) inch – twenty-four (24) inch) shall be ductile iron-bodied, bronze-mounted, non-rising stem, type 304 stainless steel fasteners, valves equal to Clow Model 2638 conforming to AWWA C515 and latest revisions.

All valves shall have a minimum working pressure of two-hundred (200) psi, and shall conform to the specifications of the AWWA. Valves shall have O-ring seals. All valves shall have two (2) inch square wrench nuts. All valves shall be assembled at the factory with type 304 stainless steel fasteners. All valves shall open “left”. All valves shall be made in the USA. All buried gate valves shall be provided with valve boxes.

IV-18.2 PRESSURE SEWER MAIN VALVE BOXES

All buried valves shall be provided with valve boxes. Valve boxes shall be the screw-type, of adequate length considering the cover over the pipe. Valve boxes for two (2) inch – twelve (12) inch valves shall be East Jordan Iron Works 8550 series, complete with lid marked CONWAY SEWER. Valve boxes for fourteen (14) inch and larger shall be East Jordan Iron Works 8560 series, complete with lid marked CONWAY SEWER.

Where valve boxes need to be extended to match finished grade, the box shall be extended by the addition of an East Jordan Iron Works 8550 series box extension or by replacing the valve box with an East Jordan Iron Works 8550 or 8560 series box of the correct height or as directed by the engineer.

Valve Boxes shall be made in the USA.

The cost of valve boxes and valve box extensions shall be included with the contract unit price of the valve and therefore will not be paid for separately

IV-18.3 VACUUM/AIR RELEASE VALVES

The Contractor shall furnish and install the following equipment in accordance with these Specifications and as shown on the Plans.

1. Combination Automatic Air/Vacuum Release Valve for Sewage: Contractor shall supply 2” NPT (or size as shown on plans) threaded air release valves with valves necessary for flushing and a valve service box. Valve shall be by A.R.I Valves, Model D-025 which includes an approved one – way check on top, or approved equal.
2. The combination automatic air/vacuum release valves shall be specifically designed for air release of solids laden wastewater at high flow rates during the filling of the system and admit air into the system at high flow rates during drainage. These valves shall be installed with shut off valves and flushing valves for complete serviceability in the field and without having to remove the valve from the pressure lines or force main lines. Any dimensional modifications required for those connections shall be coordinated between the manufacturer and Contractor for a complete and working system.
3. The automatic combination air/vacuum release valve shall be designed to be a self cleaning mechanism and shall be flushed through a ball valve at the valves lower part. All inner parts, springs, washers and stem shall be stainless steel with a standard nylon body. Valve connections to the mains shall be by NPT threaded connections and valves shall be rated to 150 PSI. Valve shall be as manufactured by A.I.R USA Flow Control Accessories Model D-025 or approved equal.
4. The equipment shall be furnished for installation by the Contractor in accordance with the Plans and as specified herein. The erection work shall include the furnishing of the necessary gravel and valves so that they are properly supported and the service boxes are set to allow surface water to flow away from the box.
5. The Contractor at the job site shall perform the following valve tests for all valves:
 - (1) Pressure test to 2 x the working pressure and leakage test as indicated in the Specifications herein.
 - (2) Valve operates as required.

The cost of valve boxes and valve box extensions including complete tested assemblies shall be included with the contract unit price of the valve and therefore will not be paid for separately.

IV-18.4 AIR RELEASE VALVES

The Contractor shall furnish and install the following equipment in accordance with these Specifications

and as shown on the Plans.

1. Automatic Air Release Valve for Sewage: Contractor shall supply 2" NPT (or size as shown on plans) threaded air release valves with valves necessary for flushing and a valve service box. Valve shall be by A.R.I Valves, Model S-020 or approved equal.
2. The automatic air release valves shall be specifically designed for air release of solids laden wastewater. These valves shall be installed with shut off valves and flushing valves for complete serviceability in the field and without having to remove the valve from the pressure lines or force main lines. Any dimensional modifications required for those connections shall be coordinated between the manufacturer and Contractor for a complete and working system.
3. The automatic air release valve shall be designed to be of a self cleaning mechanism and shall be flushed through a ball valve at the valves lower part. All inner parts shall be stainless steel with a standard steel body with a baked polyester coating. Valve connections to the mains shall be by NPT threaded connections and valves shall be rated to 150 PSI. Valves shall dispel air in the lines that collect during filling and normal operation. Contractor shall install valves at the high points in the lines as shown on the Plans. Valves shall be as manufactured by A.I.R USA Flow Control Accessories Model S-020 or approved equal.
4. The equipment shall be furnished for installation by the Contractor in accordance with the Plans and as specified herein. The erection work shall include the furnishing of the necessary gravel and valves so that they are properly supported and the service boxes are set to allow surface water to flow away from the box.
5. The Contractor at the job site shall perform the following valve tests for all valves:
 - (1) Pressure test to 2 x the working pressure and leakage test as indicated in the Specifications herein.
 - (2) Valve operates as required.

The cost of valve boxes and valve box extensions including the complete tested assemblies shall be included with the contract unit price of the valve and therefore will not be paid for separately.

IV-19. TESTING PRESSURE SEWER LINES

Pressure sewer lines shall be tested by the Contractor in the presence of the Engineer and Owner at 200 pounds per square inch (psi). Test may be conducted after the line is complete and backfill made. Test pressures shall be in accordance with AWW M23 where maximum allowable leakage is as follows:

$$L = \frac{N(D)\sqrt{P}}{7400}$$

where: L = Leakage in Gallons Per Hour
 N = Number of Pipe Joints
 D = Pipe Diameter in Inches
 P = Average Pressure in psig

Should any test of pipe laid disclose leakage greater than that specified, the Contractor, shall at his own expense locate and repair the defective joints until the leakage is within the specified allowance.

DETAILED SPECIFICATIONS

PART V - CURED-IN-PLACE MAINLINE RECONSTRUCTION SPECIFICATIONS

V-1. INTENT

It is the intent of this specification to provide for the reconstruction of pipelines and conduits by the installation of a resin-impregnated flexible tube, which is formed to the original conduit by use of a hydrostatic head. The resin is cured using hot water under hydrostatic pressure within the tube. The Cured-In-Place Pipe (CIPP) will be continuous and tight fitting. Any pulled-in-place method of installation will only be allowed for pipe sizes of 6", 8", 10", and 12".

The CONTRACTOR shall submit engineering calculations for liner thickness using ASTM F1216 and sealed by a Registered Professional Engineer for approval by the Owner prior to the start of work. All pipes to be rehabilitated in this contract shall be considered fully deteriorated and design thickness calculated accordingly. Pipe depth used in the design thickness calculation shall be the greater of 10 feet or the actual depth.

V-2. REFERENCED DOCUMENTS

This specification references ASTM F1216 (Rehabilitation of pipelines by the inversion and curing of a resin-impregnated tube), ASTM F1743 (Rehabilitation of pipelines by pulled-in-place installation of a cured-in-place thermosetting resin pipe), ASTM D5813 (Standard Specification for Cured-In-Place Thermosetting Resin Sewer Piping Systems), and ASTM D790 (Test methods for flexural properties of un-reinforced plastics), which are made a part hereof by such reference and shall be the latest edition and revision thereof. In case of conflicting requirements between this specification and these referenced documents, this specification will govern.

V-3. PRODUCT, MANUFACTURER, CONTRACTOR QUALIFICATION REQUIREMENTS:

In order to minimize the Owner's risk, only proven products with substantial successful long-term track records will be approved. All trenchless rehabilitation products and Contractors must be approved by the Owner for the bid to be acceptable.

Products and Contractors seeking approval must meet all of the following criteria to be deemed Commercially Acceptable:

For a *Product* to be considered Commercially Proven, a minimum of 1,000,000 linear feet or 4,000 manhole-to-manhole line sections of successful wastewater collection system installations in the U.S. must be documented to the satisfaction of the Owner to assure commercial viability. In addition, at least 50,000 linear feet of the product shall have been in successful service within the State of Arkansas for a minimum of five years.

For a *Contractor* to be considered as Commercially Proven, the Contractor must satisfy all insurance, financial, and bonding requirements of the Owner, and must have had at least 5 (five) years active experience in the commercial installation of the product bid. In addition, the Contractor must have successfully installed at least 50,000 feet of the product bid in wastewater collection systems in the State of Arkansas. Acceptable documentation of these minimum installations must be submitted to the Owner.

Sewer rehabilitation products submitted for approval must provide *Third Party Test Results* supporting the long-term performance and structural strength of the product and such data shall be satisfactory to the Owner. No product will be approved without independent third party testing verification.

Both the rehabilitation manufacturing and installation processes shall operate under a quality management system that is third party certified to ISO 9001 or other internationally recognized organization standards. Proof of certification shall be required for approval.

V-4. MATERIALS

Tube - The sewn Tube shall consist of one or more layers of absorbent non-woven felt fabric and meet the requirements of ASTM F1216 or ASTM F1743, Section 5. The tube shall be constructed to withstand installation pressures, have sufficient strength to bridge missing pipe, and stretch to fit irregular pipe sections.

The wetout Tube shall have a uniform thickness that when compressed at installation pressures will meet or exceed the Design thickness.

The Tube shall be sewn to a size that when installed will tightly fit the internal circumference and length of the original pipe. Allowance should be made for circumferential stretching during inversion. Overlapped layers of felt in longitudinal seams that cause lumps in the final product shall not be utilized.

The outside layer of the Tube (before wetout) shall be coated with an impermeable, flexible membrane that will contain the resin and facilitate monitoring of resin saturation during the resin impregnation (wetout) procedure.

The Tube shall be homogeneous across the entire wall thickness containing no intermediate or encapsulated elastomeric layers. No material shall be included in the Tube that may cause delamination in the cured CIPP. No dry or unsaturated layers shall be evident.

The wall color of the interior pipe surface of CIPP after installation shall be a light reflective color so that a clear detailed examination with closed circuit television inspection equipment may be made.

Seams in the Tube shall be stronger than the unseamed felt.

The outside of the Tube shall be marked for distance at regular intervals along its entire length, not to exceed 5 ft. Such markings shall include the Manufacturers name or identifying symbol. The tubes must be manufactured in the USA.

The Contractor is solely responsible for field verification of all pipe diameters and lengths prior to fabrication and installation. The Contractor shall remedy, at no cost to the Owner, any defects in the installed resin tube resulting from field measurement errors, concealed changes in diameter, or from errors in diameters and lengths shown in the Unit Price Schedule. Contractor shall determine the minimum length necessary to effectively span the distance between access points.

Resin - The resin system shall be a corrosion resistant polyester, vinyl ester, or epoxy and catalyst system that when properly cured within the tube composite meets the requirements of ASTM F1216 and ASTM F1743, the physical properties herein, and those that are to be utilized in the Design of the CIPP for

this project. The resin shall produce CIPP, which will comply with the structural and chemical resistance requirements of this specification.

A watertight seal shall be created between the product and host pipe.

V-5. STRUCTURAL REQUIREMENTS:

The CIPP shall be designed as per ASTM F1216, Appendix X.1.2..2. The CIPP design shall assume no bonding to the original pipe wall.

The CONTRACTOR must have performed long-term testing for flexural creep of the CIPP pipe material installed by his Company. Such testing results are to be used to determine the long-term, time dependent flexural modulus to be utilized in the product design. This is a performance test of the materials (Tube and Resin) and general workmanship of the installation and curing. A percentage of the instantaneous flexural modulus value (as measured by ASTM D-790 testing) will be used in design calculations for external buckling. The percentage, or the long-term creep retention value utilized, will be verified by this testing. Values in excess of 50% will not be applied unless substantiated by qualified third party test data. The materials utilized for the contracted project shall be of a quality equal to or better than the materials used in the long-term test with respect to the initial flexural modulus used in Design.

The Enhancement Factor ‘K’ to be used in ‘Partially Deteriorated’ Design conditions shall be assigned a value of 7. Application of Enhancement (K) Factors in excess of 7 shall be substantiated through independent test data.

The layers of the cured CIPP shall be uniformly bonded. It shall not be possible to separate any two layers with a probe or point of a knife blade so that the layers separate cleanly or the probe or knife blade moves freely between the layers. If separation of the layers occurs during testing of field samples, new samples will be cut from the work. Any reoccurrence may cause rejection of the work.

The cured pipe material (CIPP) shall conform to the structural properties, as listed below.

MINIMUM PHYSICAL PROPERTIES

| Cured Composite | | | |
|------------------------|-------------------------|-----------------------|---------------------|
| <u>Property</u> | <u>Test Method</u> | <u>per ASTM F1216</u> | <u>(400k Resin)</u> |
| Modulus of ElastiOwner | ASTM D-790 (short term) | 250,000 psi | 400,000 psi |
| Flexural Stress | ASTM D-790 | 4,500 psi | 4,500 psi |

The required structural CIPP wall thickness shall be based as a minimum, on the physical properties above and in accordance with the Design Equations in the appendix of ASTM F 1216, and the following design parameters:

| | | |
|---|---|------------------------|
| Design Safety Factor | = | <u>2.0</u> |
| Retention Factor for Long-Term Flexural Modulus to be used in Design (as determined by Long-Term tests described in paragraph 5.2) | = | <u>1% - 50%</u> |
| Ovality* | = | <u>2%</u> |
| Enhancement Factor, k | = | <u>See Section 5.3</u> |
| Groundwater Depth (above invert)* assume equal to depth less 2 feet | = | <u>ft.</u> |
| Soil Depth (above crown)* the greater of 10 feet or actual depth | = | <u>ft.</u> |
| Soil Modulus** | = | <u>Psi</u> |
| Soil Density** | = | <u>120 pcf</u> |
| Live Load** | = | <u>H20 Highway</u> |
| Design Condition (partially or fully deteriorated)*** | = | <u>Fully</u> |

*Denotes information which can be provided here or in inspection video tapes or project construction plans. Multiple line segments may require a table of values.

**Denotes information required only for fully deteriorated design conditions.

***Based on review of video logs, conditions of pipeline can be fully or partially deteriorated.

(See ASTM F1216 Appendix) The Owner will be sole judge as to pipe conditions and parameters utilized in Design.

Any layers of the tube that are not saturated with resin prior to insertion into the existing pipe shall not be included in the structural CIPP wall thickness computation.

Chemical Resistance - The CIPP shall meet the chemical resistance requirements of ASTM F1216, Appendix X2. CIPP samples for testing shall be of tube and resin system similar to that proposed for actual construction. It is required that CIPP samples with and without plastic coating meet these chemical-testing requirements.

Hydraulic Capacity - Overall, the hydraulic profile shall be maintained as large as possible. The CIPP shall have a minimum of the full flow capacity of the original pipe before rehabilitation. Calculated capacities may be derived using a commonly accepted roughness coefficient for the existing pipe material taking into consideration its age and condition.

CIPP Field Samples - When requested by the Owner, the CONTRACTOR shall submit test results from field installations in the USA of the same resin system and tube materials as proposed for the actual installation. These test results must verify that the CIPP physical properties specified in Section 5.0 have been achieved in previous field applications.

V-6. INSTALLATION RESPONSIBILITIES FOR INCIDENTAL ITEMS

It shall be the responsibility of the Owner to locate and designate all manhole access points open and accessible for the work, and provide rights of access to these points. The Owner shall provide free access to water hydrants for cleaning, inversion and other work items requiring water. For all of the following items, if pay items are not included in the proposal, then those items will be considered incidental to the lining and will not be paid for separately.

Cleaning of Sewer Lines - The CONTRACTOR, when required, shall remove all internal debris out of the sewer line that will interfere with the installation of CIPP. The Owner shall provide a dumpsite for all debris removed from the sewers during the cleaning operation. Unless stated otherwise, it is assumed this site will be at or near the sewage treatment facility to which the debris would have arrived in absence of the cleaning operation. Any hazardous waste material encountered during this project will be considered as a changed condition.

Bypassing Sewage - The CONTRACTOR, when required, shall provide for the flow of sewage around the section or sections of pipe designated for repair. The bypass shall be made by plugging the line at an existing upstream manhole and pumping the flow into a downstream manhole or adjacent system. The pump and bypass lines shall be of adequate capacity and size to handle the peak wet weather flow. The Owner may require a detail of the bypass plan to be submitted.

Inspection of Pipelines - Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by close circuit television. The interior of the pipeline shall be carefully inspected to determine the location of any conditions, which may prevent proper installation of CIPP into the pipelines, and it shall be noted so that these conditions can be corrected. A videotape and suitable log shall be kept for later reference by the Owner.

Line Obstructions - It shall be the responsibility of the CONTRACTOR to clear the line of obstructions such as solids and roots that will prevent the insertion of CIPP. If pre-installation inspection reveals an obstruction such as a protruding service connection, dropped joint, or a collapse that will prevent the inversion process and it cannot be removed by conventional sewer cleaning equipment. The Conway Corp will require that a point excavation to uncover and remove and or repair the obstruction.

Public Notification - The CONTRACTOR shall make every effort to maintain service usage throughout the duration of the project. In the event that a service will be out of service, the maximum amount of time of no service shall be 8 hours for any property served by the sewer unless approved by Engineer. A public notification program shall be implemented, and shall as a minimum, require the CONTRACTOR to be responsible for contacting each home or business connected to the sanitary sewer and informing them of the work to be conducted, and when the sewer will be off-line. The CONTRACTOR shall also provide the following:

Written notice to be delivered to each home or business the day prior to the beginning of work being conducted on the section, and a local telephone number of the CONTRACTOR they can call to discuss the project or any problems that could arise.

Personal contact with any home or business, which cannot be reconnected within the time, stated in the written notice.

The CONTRACTOR shall be responsible for confirming the locations of all branch service connections prior to installing and curing the CIPP.

The CONTRACTOR shall be responsible for any backups in the sanitary sewer system caused by the cleaning and/or TV operation. Any damage to property, both public and private, including but not limited to backup into homes, businesses, etc., shall be repaired, cleaned or replaced to the satisfaction of the owner of such property at no cost to the OWNER.

Installation - CIPP installation shall be in accordance with ASTM F1216, Section 7, or ASTM F1743, Section 6, with the following modifications

Resin Impregnation - The quantity of resin used for tube impregnation shall be sufficient to fill the volume of air voids in the tube with additional allowances for polymerization shrinkage and the loss of resin through cracks and irregularities in the original pipe wall. A vacuum impregnation process shall be used. To insure thorough resin saturation throughout the length of the felt tube, the point of vacuum shall be no further than 25 feet from the point of initial resin introduction. After vacuum in the tube is established, a vacuum point shall be no further than 75 feet from the leading edge of the resin. The leading edge of the resin slug shall be as near to perpendicular as possible. A roller system shall be used to uniformly distribute the resin throughout the tube. If the Contractor uses an alternate method of resin impregnation, the method must produce the same results. Any alternate resin impregnation method must be proven.

Tube Insertion – The wetout tube shall be positioned in the pipeline using either inversion or a pull-in method. If pulled into place, a power winch should be utilized and care should be exercised not to damage the tube as a result of pull-in friction. The tube should be pulled-in or inverted through an existing manhole or approved access point and fully extend to the next designated manhole or termination point.

Temperature gauges shall be placed inside the tube at the invert level of each end to monitor the temperatures during the cure cycle.

Curing shall be accomplished by utilizing hot water under hydrostatic pressure in accordance with the manufacturer's recommended cure schedule.

V-7. REPAIR OF CIPP:

Contractor shall provide a method of repair for CIPP should the liner be damaged after the warranty period has expired.

V-8. REINSTATEMENT OF BRANCH CONNECTIONS:

It is the intent of these specifications that active branch connections and service connections to buildings be reopened without excavations, utilizing a remotely controlled cutting device monitored by a video TV camera. The Contractor shall have a minimum of 2 complete working cutters plus spare key components on the site before each inversion. All branch and service connections reinstated internally shall be completed with care to assure the service opening is completely opened. If the service connection is leaking from the annular space, the service connection will require grouting or an external service connection must be made. The Engineer shall decide if a service connection is leaking and needs repair. The grouting method used by the Contractor must be approved by the Engineer prior to starting the project. No additional payment will be made for grouting, if necessary. External reconnects may be required as directed by Engineer.

Internal service connection shall be cut at 95% of the opening with the remaining brushed into the lateral using a wire brush to provide a smooth transition from the main line to the service lateral; external reconnects shall be cut at 75% of the opening with the remainder removed by other means. The Contractor must provide with his bid demonstrated successful experience with internal reinstatement of services located on 6-inch diameter sewer mains. External opening of service connections shall be paid for in the installation of CIPP or closest line pay item.

V-9. INSPECTION:

CIPP samples shall be prepared and physical properties tested in accordance with ASTM F1216 or ASTM F1743, Section 8, using either method proposed. The flexural properties must meet or exceed the values listed in Table 1 of the applicable ASTM.

Wall thickness of samples shall be determined as described in paragraph 8.1.6 of ASTM F1743. The minimum wall thickness at any point shall not be less than 87½% of the design thickness as calculated in paragraph 5 of this document.

Visual inspection of the CIPP shall be in accordance with ASTM F1743, Section 8.6.

V-10. CLEAN-UP

Upon acceptance of the installation work and testing, the CONTRACTOR shall restore the project area affected by the operations to a condition at least equal to that existing prior to the work.

DETAILED SPECIFICATIONS

PART VI. - CLEANING AND INTERNAL TELEVISION INSPECTION OF EXISTING SANITARY SEWERS SPECIFICATIONS

VI-1. GENERAL

This section includes provision of cleaning operations, inspection, and closed circuit television monitoring operations, and all associated work for the sizes and lengths of sewers encountered. Pre cleaning, debris/solids/root removal, and internal television will be paid for at the unit price bid per pipe size. Post CIPP application internal television cost is considered subsidiary to the cost for installing the CIPP liner per pipe size and no additional payment will be made for post television.

All sewers to be inspected shall be cleaned as hereinafter specified.

It is not required that television inspection be provided by the CONTRACTOR during the cleaning operation. However, he may do so at his own expense. But television inspection shall be done on all sewers after cleaning.

CONTRACTOR's cleaning operations and line inspections are generally limited to 7:00 a.m. to 5:00 p.m. on Monday through Friday except holidays unless previously approved by OWNER.

CONTRACTOR shall provide traffic control personnel during operations to maintain safety of all personnel and public traffic maintenance.

Contractor shall plug each sewer segment and allow to drain prior to performing internal inspection if flow levels exceed 30 percent of pipe diameter

If the specified low flow levels are not achievable using flow through plugs or by scheduling inspection during low flow hours, the OWNER may authorize the inspection above these flow levels.

The CONTRACTOR shall be responsible for any backups in the sanitary sewer system caused by the cleaning and/or TV operation. Any damage to property, both public and private, including but not limited to backup into homes, businesses, etc., shall be repaired, cleaned or replaced to the satisfaction of the owner of such property at no cost to the OWNER.

VI-2. EQUIPMENT

The CONTRACTOR shall allow OWNER to become familiar with CONTRACTOR's equipment before commencement of work.

Cleaning Equipment

The CONTRACTOR shall provide all equipment necessary for proper flushing and cleaning of the sewers in the sizes indicated prior to television inspection. Hydraulic high pressure sewer cleaners used for sanitary sewer cleaning shall be specifically designed and constructed for such cleaning. The sewer cleaner shall have a minimum usable water capacity of 600 gallons and a pump capable of delivering at least 30 gallons per minute (gpm) at 1,000 psi. Pressure to the nozzle shall be regulated by a relief valve adjustable from 0 to 1,500 psi minimum. The equipment will be subject to approval by the OWNER.

Satisfactory precautions shall be taken to protect the sewer lines from damage that might be inflicted by the improper use of cleaning equipment. Sewers damaged as a result of the CONTRACTOR's operations shall be promptly repaired by the CONTRACTOR at no cost to the OWNER.

All equipment, devices, and tools required for this contract shall be owned (or leased) and operated by the CONTRACTOR.

Television Equipment

The television cameras used for the inspection shall be specifically designed and constructed for such inspection and shall provide a color picture. Lighting for the camera shall be suitable to allow a clear picture for the entire periphery of the pipe, acceptable to the OWNER. The camera shall be operative in 100 percent humidity conditions, have 360B rotate and 290B pan capability, a minimum of 3 lux light capability, and shall have a minimum of 600 line resolutions. The camera equipment must have the capability of being mounted on skids and winched through the sewer lines if required by the condition of the lines.

The CONTRACTOR shall also provide a color mini-camera based closed circuit television inspection system. This system will be used to remotely inspect service laterals from the cleanout. Picture quality should be of a degree of quality to allow a thorough evaluation of service lateral condition.

Cassette recording equipment will be required for all videotaping. The video tapes that will be provided to OWNER shall be VHS format. The CONTRACTOR shall also deliver the video in CD format that can be read on most CD ROMs (DVD).

The CONTRACTOR shall provide equipment for viewing of the inspection as it takes place.

VI-3. CLEANING OPERATION

Cleaning Sewers

Existing flows shall not be interrupted for periods longer than one hour. Sewage diverted during cleaning operations shall be returned to the sanitary system and not discharged into the streams or storm drain system. Cleaning of these sewers may be by means of hydraulic high pressure jetting or other equipment as needed.

Jet machines may be refilled from fire hydrants in a manner acceptable to the OWNER. The CONTRACTOR is responsible for any adverse impact on the water distribution system resulting from his filling operations. Water will be available at no cost to the CONTRACTOR from fire hydrants acceptable to the OWNER. A backflow prevention valve with approved Conway Corp meter is required on CONTRACTOR'S equipment during filling operations. Contractor shall keep up with all water used during the project and provide owner with the amount of water used.

Cleaning shall generally be performed prior to closed circuit television inspection. The cleaning operations shall be conducted no more than 48 hours in advance of television inspection of the sewer line.

Unless other methods are authorized by the OWNER, light hydraulic cleaning shall be performed for all main sewers to be inspected. Three attempts shall be made, if necessary, by the CONTRACTOR unless directed otherwise by the OWNER. If the line is still not suitable for TV inspection, then heavy cleaning shall be recommended to OWNER.

Remove all sludge, dirt, sand, grease, roots, rocks, gravel, and other materials from the pipe and collect and remove resulting debris from the downstream manhole of the sewer section being cleaned. Passing material from sewer section to sewer section will not be permitted. An approved dam or weir shall be constructed in the downstream manhole in such a manner that debris and solids will be trapped and retained.

Roots shall be removed in the sections designated by the OWNER where root intrusion is a problem. Special precautions should be exercised to assure removal of visible roots from the joint area that could hinder normal flow or interfere with any rehabilitation or repair techniques that may be performed. The use of mechanical devices such as kites, balls, rodding machines, root cutters, porcupines, and hydraulic procedures such as high-pressure jet cleaners shall be used, as required. This work will be documented with videotape, before and after removal of the roots, as directed by the OWNER.

VI-4. DISPOSAL OF DEBRIS

Under no circumstances shall sewage or solids be dumped onto the ground surface, street or into ditches, catch basins or storm drains.

All solids or semi-solids resulting from the operations shall be removed from the site by the CONTRACTOR unless authorized or directed otherwise by the OWNER. Trucks hauling solids or semi-solids from the site shall be watertight so that no leakage or spillage will occur.

Disposal will be the responsibility of the CONTRACTOR and disposal shall be performed according to all state and federal regulations.

VI-5. RE-CLEANING

If a pipeline is found not to be properly cleaned (by visual inspection, tape review, or field analysis) in the opinion of the OWNER, the television equipment shall be removed and the sewer re-cleaned at no expense to the OWNER.

VI-6. INSPECTION OPERATIONS

Camera Work

When the OWNER directs that no cleaning shall be performed prior to the inspection and stringing the line is required, the CONTRACTOR shall string the line by approved means so as not to disturb the existing sewer line conditions.

The inspections shall be done one sewer section (manhole # to Manhole #) at a time. The section being inspected shall be isolated from the remainder of the sewer in a manner approved by the OWNER. Such method will include plugging all upstream flow if necessary. Plugs shall be secure to remain in place and operations conducted to prevent backflow into buildings.

The camera shall be inserted in the upstream manhole of the line segment and moved through the line at a uniformly slow rate (maximum 30 feet/minute), stopping at defective joints, all defects and each service connection to allow adequate evaluation by OWNER. In addition, the pan/tilt feature of the camera shall be utilized at each service connection and lateral to provide a clear picture for determination of condition by the OWNER, and whether the line is plugged or active. If the line segment to be televised has a cleanout on the upstream end, then the inspection will begin at the downstream manhole.

If progress of the television camera is impeded or stopped by roots in the sewer reach being inspected, the camera shall be withdrawn, at the direction of the OWNER. The camera shall then be reinserted at the other manhole of the sewer reach and the television inspection resumes. If the camera is stopped by roots or debris that, in the opinion of the OWNER, should have been removed by the cleaning operation, the camera shall be removed and the line re-cleaned at no additional cost to the OWNER. Once the re-cleaning is complete, the CONTRACTOR shall televise the line segment. The cost to re-televising is considered subsidiary to the work and paid for one time at the unit cost per foot of pipe actually televised.

Other obstruction may be encountered during the course of the internal inspection that prevent the travel of the camera. Should an obstruction not be passable, the CONTRACTOR shall withdraw the equipment and begin internal inspection from the opposite end of the sewer reach. Should additional obstructions be encountered after the re-employment and no means are available for passing the obstruction without damage to the equipment, then the remaining sections of the sewer not inspected shall be excluded from the work requirements of the contract. Cost related to difficulties encountered during internal inspections will not be measured for payment nor constitute additional cost to the Contract Price, but will be considered as incidental to the contract.

The OWNER will provide for removal of equipment that may become lodged in the sanitary sewer line unless OWNER is requested not to inspect a specific sanitary sewer segment. The OWNER is not responsible for damage of the television (TV) camera and its associated equipment during the retrieval process.

Viewing

Telephones, portable radio, CB, walkie-talkies, or other electronic means of communications must be set up where voice or manual communications is not feasible. The CONTRACTOR shall provide facilities for the purpose of viewing the monitor while the inspection is in progress.

Record Logs

Measurement for location of defects in sewer mains shall be at the ground level by means of a meter device. Marking on cable or the like which requires interpolation for depth of manhole will not be allowed. Measurement meters shall be accurate to 0.2 feet. A measuring target in front of the television camera shall be used as an exact measurement reference point, and the meter reading shall show this exact location of the measurement reference point. The first feature out of the manhole or cleanout will be measured and used as the initial reference point. If a buried manhole is encountered during the internal TV inspection, the footage will be reset to zero and that segment shall be treated as a new line segment. The OWNER'S field representative shall instruct the CONTRACTOR on the numbering procedure for this new manhole.

The CONTRACTOR shall furnish all cassette video equipment and cassette videotape film for cassette video tape recording. And the Contractor shall furnish video inspection on CD DVD within 48 hours after video being made. No reel-to-reel video recording equipment or tapes will be permitted. In the course of inspection, all sewer sections will be videotaped in their entirety.

Defects shall be described and quantified verbally on the videotapes by the CONTRACTOR. Where appropriate, existing landmarks shall be identified. The cassette videotapes (DVD) will be reviewed by the OWNER for focus, lighting, clarity of view, and technical quality. The CONTRACTOR shall maintain sharp focus, proper lighting, and clear, distortion free viewing during the camera operations. The CONTRACTOR shall maintain plugging and eliminate steam in the line for the duration of the inspection. Failure to maintain these conditions will result in rejection of the videotape by the OWNER. Any sewer line whose video is not acceptable to the OWNER will be re-televised at no expense to the OWNER

Each individual cassette videotape and CD (DVD) shall be properly labeled by the CONTRACTOR prior to submittal to the OWNER. The label shall list the OWNERS sewer line segment by manhole numbers data, OWNER/OWNER, name of CONTRACTOR, and tape number.

Each setup shall be described visually (by superimposing a descriptive caption on the video tape recording which identifies critical information) and described audibly on the video tape recording, both at the initiation and at the conclusion of the setup. The line segment shall be described by the OWNER's segment number which includes both basin and manhole numbers. The video counter number shall be voiced on the video tape recording and written on the record logs both at the initiation and conclusion of each setup. In addition, the video counter number and a brief description of all service laterals, cleanouts, and defects shall be audibly indicated on the video tape recording.

A printed report shall be furnished (both electronic and printed in the format as requested by the OWNER) for each line segment televised within 48 hours after being produced. The report will contain the location of service laterals, the status of the laterals, location of cleanouts, the status of the cleanouts and the location and description of any defects.

DETAILED SPECIFICATIONS

PART VII. FINAL PERFORMANCE REQUIREMENTS

VII – 1. GENERAL

VII - 1.01 WORK INCLUDED

This Section covers the final product requirements for the rehabilitated pipe section using any of the preapproved methods mentioned in these specifications.

VII – 2. PRODUCT PERFORMANCE REQUIREMENTS

VII - 2.01 PRODUCT SEAL AT MANHOLE

Seal of rehabilitated pipe at new and existing manholes will be inspected upon completion of each line segment and again at a final inspection prior to final acceptance of the project. No visible leaks will be allowed. Should a leak be present at any of the inspection times it will be the responsibility of the Contractor to stop the leak with a method approved by the Engineer. All retainage being held by the Owner will be retained until such time as all visible leaks have been repaired to the Engineer's satisfaction. After final acceptance of the project the seals will be inspected again within a 6 month period and any additional leaks will be repaired under the Warranty Period.

VII - 2.02 FINAL REHABILITATED PIPE PRODUCT

Television Inspection - All rehabilitated pipeline sections regardless of the method used will be televised as required by these specifications. Should the television camera fail to pass smoothly and without unnecessary force through a pipeline section that section will be considered as unsatisfactory and repair of the section will be performed as required by these specifications.

Mandrel Inspection - All rehabilitated pipeline sections regardless of the method used will be inspected by means of a mandrel pulled by hand through the pipeline section. The mandrel will have an outside diameter equal to approximately 80% of

the original inside diameter of the pipeline section prior to rehabilitation. Should the mandrel fail to pass through the section being pulled by hand, the section will be considered as unsatisfactory and repair of the section will be performed as required by these specifications. Mandrel (80% Diameter) will be supplied by the Contractor and checked and approved by Engineer prior to performing test. Mandrel test may be made in conjunction with Television inspection if Mandrel is attached in front of camera to allow Engineer to visually see results.

Deformations Within The Invert Area - During the television inspection of all rehabilitated pipeline sections, the lower third of the pipe cross-section will be checked for deformations in the rehabilitated pipeline that in the opinion of the Engineer will affect the natural flow of the pipeline. Deformations will be considered any abnormal protrusion either parallel or perpendicular with the flow of the pipeline. Should any deformations be found in the lower third of the pipe cross-section, the section will be considered unsatisfactory and repair of the section will be performed as required by these specifications. Deformations caused by the original pipeline section will also not be accepted. It will be the Contractor's responsibility to identify those locations of the original pipeline that may cause such deformities and make required repairs prior to the rehabilitation process. Such repairs will be considered incidental to the price bid for rehabilitation of the pipeline section.

Service Reinstatements - During the final televising of the rehabilitated section, the camera shall stop and pan all services to assure the Engineer that all services have been installed properly and without visible groundwater leaks. The contractor shall work with the Engineer to ensure all services are repaired to a reasonable standard. Should a leak be present, it will be the responsibility of the Contractor to stop the leak with a method approved by the Engineer. All retainage being held by the Owner will be retained until such time as all visible leaks have been repaired to the Engineer's satisfaction.

Site Cleanup - The entire construction area will be returned to its original condition including the replacement of vegetation as required by these specifications as soon as possible after final acceptance of the pipeline section has been made. No retainage will be released on the project until all areas have been restored to their original condition.

VII – 3. REPAIR OF DEFECTS

VII - 3.01 PIPELINE SECTION REPAIR

All sections of rehabilitated pipeline considered as unsatisfactory for any of the reasons mentioned in these specifications may be repaired as follows:

Open Cut Methods – Pipe will be removed and replaced with a pipe installed according to the requirements of these specifications.

Liner Methods - Liner will be removed and replaced with a liner installed according to the requirements of these specifications.

Pipe Bursting Method - Point repair area considered unsatisfactory with approved materials. Care should be taken in joining the sections of pipe to assure they are joined according to these specifications.

VII - 3.02 DEDUCTION FOR NONREPAIRED SECTIONS

If, at the sole discretion of the Engineer, the unsatisfactory pipe section is allowed to remain, a deduction of 30% of the bid amount for that line segment from manhole to manhole containing the unsatisfactory section will be made. The Contractor has the alternative of repairing the unsatisfactory pipe section as mentioned above if they do not want the deduction of the bid amount to occur. The alternative mentioned in this section to repairing the unsatisfactory pipeline section will be only at the Engineer's discretion and the Engineer's decision will be final.

DETAILED SPECIFICATIONS

PART VIII. MANHOLE REHABILITATION USING CEMENTITIOUS LINER

VIII-1. SCOPE

The Contractor is to provide a competent person who has experience in the different manhole construction techniques that have been used in the past. This person must have the ability to assess the condition of sanitary manholes. The competent person assigned by the Contractor will complete the manhole inspection report (see figure 1). An inspection report will be completed for each numbered manhole in the Project area. The inspection reports are to be turned into the OWNER. After review and evaluation of the forms, the OWNER will select what manholes are to be rehabilitated.

VIII-2. GENERAL

These Construction Specifications describe the work required for the rehabilitation of manholes within the sanitary sewer collection system in the city of Conway, Arkansas. All manhole rehabilitation procedures will involve: flow control, debris removal and disposal, surface restoration, and other related and incidental work as may be required to provide complete and rehabilitated manholes acceptable to the Owner.

VIII-3. MANHOLE REHABILITATION USING CEMENTITIOUS LINER

General

The Contractor, approved and trained by the manufacturer, shall furnish all labor, equipment and materials for applying a cementitious mix to form a structural monolithic liner of a minimum ½ inch thickness, with machinery specially designed and manufactured by the material supplier for the application. All aspects of the installation shall be in accordance with the manufacturer's recommendation and per the following specifications.

Cementitious materials for lining manholes shall be designed for environments with a pH of 3.0 or higher. Contractor shall test manholes for pH. Under no circumstances shall material designed for a pH of 3.0 or higher be installed in a manhole with a pH less than 3.0. In the event that a pH test indicates a pH less than 3.0, Contractor shall notify Engineer. The Engineer shall assess the condition of the manhole in question and report the findings to the Owner. The Owner reserves the right to have manholes with a pH less than 3.0 rehabilitated with a product specifically designed for a pH less than 3.0 as specified elsewhere in the specifications, or remove the manholes from the scope of the project.

VIII-4. STATEMENT OF QUALIFICATIONS

The Contractor that performs the manhole rehabilitation work shall be subject to the approval of the Engineer and meet the following minimum qualifications. Qualifications shall be submitted with the bid documents. Manhole rehabilitation work shall not commence without the written approval of the Engineer.

Submit Arkansas address of applicator and Product Company and Arkansas Contractor's license number.

Submit manufacturer's product data, including physical properties, surface preparation, repair, application, curing, and field quality control.

Submit written and dated certification stating Contractor is factory trained and approved by manufacturer in application of the specified products.

Submit documentation of previous manhole rehabilitation work. A Contractor shall have a minimum 5-year history in manhole rehabilitation work and a minimum of 25,000 vertical feet and 2,500 manholes of successful manhole rehabilitation work in the U.S. documented to the satisfaction of the Owner to assure commercial viability.

Submit a list of five (5) recently completed manhole rehabilitation projects in the state of Arkansas, including project name and location, names of owner and engineer, and description of products used, substrates, and application procedures.

Submit a list of key supervisory personnel and other personnel that will be working on the project. Provide a resume for each of the key supervisory personnel that includes their experience with the proposed product, including specific projects and their responsibilities, and their history with the Contractor submitting the bid. Key supervisory personnel shall have a minimum three (3) year history installing the proposed product.

Key supervisory personnel shall be on-site when work is being performed on the project. The Engineer shall be notified in writing when there is any change in key supervisory personnel. A resume shall be submitted to the Engineer for any key supervisory personnel added to the project.

A factory representative shall be on job site for the first two days of the project.

VIII-5. PRODUCTS AND MATERIALS

Patching material shall be rapid-setting, fiber-reinforced, high-early-strength, corrosion-resistant, hand-mixed and hand-applied, calcium aluminate based cementitious material, Strong-Seal QSR, or equal and have the following minimum requirements:

| | | |
|----------------------|-----------|-----------------------|
| Compressive Strength | ASTM C109 | 1400 psi at 6 hours |
| Bond | ASTM C321 | 145 psi at 28 days |
| Cement | | Sulfate resistant |
| Applied Density | | 105 lbs. ± 5 lbs, pcf |
| Shrinkage | ASTM C596 | 0% at 90% R.H. |

Infiltration control material used to stop minor water infiltration shall be rapid-setting, high-early-strength, hand-applied, cementitious material, Strong-Seal Strong Plug, or equal and have the following minimum requirements:

| | | |
|----------------------|-------------------------|---|
| Compressive Strength | ASTM C109 | 1200 psi at 1hr., 3000 psi at 24 hrs. |
| Expansion | ASTM C827 | 0.1% |
| Sulfate Resistance | ASTM C267 | No weight loss after 15 cycles, 2000 ppm; test continuing |
| Freeze/Thaw | ASTM C666 "Method A" | 100 cycles |
| Pull out strength | ASTM C234 | 14000 lbs. |
| Placement time | | < 1.0 minute |

Cementitious grout shall be used for stopping very active infiltration and filling voids. Strong-Seal Grout 250, or equal and have a minimum of 28 day compressive strength of 250 psi.

Liner material for pH 3.0 or higher shall be fiber-reinforced, spray-applied, cementitious mortar, Strong-Seal MS-2A, or equal. Strong Seal MS-2A shall be made with Type I or Type III Portland Cement and shall be used in accordance with manufacturer's recommendations. MS-2A shall be factory blended requiring only the addition of potable water at the jobsite.

Liner material for pH or 2.0 - 3.0 shall be fiber-reinforced, spray-applied, cementitious mortar, Strong-Seal MS-2C, or equal. Strong-Seal MS-2C shall be made with Calcium Aluminate Cement and shall be used in accordance with manufacturer's recommendations. MS-2C shall be factory blended requiring only the addition of potable water at the jobsite.

Liner material for pH 1.0 - 2.0 shall be fiber-reinforced, spray-applied, cementitious mortar, Strong-Seal High Performance Mix, or equal. Strong-Seal High Performance Mix shall be made with 100% pure fused calcium aluminate clinker and calcium aluminate cement and shall be used in accordance with manufacturer's recommendations. High Performance Mix shall be factory blended requiring only the addition of potable water at the jobsite.

Liner materials shall meet the following minimum requirements:

| Table 2.1 – Liner Specifications | | | | | |
|----------------------------------|---------------|---------|------------|------------|----------------------|
| Item | Specification | Time | MS-2A | MS-2C | High Performance Mix |
| A. Compressive Strength (psi) | ASTM C109 | 28 days | 9000 | 8000 | 9000 |
| B. Tensile Strength (psi) | ASTM C496 | 28 days | 500 | 600 | 800 |
| C. Flexural Strength (psi) | ASTM C78 | 28 days | 600 | 700 | 1200 |
| D. Shrinkage @ 90% R.H. | ASTM C596 | 28 days | 0% | 0% | 0% |
| Item | Specification | Time | MS-2A | MS-2C | High Performance Mix |
| E. Bond (psi) | ASTM 882 | 28 days | > 2000 psi | > 2000 psi | > 2000 psi |
| F. Applied Density (pcf) | - | - | 133 ± 5 | 120 ± 5 | 150 ± 5 |

| | | | | | |
|----------------|--------------|---|------------------------------------|------------------------------------|------------------------------------|
| G. Freeze/Thaw | ASTM C666 | - | 100 cycles No visible damage | 100 cycles No visible damage | 100 cycles No visible Damage |
|----------------|--------------|---|------------------------------------|------------------------------------|------------------------------------|

All liner products shall be reinforced with alkaline resistant fiberglass rods not less than ½-inch in length nor greater than 5/8-inches, with the following physical properties:

½ to 5/8 inches alkaline-resistant fiberglass rods.

Minimum Young’s Modulus Rating of 11,000,000 psi.

Minimum Tensile Strength of 250,00 psi.

Maximum Strain at Failure rating of 3.6%.

All material shall meet or exceed industry standards and shall not have any basic ingredient that exceeds EPA maximum allowable limit for any heavy metal.

Water shall be clean and potable.

VIII-6. PREPARATION

The contractor shall be responsible for preventing any and all construction related material from entering the sewer lines. It is recommended to place covers over the manhole invert to prevent extraneous material from entering the sewer lines. Any construction related material that enters the sewer lines shall be removed by the contractor.

All foreign material shall be removed from the manhole wall and bench using a high-pressure water spray (minimum 2500psi). All existing manhole steps shall be removed. Loose and protruding brick, mortar, and concrete shall be removed using a mason’s hammer and chisel and/or scraper. Fill any large voids with quick setting grout.

Active leaks shall be stopped using approved quick setting grouts or fillers. Some leaks may require weep holes to localize the infiltration during the application. After application the weep holes shall be plugged with the quick setting material prior to the application of the final coat. When severe infiltration exists, drilling may be required in order to pressure grout using a cementitious grout or chemical grout. Manufacturer’s recommendations shall be followed when pressure grouting is required.

VIII-7. INVERT AND BENCH REPAIR INVERT

Invert and bench repair shall be performed on all inverts with visible damage or where infiltration is present. After blocking flow through manhole, and thoroughly cleaning invert and bench, Strong-Seal QSR patching mix, or approved equal shall be applied to the invert and bench in an expeditious manner. The material shall be troweled uniformly onto the damaged invert at a minimum thickness of ½ inch at the invert extending out onto the bench of the manhole sufficiently to tie into the walls of the manhole and structurally enhanced monolithic liner to be spray applied. The finished invert and bench surfaces shall be smooth and free of ridges.

VIII-8. SPRAYING

The surface shall be clean and free of all foreign material and shall be damp without noticeable free water droplets or running water, but totally saturated just prior to application of material. Materials shall be spray applied up to one inch thick in one or more passes from the bottom of the frame, however, minimum thickness shall not be less than ½ inch. The surface is then troweled to relatively smooth finish, being careful not to over trowel.

A brush finish shall be applied to the trowel finished surface. Manufacturer's recommendations shall be followed whenever more than 24 hours have elapsed between applications.

The covers shall be removed at this time and the bench sprayed with materials mixed per specifications and spray applied in such a manner that a gradual slope is produced from the walls to the invert with the thickness at the invert to be no less than ½ inch. The wall/bench intersection shall be rounded to uniform radius the full circumference of the intersection.

VIII-9. CURING

Cure materials in accordance with manufacturer's instructions.

Minimize exposure of applied materials to sunlight and air movement. Cover structure if time between application of additional coats is to be longer than 15 minutes. Do not expose finished materials to sunlight or air movement for longer than 15 minutes before covering or closing access. Shade manhole while rehabilitation is in process in hot and arid climates.

Apply concrete curing compound if relative humidity is less than 70 percent within manhole. Apply curing compound in accordance with manufacturer's instructions.

VIII-10. QUALITY ASSURANCE TESTING

Compressive strength test to be performed by manufacturer at Contractor's expense. Cast four 2 inch cubes each day or from each pallet of material. Label, package, and mail cubes to manufacturer. Manufacturer shall test cubes for compressive strength in accordance with ASTM C109 and submit test results to the Contractor and Engineer.

VIII-11. MANHOLE CASTING – REMOVE AND REPLACE

The Contractor shall furnish all labor, equipment and materials to remove existing manhole castings and replace with new manhole castings per the following specifications.

The owner will use the completed manhole Inspection Report to determine what existing manholes will get frames and lids.

Salvaged ring and covers shall remain the property of the Owner. Contractor shall deliver rings and covers to a storage area as designated by the Owner. Contractor shall dispose of all ring and covers the Owner does not retain.

VIII-12. CONSTRUCTION METHODS

Materials shall be removed from around the frame to a depth to expose the entire frame and cover and at least two brick courses or 6 inches of the top of the manhole corbel.

If the manhole is located in pavement, the frame and cover removal shall be accomplished by saw cutting a 4 feet by 4 feet square cut, or 4 feet diameter circular cut in the pavement.

Removed material shall be stockpiled.

Rebuild and adjust, if necessary, the top of the manhole to required elevation, using lightweight structural grade adjusting rings as mfg. by The Strong Company, Inc.

Set the new cast iron manhole frame in full mortar bed with a mastic seal between mortar and iron frame. Grout the perimeter of the new casting to the existing cone or chimney section

In public rights-of-way, set the ring and cover flush with pavements, sidewalks, or other paved areas.

When raising manhole casting to grade in non-paved areas, set the ring and cover one-tenth (0.10) of a foot above existing natural grade.

Backfill under pavement, drives, and sidewalks shall be compacted to 95% maximum density (Modified Proctor)/

Backfill in other areas shall be compacted to 90% maximum density (Modified Proctor).

If the manhole is in a pavement area, replace the base and pavement in accordance with the Arkansas Highway and Transportation Department "Standard Specifications for Highway Construction, latest edition." Cold mix asphalt material will not be accepted as a permanent replacement material.

VIII-13. MANHOLE CASTINGS

SEE PART IV – 11.2 OF THESE SPECIFICATIONS.

VIII-14. RESTORATION OF RIGHT-OF-WAY

All areas of exposed soil following backfill operations shall be dressed and cleaned of construction debris, stumps, limbs, roots, rocks, etc., and vegetative cover shall be restored as soon as possible. All areas affected by construction activities shall be neatly graded and leveled so as to match adjacent undisturbed areas.

Cultivated fields shall not be seeded. However, all cultivated fields shall be neatly graded and leveled so as to match adjacent undisturbed areas.

Areas of cultivated and maintained lawn grass shall be restored in kind to equal or better than original condition using sod if the Owner decides it necessary. Existing turf may be salvaged and used in restoration, supplemented as needed with topsoil, new sod, seeding, fertilizer, mulch, and water. Areas of maintained lawn grass shall be neatly graded with all rocks, clumps of dirt, roots, and other materials removed.

All areas of exposed soil that are not sodded shall be seeded, mulched, fertilized, and watered in order to establish grass cover as quickly as possible. Seeding, fertilizing, and mulching shall be as specified in elsewhere in the specifications.

Restoration of vegetative cover along the construction right-of-way shall be subject of Owner’s approval before final contract payment is made.

VIII-15. SEEDING, FERTILIZING, AND MULCHING

The Contractor shall provide for seeding, fertilization, and mulching as herein prescribed for any and all areas impacted by construction activity that are not sodded. Seeding shall conform to Section 620 of the Arkansas Highway and Transportation Departments “Standard Specification for Highway Construction” latest edition and as herein specified. Cultivated fields shall not be seeded, fertilized, mulched.

Areas shall be seeded, fertilized, mulched, watered, and maintained by the Contractor so as to establish a complete and uniform growth of grass over the area. Any area where growth of grass dies, shall be reseeded and remulched as required until acceptable growth is established.

Seeding shall be accomplished according to the following schedule. Seed shall be composed of the varieties and amount by weight as shown below:

| | |
|--|--------------------|
| <u>March 1st through June 15th</u> | |
| Bermuda Grass (Common) unhulled | 10 pounds per acre |
| Bermuda Grass (Common) hulled | 5 pounds per acre |
| Lespedeza (Kobe) | 35 pounds per acre |
| <u>June 16th through August 31st</u> | |
| Bermuda Grass (Common) unhulled | 10 pounds per acre |
| Bermuda Grass (Common) hulled | 5 pounds per acre |
| Weeping Love Grass (Eragrostis Curvulva) | 10 pounds per acre |
| <u>September 1st through February 28th</u> | |
| Wheat | 30 pounds per acre |
| Crimson Clover (Dixie) | 20 pounds per acre |
| Bermuda Grass (Common) unhulled | 20 pounds per acre |
| Lespedeza (Kobe) | 35 pounds per acre |

If seed is planted in dry weather and the ground is not moist, the area to be seeded shall be watered before and after the seeding as conditions may warrant. Sowing of seed may be by mechanical hand seeders or power equipment (hydro seeder). Either method must give uniform distribution and no seeding will be permitted during a high wind. The area shall be lightly firmed

with a cultipacker immediately after broadcasting. If hydro-seeding, the area shall be lightly firmed with a cultipacker immediately before broadcasting.

Fertilizer shall be applied at the rate of 800 pounds per acre of 10-20-10, or the equivalent amount of plant food. Fertilizer shall be uniformly incorporated into the soil alone or in conjunction with lime. If the Contractor so elects, the fertilizer may be drilled into the soil or combined with the seed in the hydro-seeding operation.

Mulch cover shall be applied at the rate of 4000 pounds per acre immediately after seeding and shall be spread uniformly over the entire area by approved power mulching equipment. When approved by the Engineer, the Contractor may use hand methods to apply mulch cover to small or inaccessible areas. If the Contractor so elects, an approved mulching machine may be used whereby the application of mulch cover and tackifier may be combined into one operation. If this method is used, no change in application rates will be allowed. In its final position, the anchored mulch shall be loose enough to allow air to circulate, but compact enough to partially shade the ground and reduce the impact of rainfall on the surface of the soil. Care shall be taken to prevent tackifier materials from discoloring or marking structures, pavements, utilities, or other plant growth. Any objectionable discoloration shall be removed.

Mulch cover shall consist of straw from threshed rice, oats, wheat, barley, or rye; of wood excelsior; or of hay obtained from various legumes or grasses. Mulch shall be free from Johnson grass or other noxious weeds, and shall not be excessively brittle or in an advanced state of decomposition.

Immediately following or during the application to the mulch cover on seeded areas, the mulch shall be anchored by tracking or roller method, asphalt tackifier, or other tackifier as approved by the Engineer. The contractor may use equipment that combines the application of mulch and tackifier into one operation.

VIII-16. FENCING AND FENCE RESTORATION

The Contractor shall be responsible for maintenance of fences during construction. The Contractor shall provide as necessary temporary fencing, gates, etc., as may be required to afford access to the construction site and maintain the full integrity of the fence.

Fences disturbed by construction activity shall be restored to their original condition or better using fencing materials that are of the same size, gauge, and character as the original fence.

VIII-17. ACCEPTANCE INSPECTION

Testing Manholes

Visual inspection for leaks.

The Contractor shall vacuum test ALL manholes sprayed with cementitious liner.

Vacuum Testing – Manholes shall be tested in accordance with ASTM C1244-93. Vacuum test shall not be performed earlier than 7 days after construction or installation. The Contractor

shall provide all testing equipment, pump, hosing, seal, and other incidentals. Vacuum test head shall be positioned at the top of the cone section immediately below the casting in accordance with the equipment manufacturer’s instructions. A vacuum of 10-inches of mercury shall be drawn and the vacuum pump isolated by the shut-off valve on the test head connection. When valve is closed, time measurement shall commence, and the time required for vacuum drop to 9-inches of mercury shall be observed and recorded. Manholes shall pass if the time for the vacuum reading to drop from 10-inches of mercury to 9-inches of mercury meets or exceeds the time values in seconds in the following table.

| Depth (feet) | Diameter (inches) | | | | | | | | |
|--------------|-------------------|----|----|----|----|----|----|-----|-----|
| | 30 | 33 | 36 | 42 | 48 | 54 | 60 | 66 | 72 |
| 8 | 11 | 12 | 14 | 17 | 20 | 23 | 26 | 29 | 33 |
| 10 | 14 | 15 | 18 | 21 | 25 | 29 | 33 | 36 | 41 |
| 12 | 17 | 18 | 21 | 25 | 30 | 35 | 39 | 43 | 49 |
| 14 | 20 | 21 | 25 | 30 | 35 | 41 | 46 | 51 | 57 |
| 16 | 22 | 24 | 29 | 34 | 40 | 46 | 57 | 58 | 67 |
| 18 | 25 | 27 | 32 | 38 | 45 | 52 | 59 | 65 | 73 |
| 20 | 28 | 30 | 35 | 42 | 50 | 53 | 65 | 72 | 81 |
| 22 | 31 | 33 | 39 | 46 | 55 | 64 | 72 | 79 | 89 |
| 24 | 33 | 36 | 42 | 51 | 59 | 70 | 78 | 87 | 97 |
| 26 | 36 | 39 | 46 | 55 | 64 | 75 | 85 | 94 | 105 |
| 28 | 39 | 42 | 49 | 59 | 69 | 81 | 91 | 101 | 113 |
| 30 | 42 | 45 | 53 | 63 | 74 | 87 | 98 | 108 | 121 |

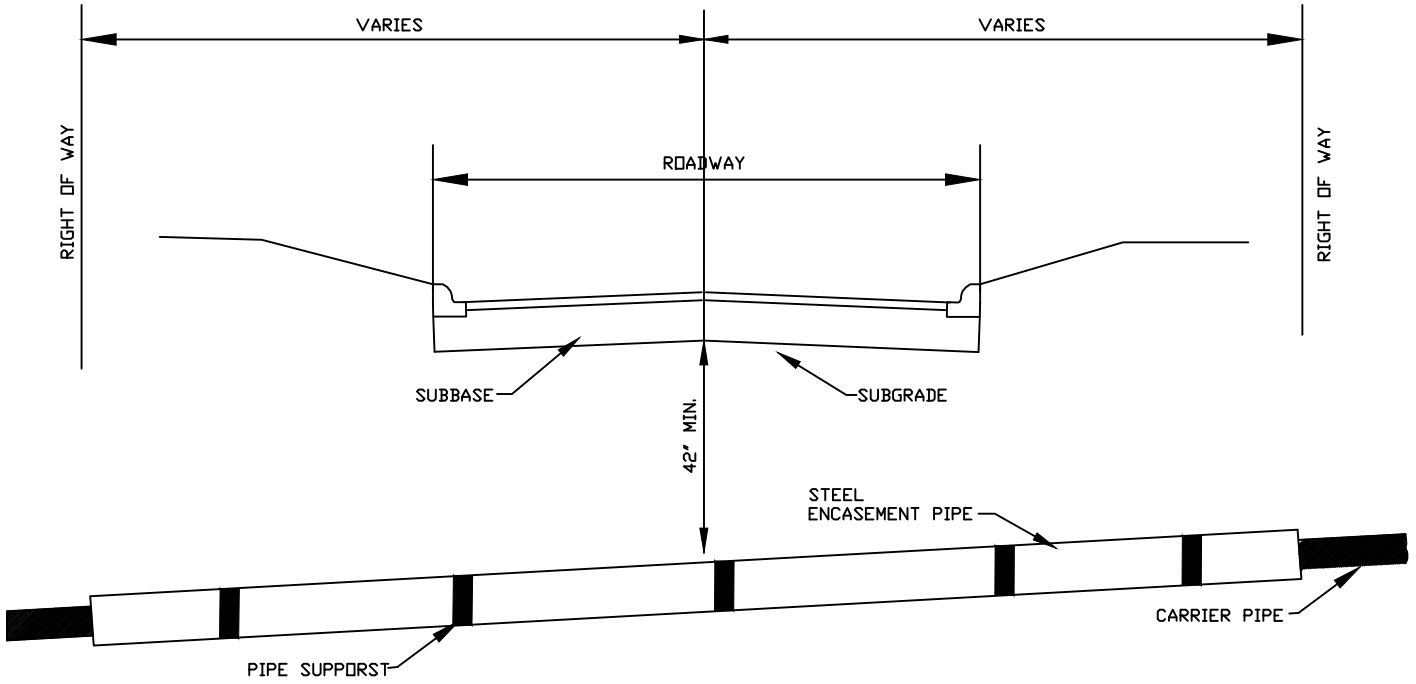
Manholes showing greater than the allowable leakage shall be repaired and re-tested until a satisfactory leakage result is obtained.

VIII-18. REPAIR OF DEFECTS

All manholes considered as unsatisfactory shall be repaired. The costs of such repairs for post-rehabilitation defect repair shall be paid for by the Contractor and the Owner shall make no payments for repair of unsatisfactory or defective work by the Contractor.

Appendix A

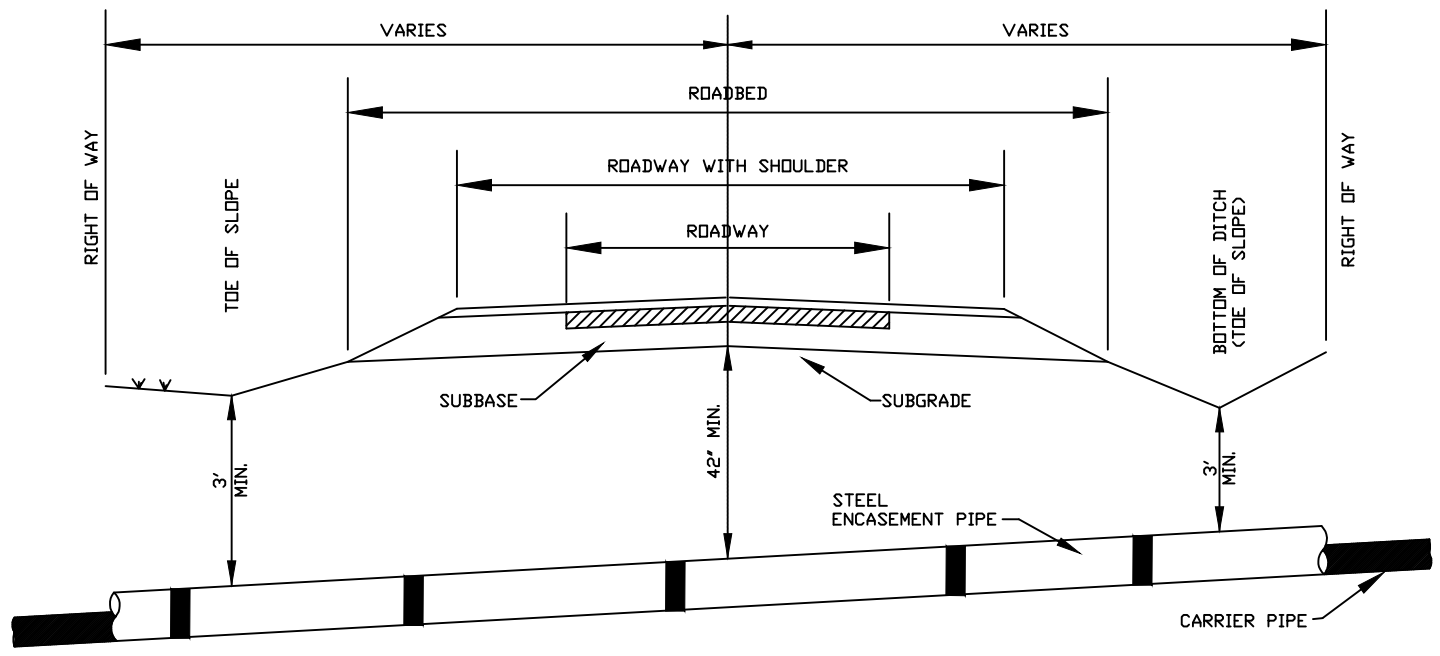
Details



TYPICAL CROSSING (ENCASED)

NTS

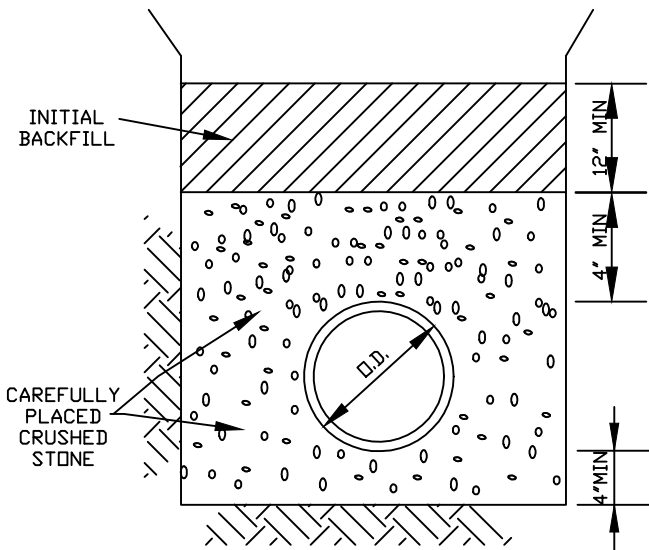
NOTE: CASING PIPE SHALL BE SEALED AT THE ENDS WITH A FLEXIBLE MATERIAL AND PIPE SUPPORTS SHALL BE USED



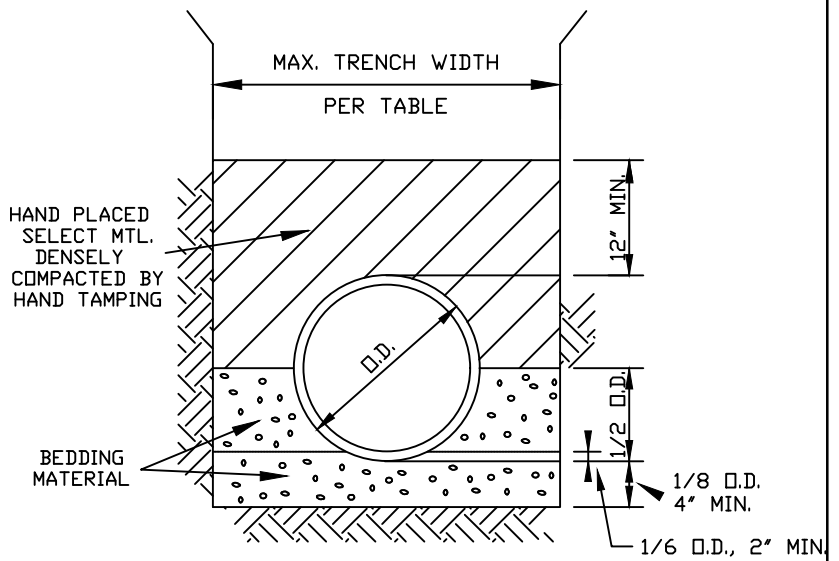
TYPICAL CROSSING (ENCASED)

NTS

NOTE: CASING PIPE SHALL BE SEALED AT THE ENDS WITH END SEALS & INSULATORS INSTALLED



CRUSHED STONE ENCASEMENT

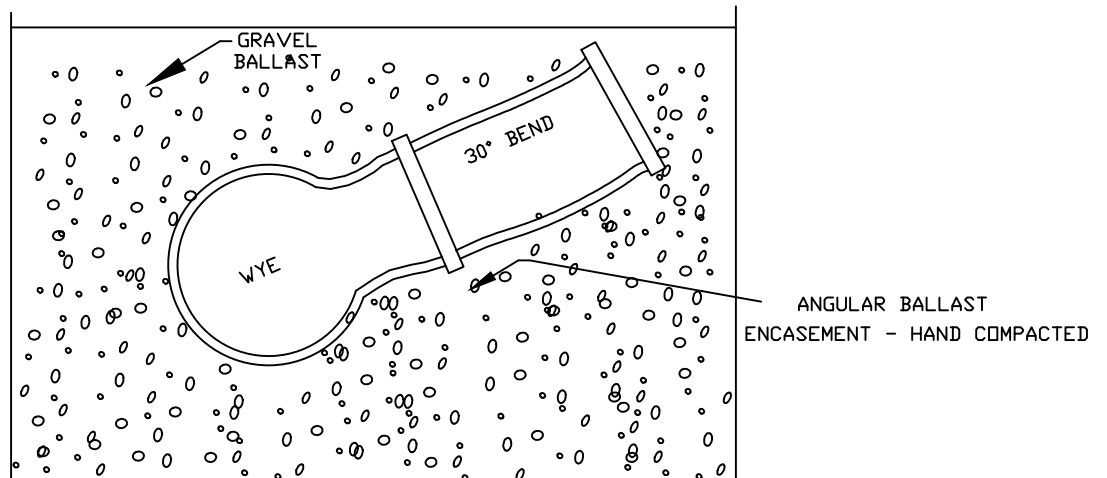


CLASS "B" BEDDING

(WHERE REQ'D)

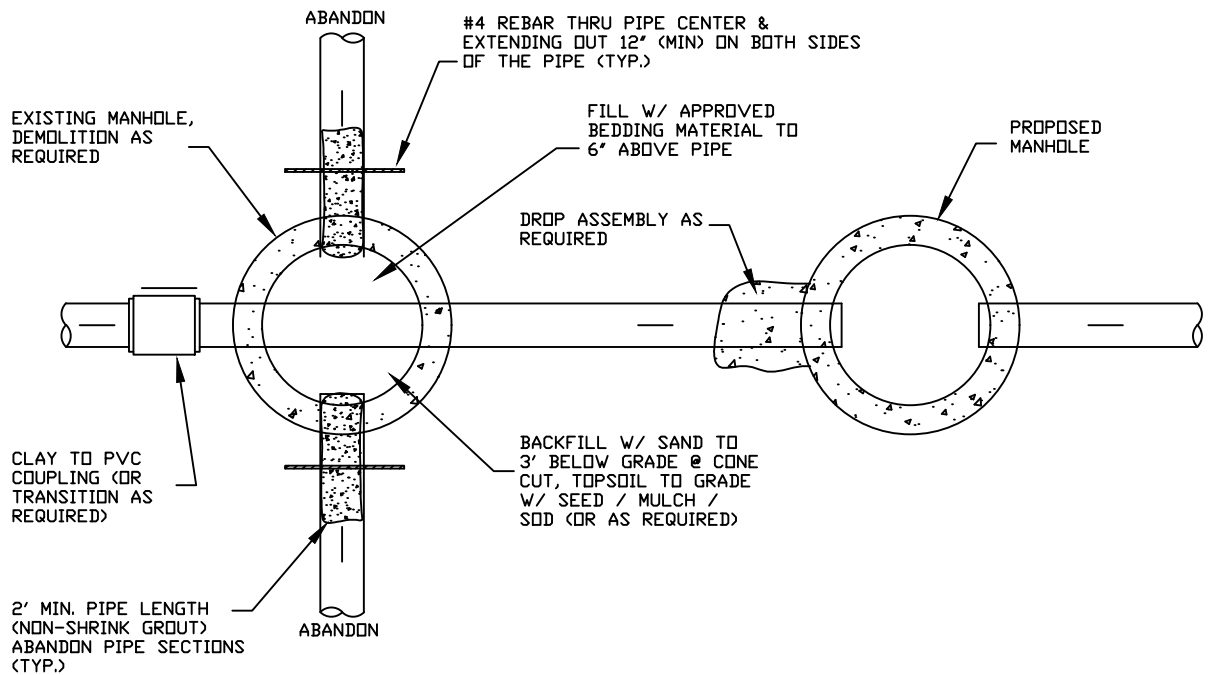
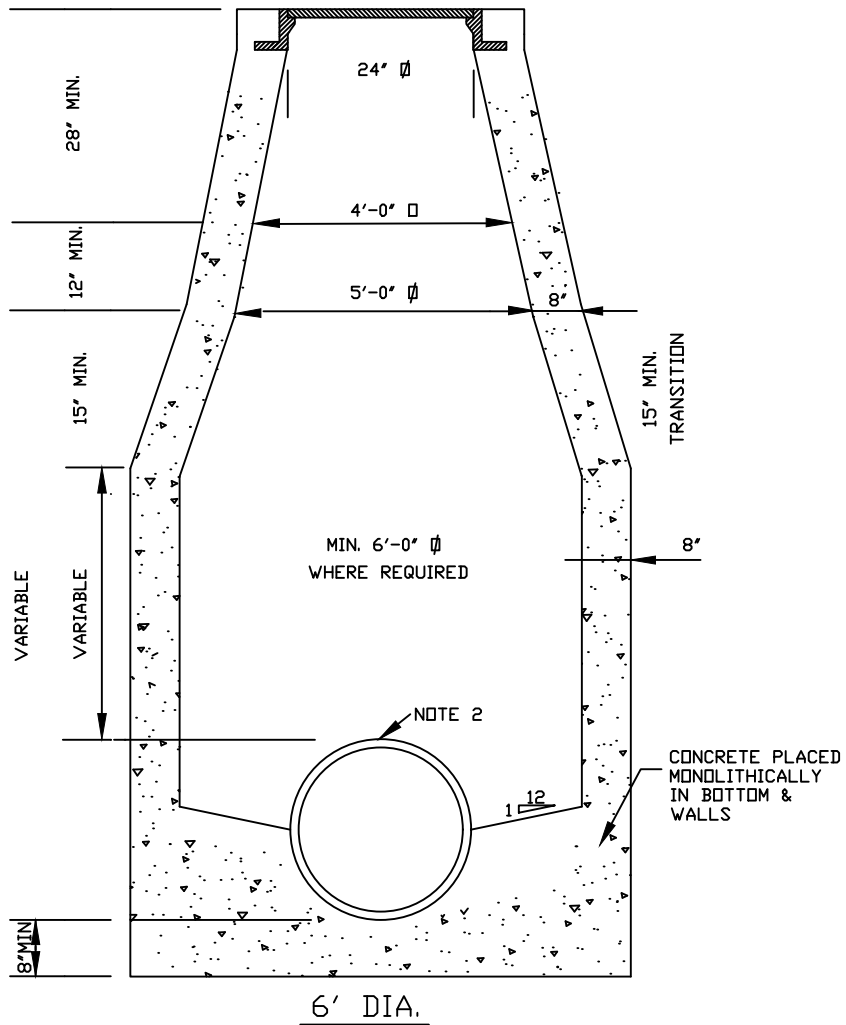
SEWER PIPE
BEDDING DETAILS

NTS

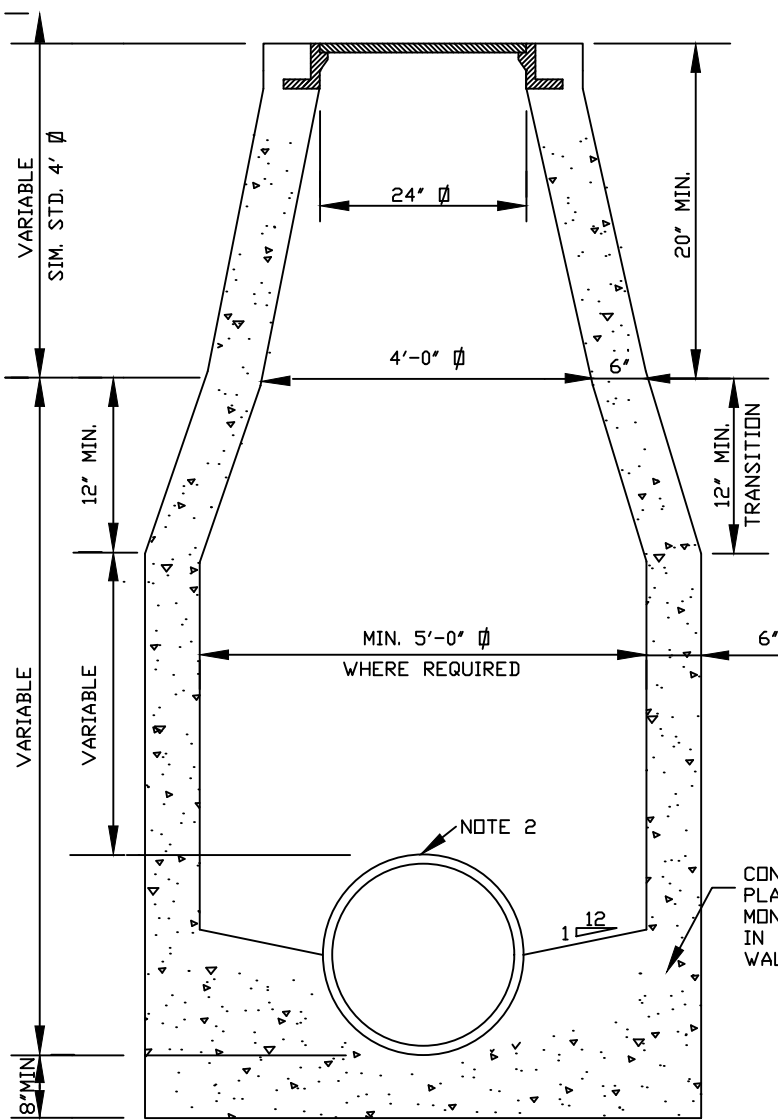


TYPICAL SEWER WYE INSTALLATION

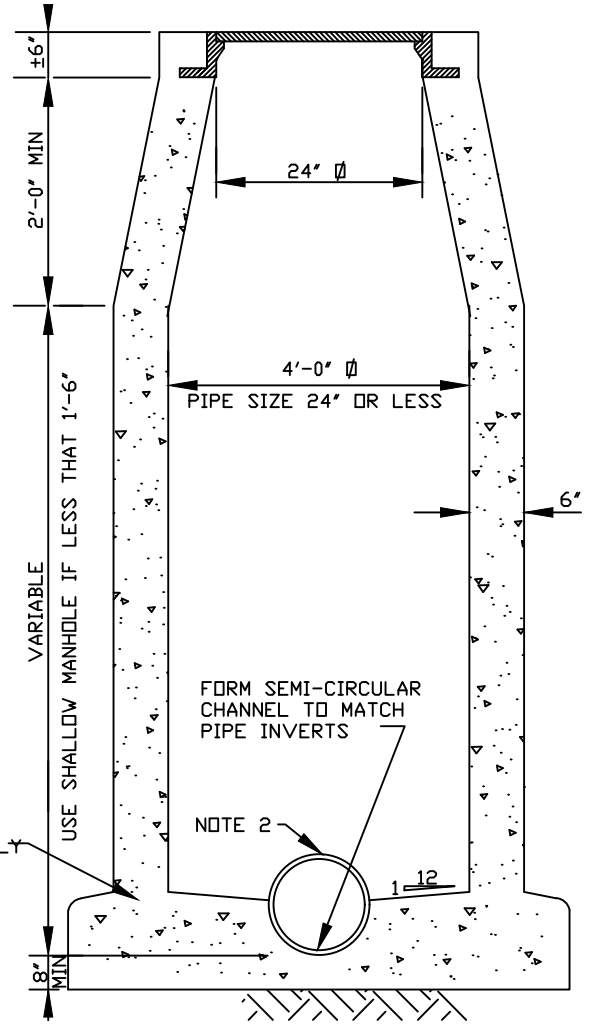
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CONNECTION TO EXISTING MAIN @ MANHOLE
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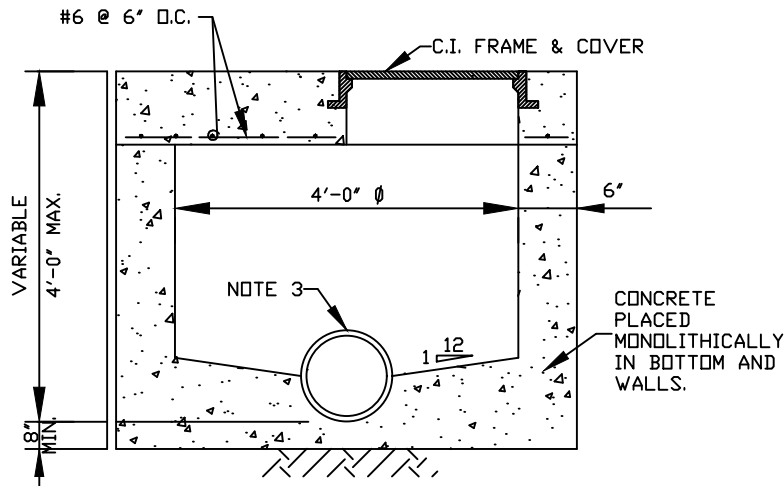


5' DIA
PIPE 18" IN DIAMETER
AND LARGER OR AS
SHOWN ON PLANS



4' DIA
PIPE 15" IN DIAMETER
OR SMALLER OR AS
SHOWN ON PLANS

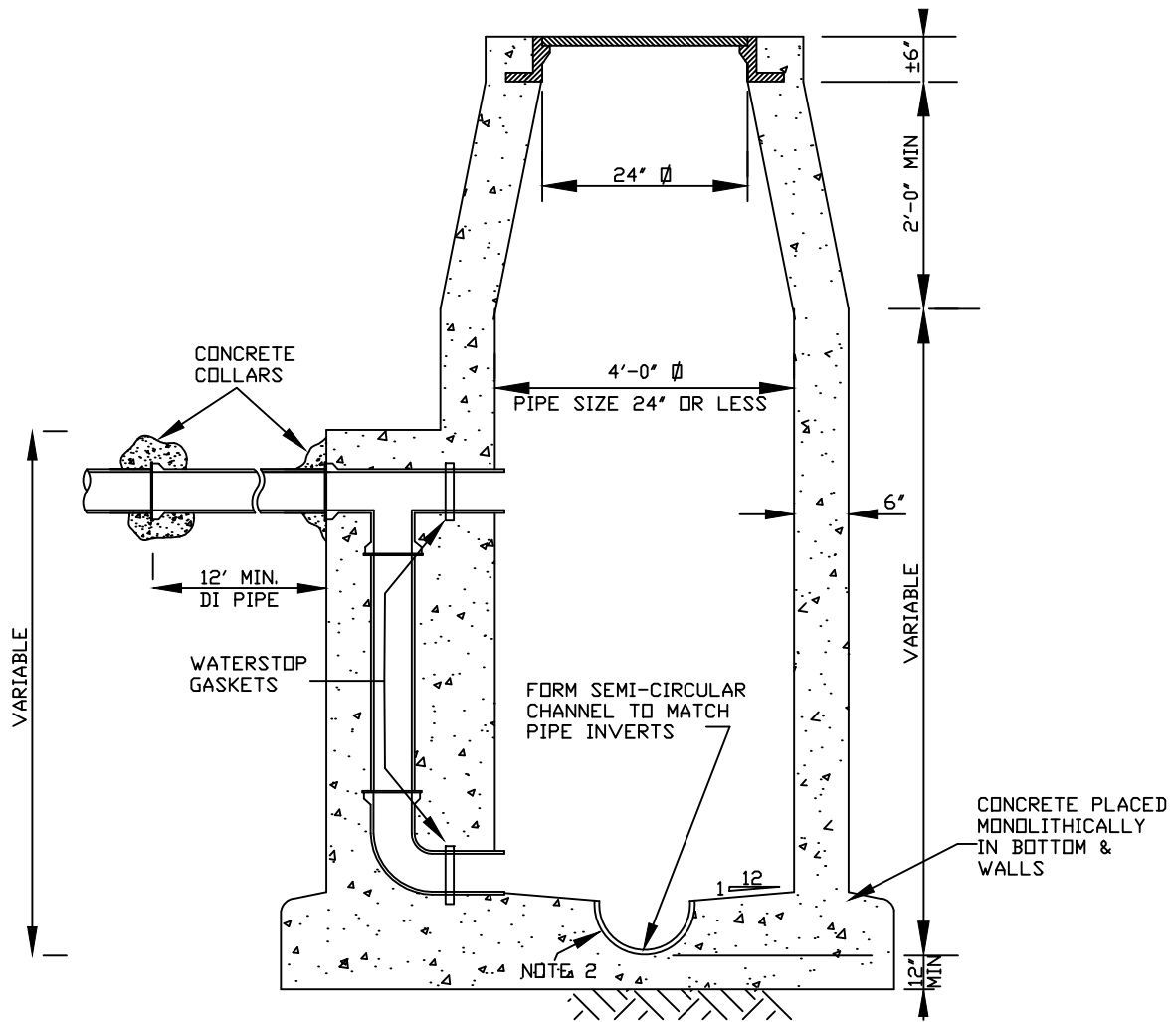
MANHOLE DETAILS
NTS



SHALLOW MANHOLE DETAILS
NTS

MANHOLE NOTES:

1. DROP INLET REQUIRED WHERE DIFFERENCE BETWEEN INLET & OUTLET INVERTS EXCEEDS 2'.
2. USE WATERSTOP GASKETS & TAR ON ALL PVC, DI & CI PIPE PENETRATIONS THROUGH WALL OF MANHOLE.



4' DIA
 PIPE 15" IN DIAMETER
 OR SMALLER OR AS
 SHOWN ON PLANS

- DROP MANHOLE NOTES:
1. DROP INLET REQUIRED WHERE DIFFERENCE BETWEEN INLET & OUTLET INVERTS EXCEEDS 2'.
 2. USE WATERSTOP GASKETS & TAR ON ALL PVC, DI & CI PIPE PENETRATIONS THROUGH WALL OF MANHOLE.
 3. USE DUCTILE IRON FITTINGS AND PIPE FOR DROP INLET AND FOR A MINIMUM OF 12' UPSTREAM FROM DROP INLET.

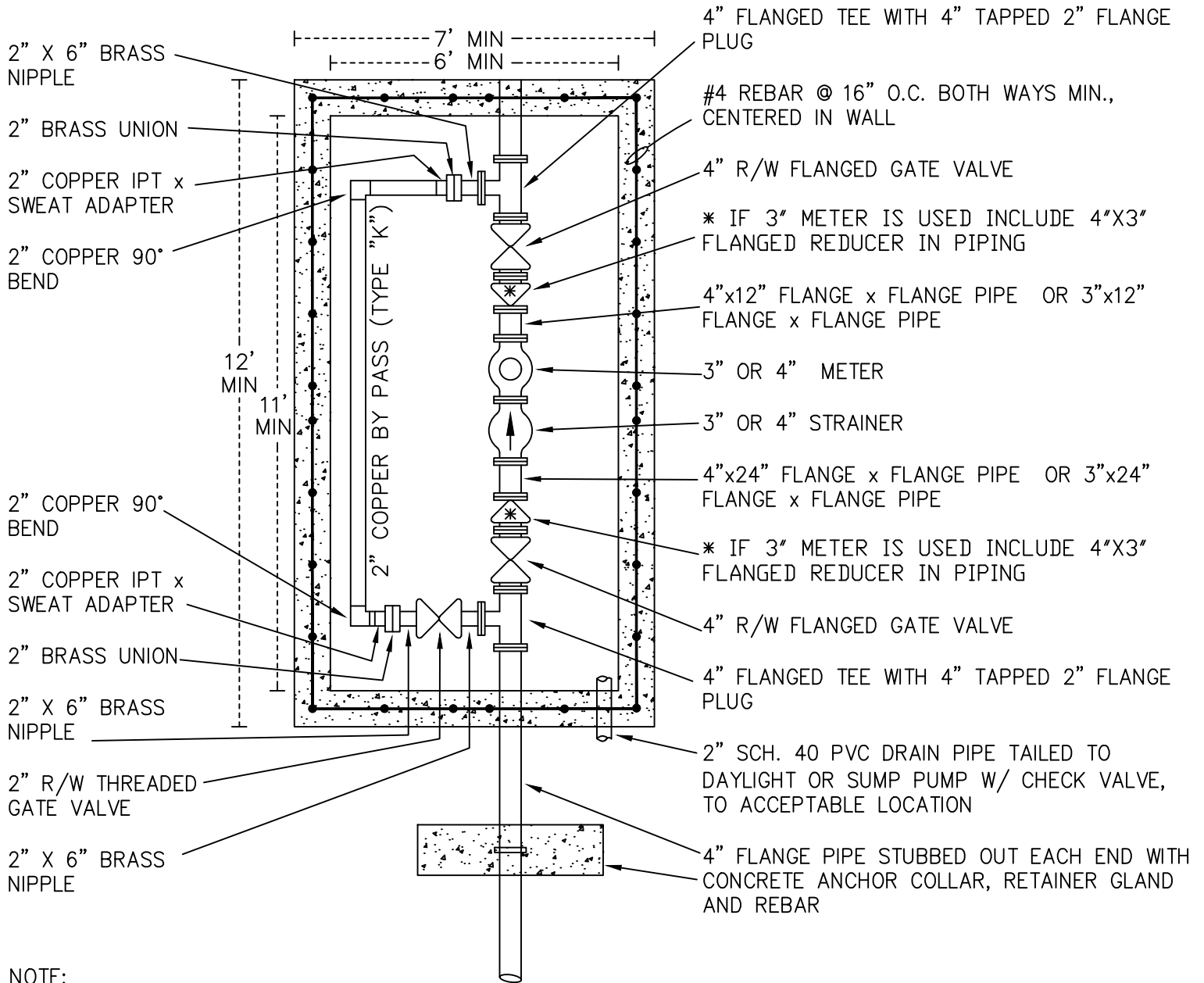
DROP MANHOLE DETAILS
 NTS

STANDARD MANHOLE RINGS AND COVERS SHALL BE OF CAST IRON, NOMINAL 24" DIAMETER, WITH COMBINED WEIGHT NOT LESS THAN 250 LBS. PATTERN SHALL BE CONCENTRIC CIRCLES WITH THE WORDS "CONWAY ARKANSAS SANITARY SEWER" AND "MADE IN THE USA" CAST IN THE PATTERN. THE MANHOLE COVER SHALL HAVE TWO EDGE INDENTATIONS FOR LIFTING TOOL. RING SHALL HAVE AT LEAST A 22" DIAMETER CLEAR OPENING. STANDARD RING AND COVER SHALL BE NO. 1348-1 BY EAST JORDAN IRON WORKS, INC., OR APPROVED EQUAL PRODUCT. STANDARD RINGS AND COVERS SHALL BE MADE IN THE USA.



STANDARD RING AND COVER DETAILS
 NTS

3" OR 4" WATER METER SYSTEM



NOTE:
ALL FLANGE FITTINGS TO HAVE FULL FACE RED RUBBER GASKETS

NOTE:
IF 3" METER IS TO BE USED 4"x3" FLANGED REDUCERS SHALL BE INCLUDED IN PIPING.

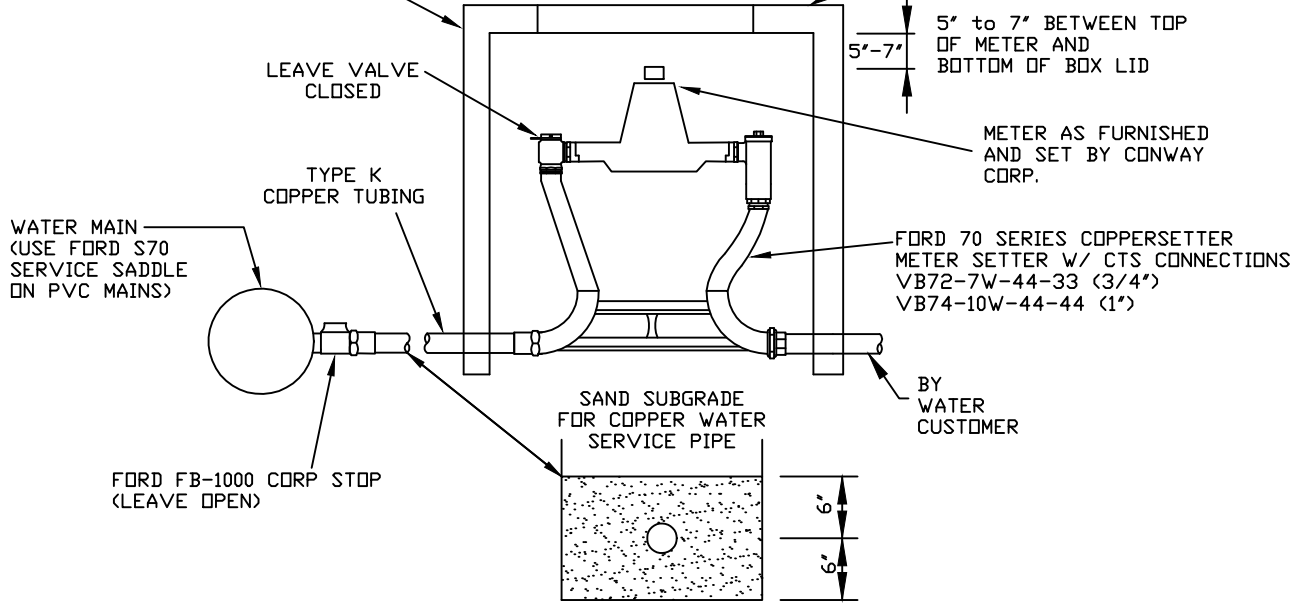
NOTE:
ALL PIPING AND FITTINGS ARE TO HAVE A MINIMUM OF 12" CLEARANCE ABOVE FLOOR OF BOX.

NOTE:
POURED IN PLACE METER VAULT IS TO HAVE A 1/4" CHECKERED PLATE ALUMINUM OR SS LID. EDGES OF THE LID ARE TO OVER LAP THE OUTSIDE EDGE OF THE VAULT 1 1/2". LID IS TO HAVE LIFTING EYES FOR REMOVAL. 2" MIN. ANGULAR SUPPORT STRUCTURE IS TO BE USED TO REINFORCE LID ON UNDERSIDE AS REQUIRED. THREE ACCESS DOORS ARE TO BE MADE OF 1/8" ALUMINUM OR SS AND RAISED A MINIMUM OF 1" ABOVE SURFACE AND INSTALLED SO THAT ALL VALVES AND METER MAY BE VIEWED AND OPERATED FROM ABOVE. EACH ACCESS DOOR IS TO BE ONE PIECE WITH PIANO HINGES USED TO SECURE DOOR TO LID(S). ACCESS DOORS MUST HAVE A HANDLE AND ANY REINFORCING IS TO BE ON THE UNDERSIDE OF THE DOORS. LIDS SHALL HAVE LOCKS CONFORMING TO CONWAY CORP REQUIREMENTS. STRUCTURAL DRAWINGS SHALL BE SUBMITTED AND SEALED BY ARKANSAS REGISTERED PROFESSIONAL / ENGINEER OF RECORD.

3/4", 1" AND 2" WATER METER SYSTEMS

METER BOXES FOR THREE-QUARTER INCH (3/4") SERVICES SHALL BE EAST JORDAN IRON WORKS MSBCF 1118-12 (ITEM# 32413700) WITH EJIW 1118-R CAST IRON COVER WITH READER (FLIP) DOOR (ITEM# 32131101)

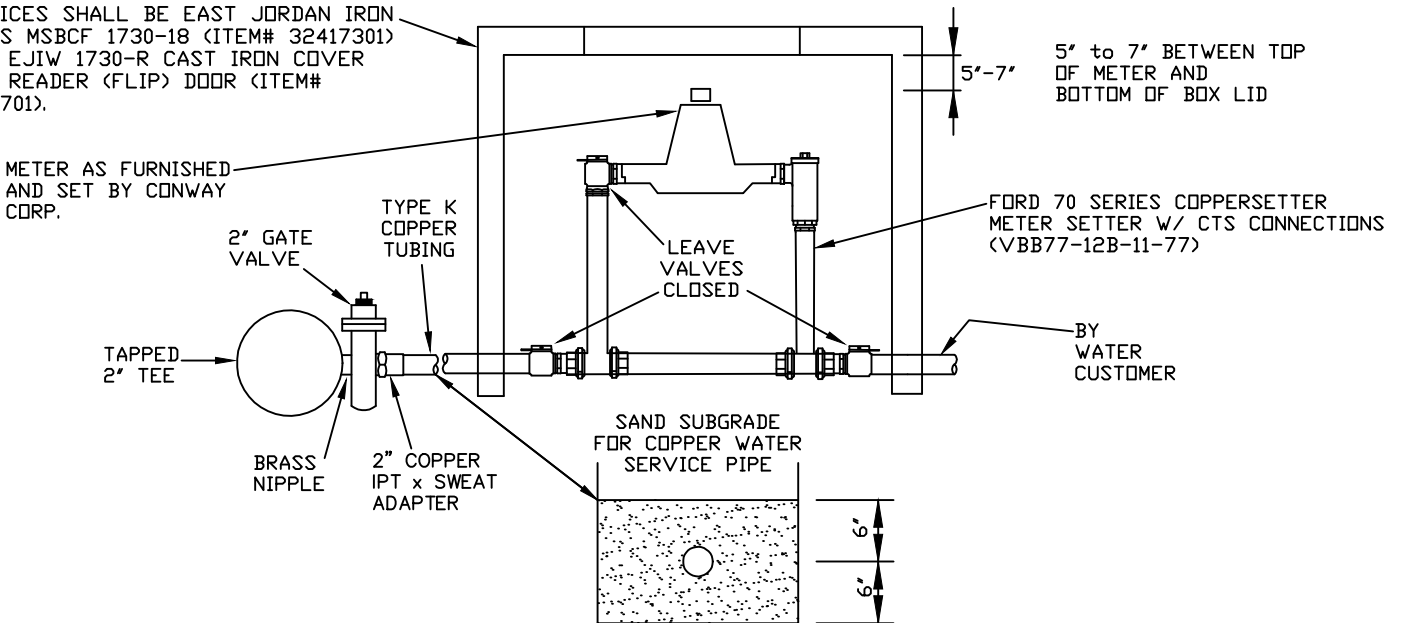
METER BOXES FOR ONE INCH (1") SERVICES SHALL BE EAST JORDAN IRON WORKS MSBCF 1324-12 (ITEM# 32414001) WITH EJIW 1324-R CAST IRON COVER WITH READER (FLIP) DOOR (ITEM# 32131301)



3/4" AND 1" WATER METER SYSTEMS

NTS

METER BOXES FOR TWO (2) INCH SERVICES SHALL BE EAST JORDAN IRON WORKS MSBCF 1730-18 (ITEM# 32417301) WITH EJIW 1730-R CAST IRON COVER WITH READER (FLIP) DOOR (ITEM# 32131701).



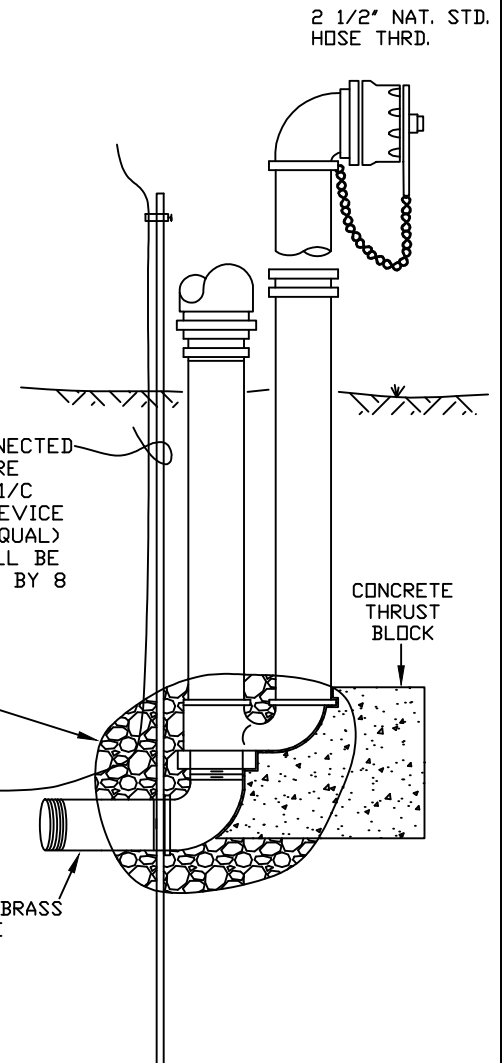
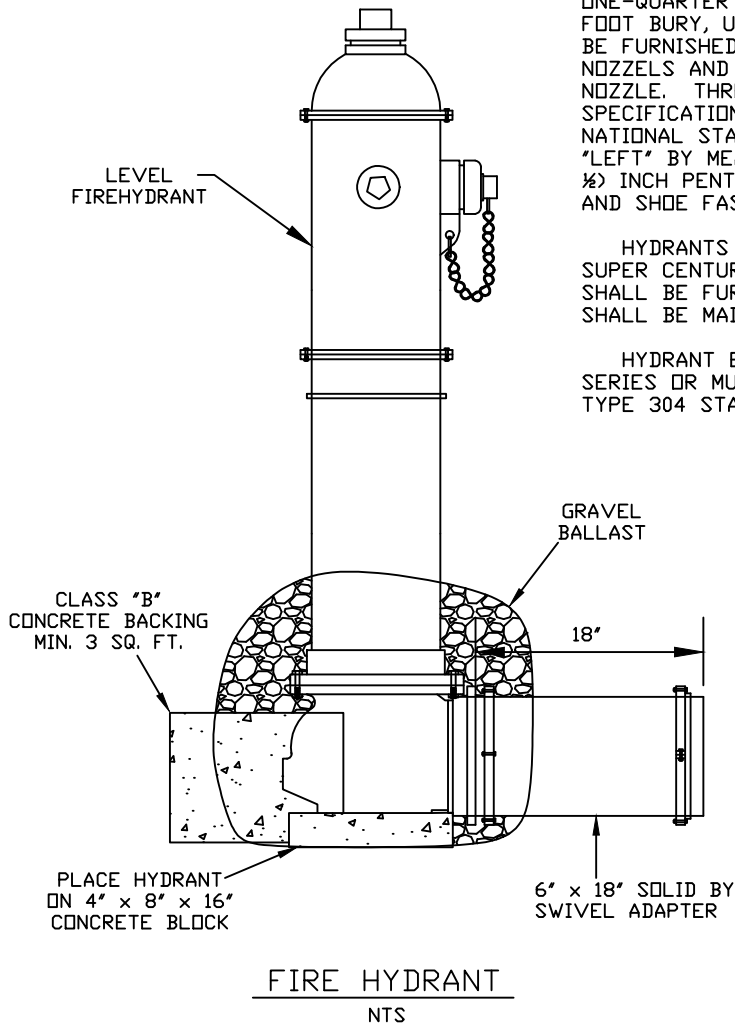
2" WATER METER SYSTEM

NTS

FIRE HYDRANTS SHALL CONFORM TO AWWA C502 AND LATEST REVISIONS WITH A MINIMUM VALVE OPENING OF FIVE AND ONE-QUARTER (5 ¼) INCH. HYDRANTS SHALL HAVE A FOUR (4) FOOT BURY, UNLESS SHOWN OTHERWISE ON THE PLANS, AND SHALL BE FURNISHED WITH TWO TWO AND ONE-HALF (2 ½) INCH HOSE NOZZLES AND ONE FOUR AND ONE-HALF (4 ½) INCH PUMPER NOZZLE. THREADS ON PUMPER NOZZLES SHALL BE MUELLER SPECIFICATIONS B-304; AND THREADS ON HOSE NOZZLES SHALL BE NATIONAL STANDARD. HYDRANTS SHALL BE FURNISHED TO OPEN "LEFT" BY MEANS OF A NATIONAL STANDARD ONE AND ONE-HALF (1 ½) INCH PENTAGONAL OPERATING NUT. ALL BONNET, SAFETY FLANGE AND SHOE FASTENERS SHALL BE OF TYPE 304 STAINLESS STEEL.

HYDRANTS SHALL BE CLOW MEDALLION F-2545 OR MUELLER SUPER CENTURION 250 A-423 WITH SIX (6) INCH MJ SHOE AND SHALL BE FURNISHED PAINTED FIRE HYDRANT RED. HYDRANTS SHALL BE MADE IN THE USA.

HYDRANT EXTENSIONS (WHERE NEEDED) SHALL BE CLOW R-1620 SERIES OR MUELLER A-320 SERIES AND SHALL BE FURNISHED WITH TYPE 304 STAINLESS STEEL FASTENERS.



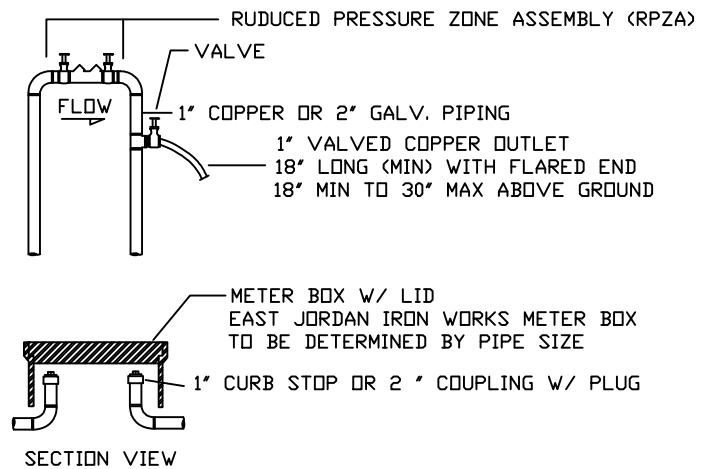
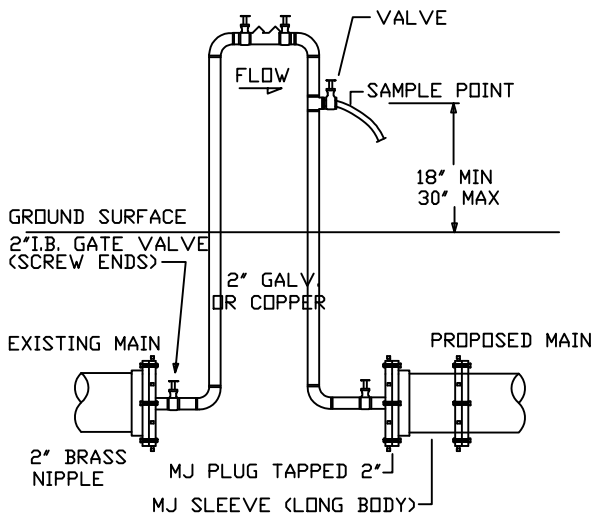
WHERE BLOW-OFF HYDRANT IS CONNECTED TO A PVC WATER MAIN TRACER WIRE SHALL BE #6 STRANDED ALUMINUM 1/C USE. TRACER WIRE TERMINATION DEVICE SHALL BE A BLACKBURN G-5 (OR EQUAL) GROUND ROD LUG. GROUND ROD SHALL BE A BLACKBURN 6258-13MX, 5/8-INCH BY 8 FOOT (OR EQUAL).

BLOW OFF HYDRANTS SHALL BE NON-FREEZING, SELF-DRAINING TYPE WITH A FOUR (4) FOOT BURY UNLESS OTHERWISE NOTED ON PLANS. THESE HYDRANTS WILL BE FURNISHED WITH A TWO (2) INCH FIP INLET, A NON-TURNING OPERATING ROD, AND SHALL OPEN TO THE LEFT. THE LOWER POSTS AND THE RISER POST SHALL BE OF CAST IRON. ALL OF THE WORKING PARTS SHALL BE OF BRONZE-TO-BRONZE DESIGN, AND BE SERVICEABLE FROM ABOVE GRADE WITH NO DIGGING. THE OUTLET SHALL ALSO BE OF BRONZE AND BE A TWO AND ONE-HALF (2 ½) INCH NST. HYDRANTS SHALL BE LOCKABLE TO PREVENT UNAUTHORIZED USE. BLOW OFF HYDRANTS SHALL BE KUPFERLE MAINGUARD #77, OR APPROVED EQUAL AND MADE IN THE USA.

BLOW-OFF HYDRANT INSTALLATION
NTS

NOTES:

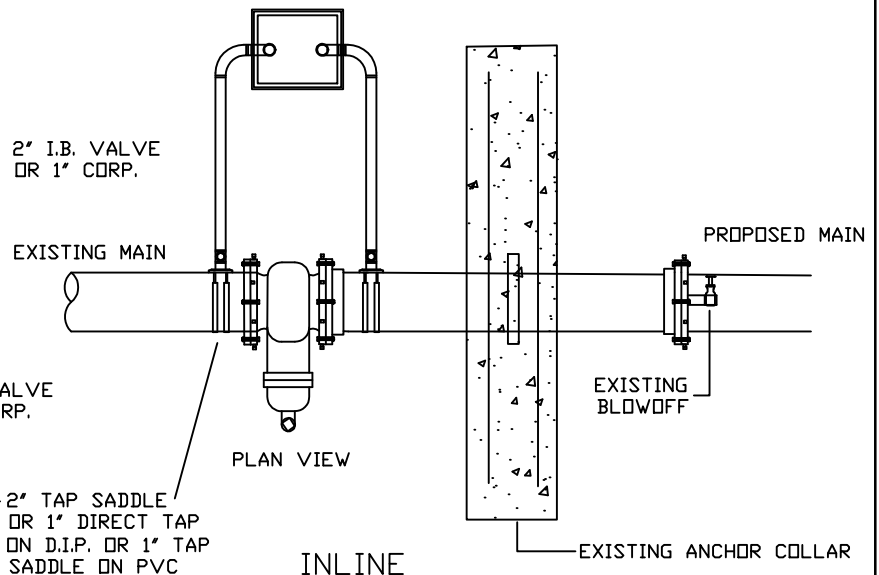
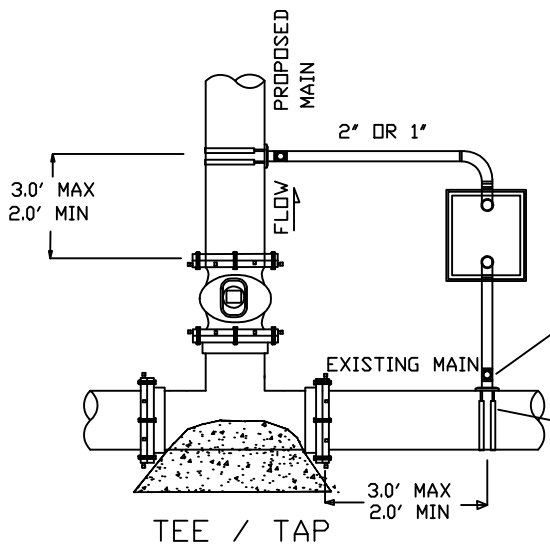
1. 2- INCH FILL CONNECTIONS ARE REQUIRED ON ALL MAINS, 12 - INCHES AND LARGER, OR AS DIRECTED BY CC ENG. 1- INCH FILL CONNECTIONS WILL BE USED ON ALL MAINS SMALLER THAN 12 - INCH'S EXCEPT FOR MAINS WITH TEMPORARY END TO END CONNECTIONS OR AS SPECIFIED.
2. FULL SIZE CONNECTIONS WILL BE ALLOWED ONLY WITH WRITTEN APPROVAL OF CC. THESE CONNECTIONS SHALL HAVE A VALVE BOX TO ACCEPT "EJIW 7 1/2" LOCKING LID. VALVES SHALL BE OPERATED ONLY IN THE PRESENCE OF THE ENGINEER. ALL OTHER CONNECTIONS TO EXISTING FACILITIES SHALL CONTAIN AN RPZA.
3. AFTER APPROVAL OF SAMPLES, CLOSE CURB STOPS AND REMOVE FILL ASSEMBLY. FOR 2" PERMANENT CONNECTIONS, CLOSE 2" VALVES, REMOVE FILL ASSEMBLY AND PLUG COUPLING.
4. 1" VALVES ON MAIN LINES SHALL BE BRASS CORPORATION STOPS.
5. ALL 1" TAPS WILL BE BY DIRECT TAP METHOD, UNLESS PREVIOUSLY APPROVED BY CC. EXCEPTIONS MAY BE: SDR17 PVC OR AC MAINS, WHERE THE USE OF SADDLES MAY BE PERMITTED.
6. ANY COMPONENT OF THIS FILL CONNECTION THAT HAS SPECIFICATIONS CONTAINED IN THIS SPEC. BOOK SHALL MEET THE SAME SPECIFICATIONS.
7. FILL CONNECTION VALVES SHALL REMAIN CLOSED UNTIL THE RPZA HAS BEEN TESTED AND APPROVED FOR USE BY AN APPROVED CERTIFIED TESTING TECHNICIAN.



TEMPORARY (END TO END)

(NO METER BOX REQUIRED)
 *** SEE NOTE NO. 1 ***

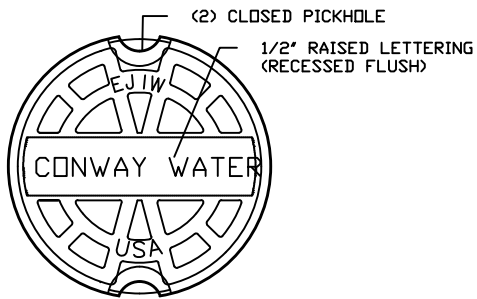
NOTE: EX. VALVE & PIPE
 MUST BE HYDROSTATICALLY TESTED PRIOR
 TO TYING IN & RUNNING FILL ASSY.



*** SEE NOTE NO. 2 ***

*** SEE NOTE NO. 2 ***

1" / 2" FILL CONNECTION DETAILS TYPICAL INSTALLATIONS



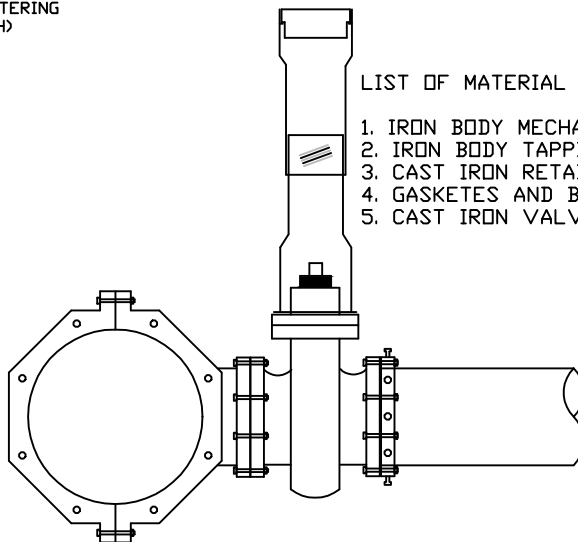
TOP



BOTTOM

VALVE BOX LID

NTS



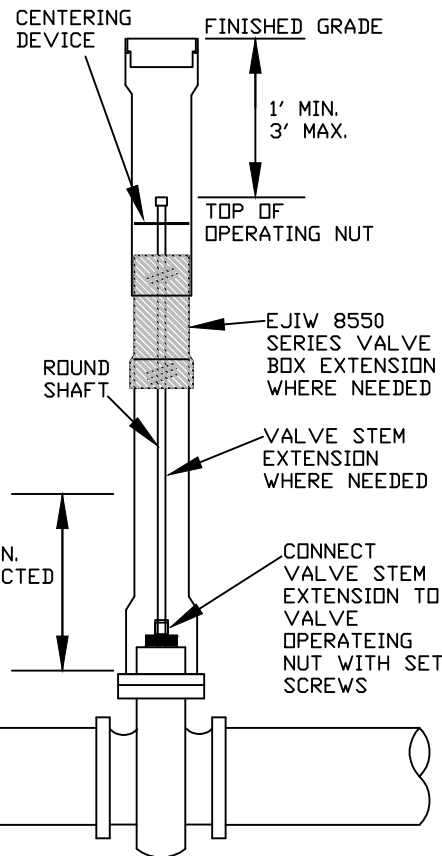
LIST OF MATERIAL

1. IRON BODY MECHANICAL JOINT TAPPING SLEEVE
2. IRON BODY TAPPING VALVE (FLANGE BY MJ)
3. CAST IRON RETAINER GLAND
4. GASKETES AND BOLTS
5. CAST IRON VALVE BOX WITH LID

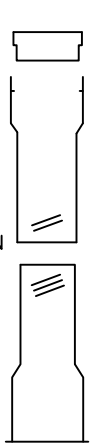
MECHANICAL JOINT TAPPING SLEEVE AND TAPPING VALVE INSTALLATION

NTS

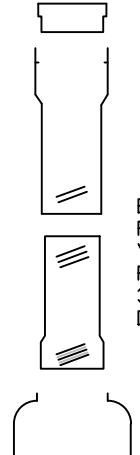
ALL VALVES SHALL BE SET WITH OPERATING STEMS IN TRUE VERTICAL POSITION, UNLESS OTHERWISE SHOWN ON THE PLANS. ALL VALVES SHALL HAVE 2" OPERATING NUTS AND SHALL BE PROVIDED WITH VALVE BOXES ADJUSTED SO THAT THE COVER CONFORMS TO THE ADJACENT FINISHED GRADE. WHERE NEEDED VALVE STEM EXTENSIONS SHALL BE PROVIDED SO THAT THE OPERATING NUT IS WITHIN 3' OF FINISHED GRADE. THE VALVE STEM EXTENSION, WHERE NEEDED, SHALL BE FACTORY MADE OF ROUND MATERIAL WITH A CENTERING DEVICE AND SHALL BE ATTACHED TO THE OPERATING NUT OF THE VALVE WITH SET-SCREWS. VALVE BOXES SHALL BE OF ADEQUATE LENGTH CONSIDERING THE COVER OVER THE PIPE. VALVE BOXES FOR 2"-12" VALVES SHALL BE EAST JORDAN IRON WORKS 8550 SERIES, COMPLETE WITH LID MARKED WATER. VALVE BOXES FOR 14" AND LARGER SHALL BE EAST JORDAN IRON WORKS 8560 SERIES, COMPLETE WITH LID MARKED WATER. VALVE BOXES SHALL BE MADE IN THE USA. WHERE VALVE BOXES NEED TO BE EXTENDED TO MATCH FINISHED GRADE, THE BOX SHALL BE EXTENDED BY THE ADDITION OF AN EAST JORDAN IRON WORKS 8550 SERIES BOX EXTENSION OR BY REPLACING THE VALVE BOX WITH AN EAST JORDAN IRON WORKS 8550 OR 8560 SERIES BOX OF THE CORRECT HEIGHT OR AS DIRECTED BY THE ENGINEER.



EJIW 8550 SERIES FOR 2"-12" VALVES. RANGE OF EXTENSION 19"-82" DEPENDING ON MODEL CHOSEN



EJIW 8560 SERIES FOR 14" AND LARGER VALVES. RANGE OF EXTENSION 33"-94" DEPENDING ON MODEL CHOSEN

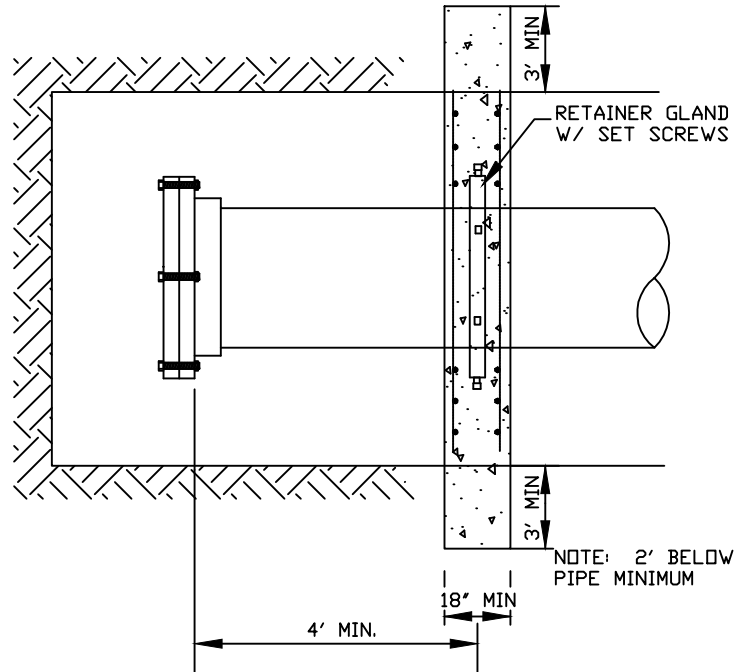
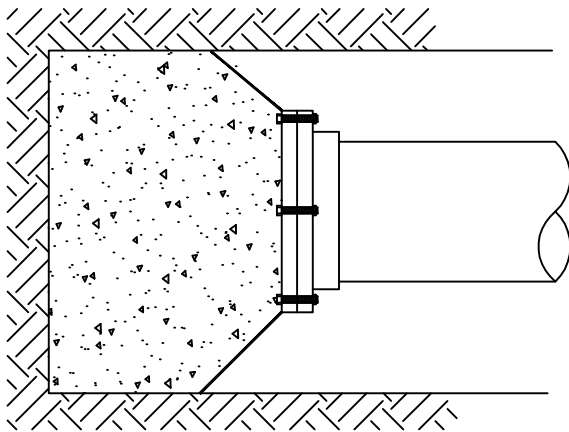
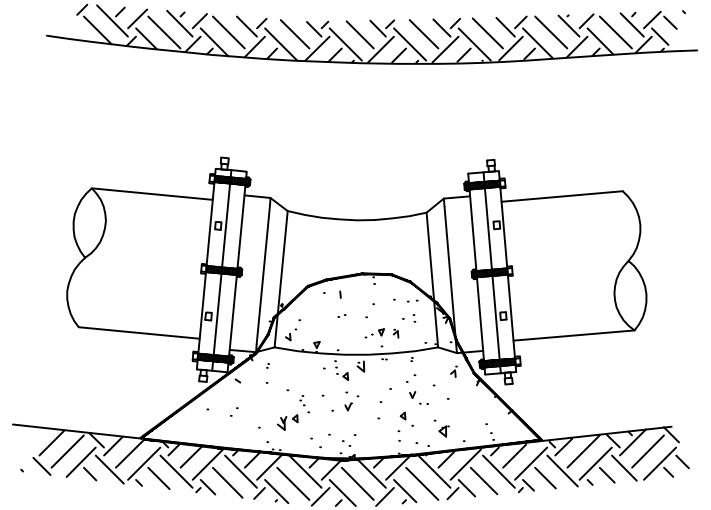
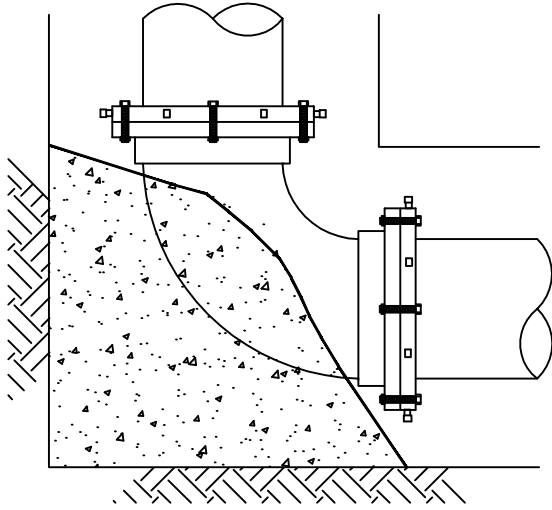


VALVE BOX INSTALLATION

NTS

NOTES:

1. BLOCKING EXTENDS TO HUBS ON ALL FITTINGS. ALL BLOCKING TO BE CLASS "B" CONCRETE.
2. COVER ALL FITTINGS WITH PLASTIC.
3. BACK TAPPING SLEEVE SAME AS "T".
4. MIN. CONTACT AREA = 3 SQ. FT.

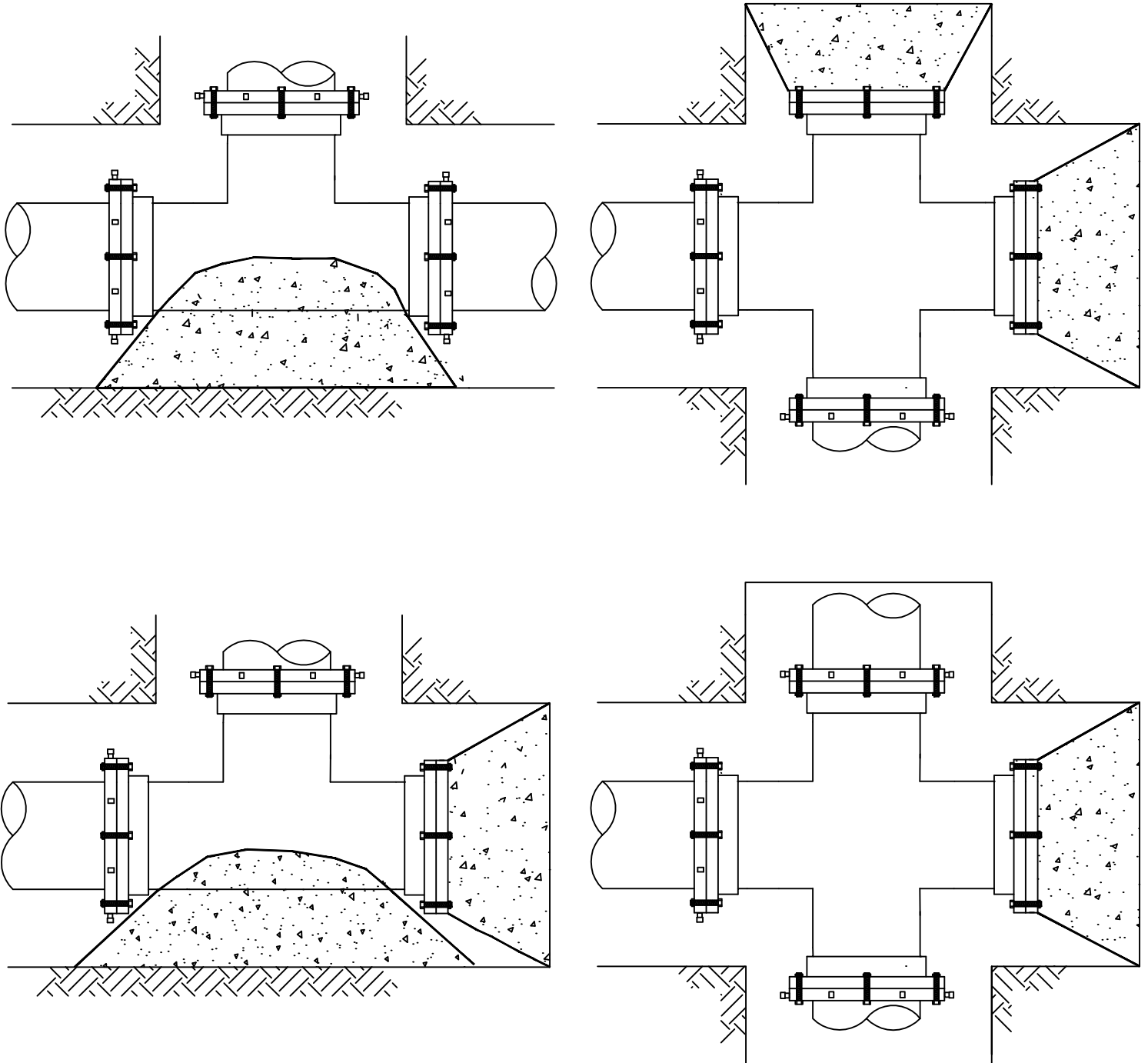


TYPICAL CONCRETE BACKING DETAILS

NTS

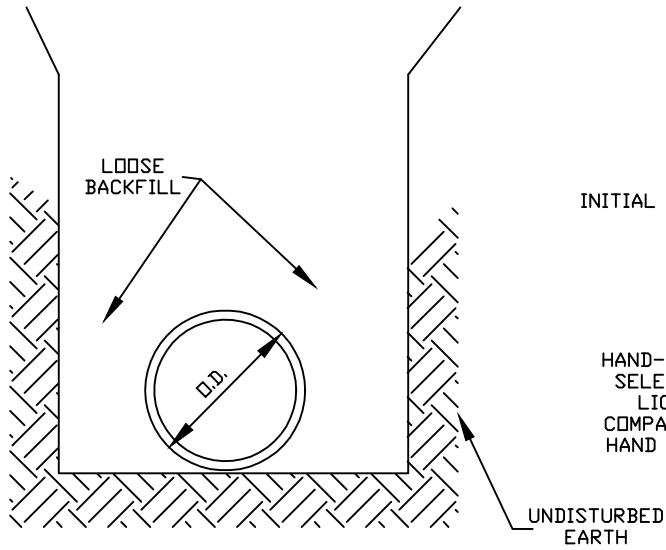
NOTES:

1. BLOCKING EXTENDS TO HUBS ON ALL FITTINGS. ALL BLOCKING TO BE CLASS "B" CONCRETE.
2. COVER ALL FITTINGS WITH PLASTIC.
3. BACK TAPPING SLEEVE SAME AS "T".
4. MIN. CONTACT AREA = 3 SQ. FT.

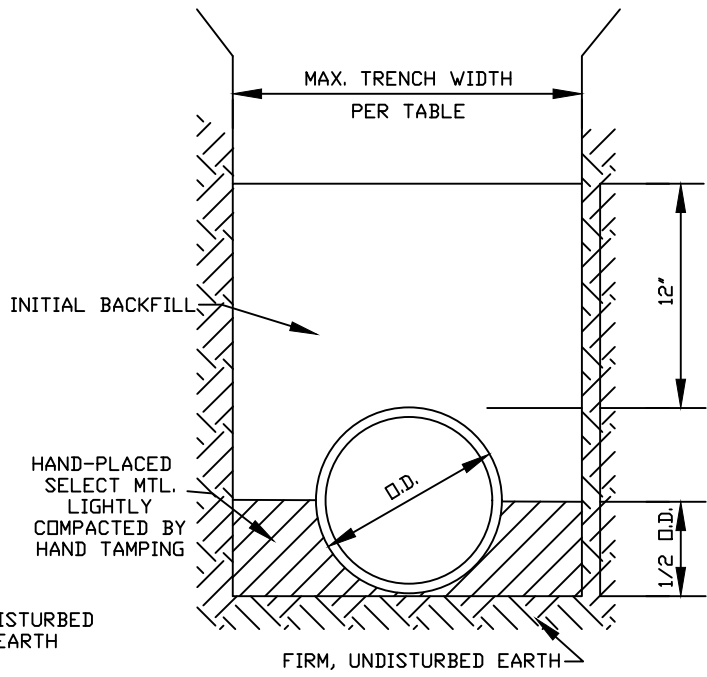


TYPICAL CONCRETE BACKING DETAIL

NTS

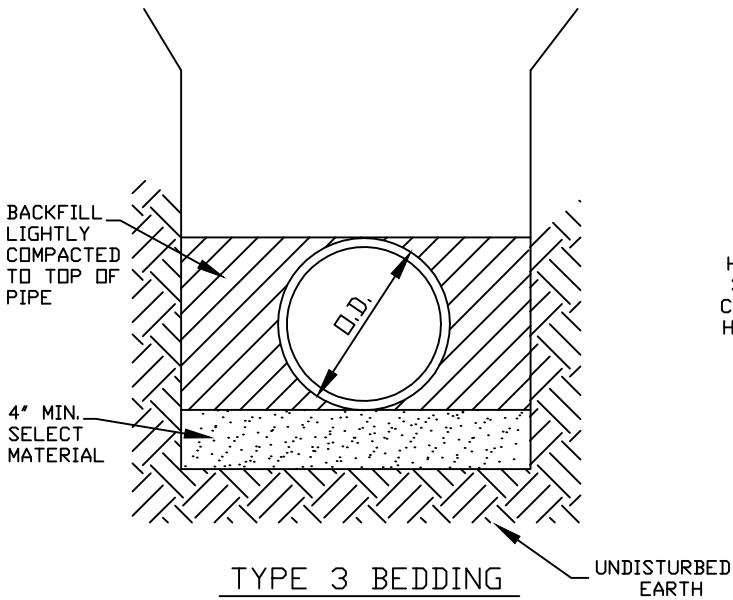


TYPE 1 BEDDING

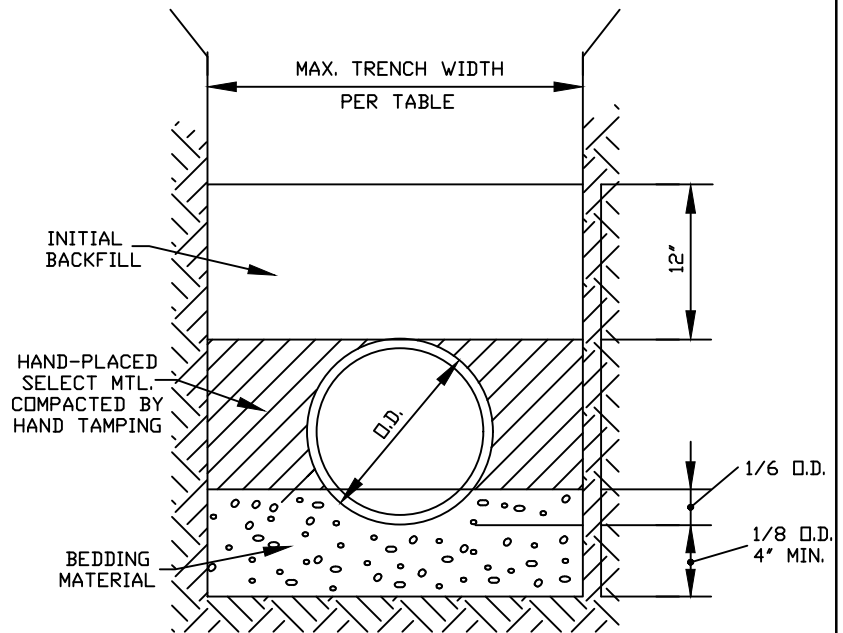


TYPE 2 BEDDING

2" SCH. 40 PVC DRAIN PIPE
WITH 1 TON OF C-BALLEST
BELOW FLOOR LEVEL



TYPE 3 BEDDING

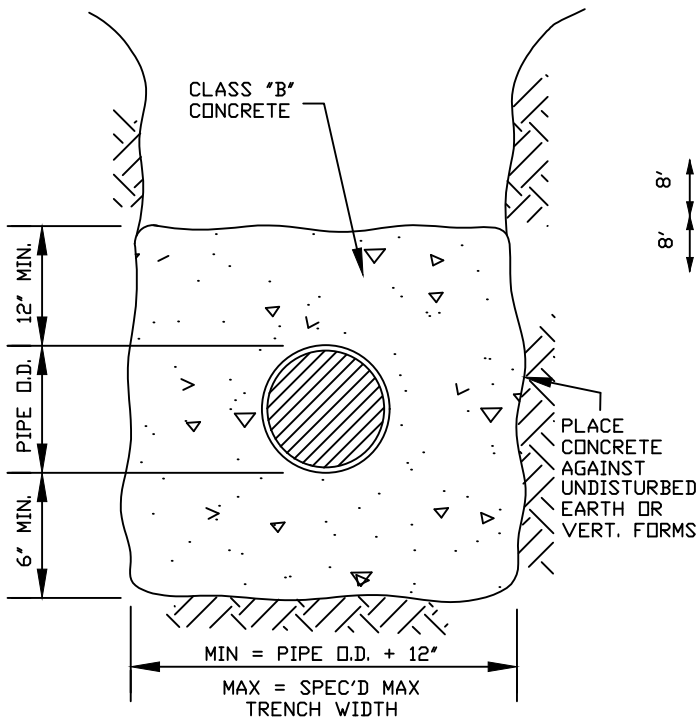


TYPE 4 BEDDING

(WHERE REQ'D ON DWGS.)

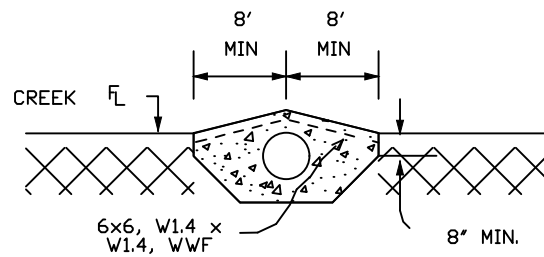
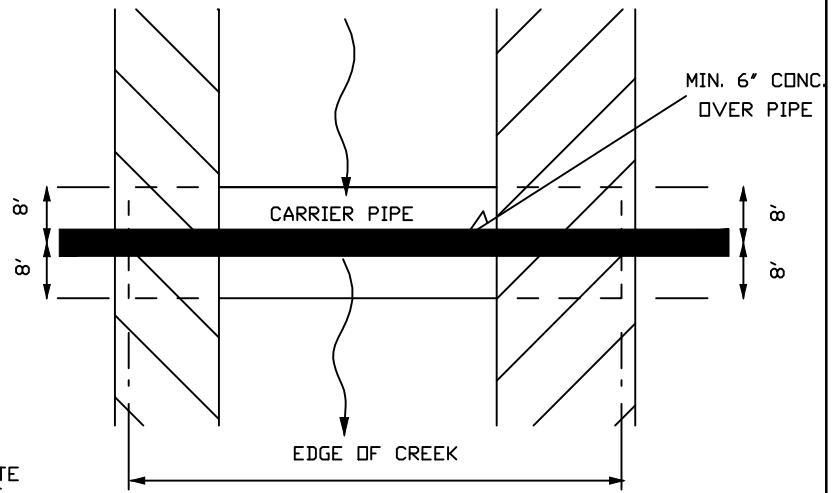
DUCTILE IRON PIPE BEDDING DETAILS

NTS



CONCRETE ENCASUREMENT

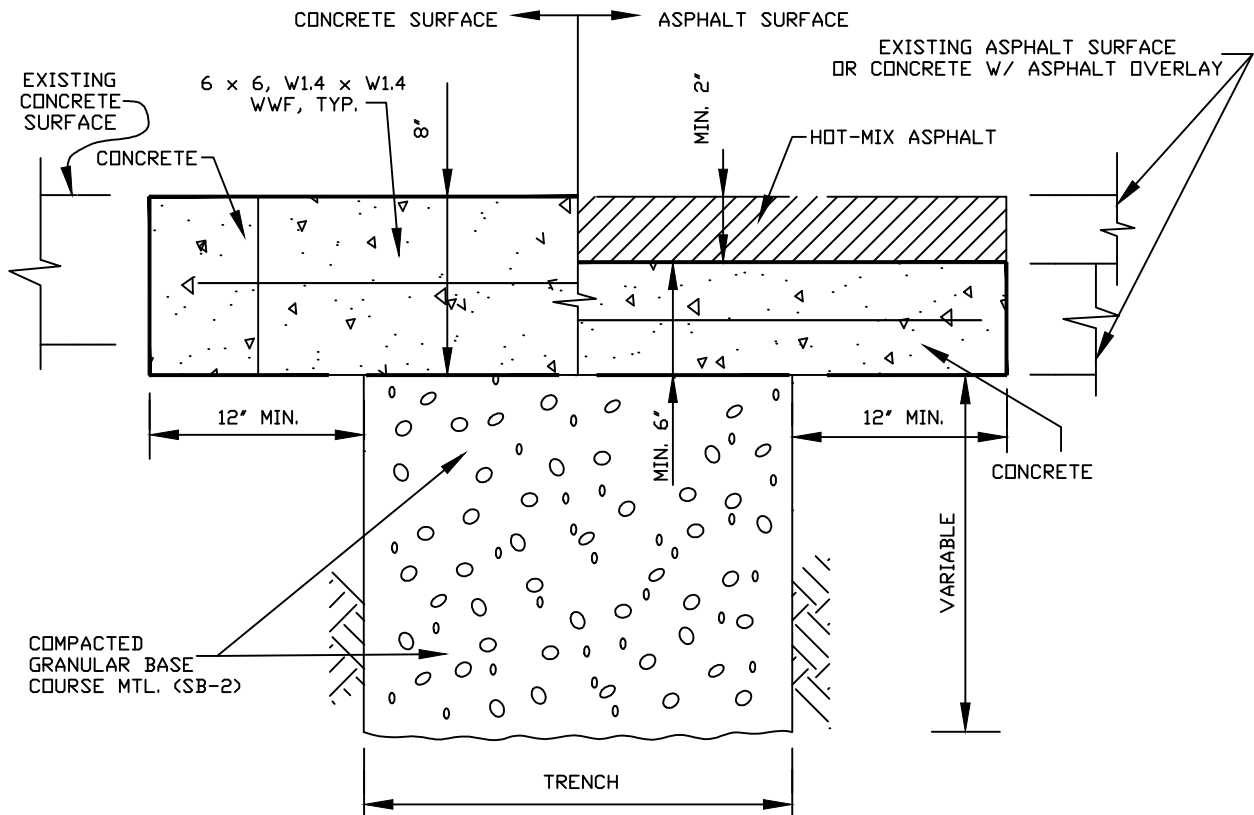
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CREEK CROSSING

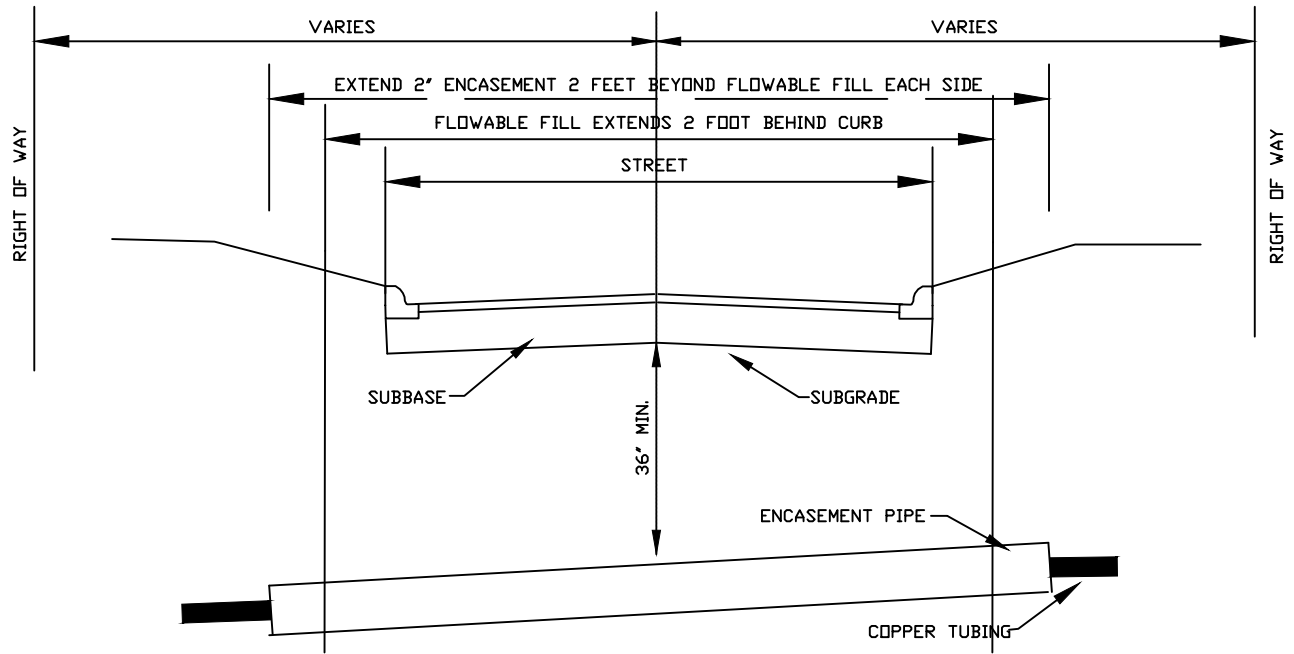
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NOTE: POLYWRAP SHALL BE INSTALLED ON D.I. OR C.I. PIPE

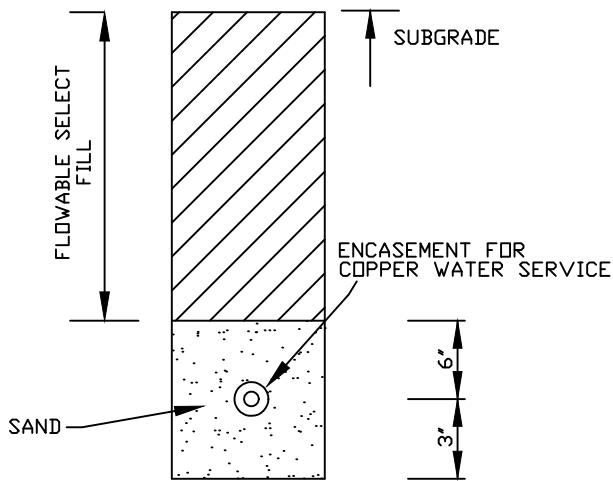


DETAIL - REPLACEMENT OF STREET AND HIGHWAY SURFACES

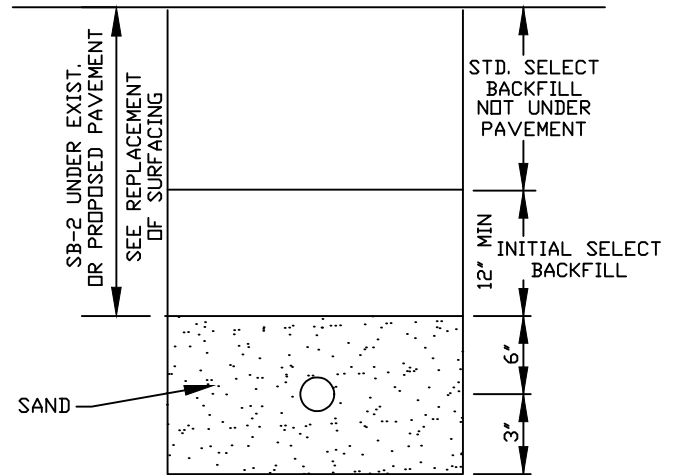
NTS



TYPICAL WATER CROSSING (ENCASED)
NTS



WATER SERVICE STREET CROSSINGS
2" PVC PIPE
NTS



BEDDING & BACKFILL
2" PVC "SDR-17" PIPE
NTS