



McGoodwin Williams & Yates
Engineering Confidence

September 10, 2012

Mr. Carl Peters, P. E., District Engineer
Arkansas Department of Health and Human Services
Division of Health
4815 West Markham Street, Slot H-37
Little Rock, Arkansas 72203-1437

COPY

Re: Gravity Sewer System Rehabilitation, Water Distribution
System and Highway Crossing
City of Batesville, Arkansas
Independence County
MWY Project No. Ba-138B5I

Dear Mr. Peters:

Enclosed for your review are two sets of Plans and Specifications for the above referenced sewer line rehabilitation in Batesville Arkansas. This set of Plans provides for the replacement of the interceptor sewer for Basin 5 in southeast Batesville, Arkansas.

This new interceptor sewer is comprised of 24-inch and 18-inch PVC which replace an old 15-inch and 18-inch concrete interceptor sewer. The resulting upsized of the existing lines is an increase in the existing capacity of the existing 15-inch sewer from 2.7 MGD to 18.7 MGD for the new 24-inch interceptor segment. The existing Sawmill List Station has a capacity of approximately 1 MGD, and these improvements will allow for substantial growth in the sewer basin served by this interceptor sewer and lift station.

A second sewer system improvement is proposed in these Plans to replace an old inverted siphon under Polk Bayou in Basin 16. The gravity reach above the old inverted siphon has a capacity of approximately 780 gallons per minute (gpm). The old inverted siphon takes on water during high flows of Polk Bayou, and several reaches of the gravity sewer above the inverted siphon have become exposed and are in danger of falling into Polk Bayou.

The service area above the inverted siphon consists of 148 acres of mixed residential and a small fraction of commercial customers. There are 149 customers in the service area with an estimated population of 382. The average monthly usage was determined by geo-coding water usage from the billing system of the Batesville Water Utility. The attached Design Summary shows that the theoretical design flow from customers in this area could range between 185 and 370 gallons per minute. Accounting for a possible additional increase in flow due to infiltration/inflow, a design rate of 740 gpm was derived.

Mr. Carl Peters, P. E.
September 10, 2012
Page 2

A data sheet showing the design of the inverted siphon is also attached. There are three sections to this data sheet with tables for the design of the inverted siphon, determination of the capacity of the gravity reach above the inverted siphon and the gravity reach below the inverted siphon. The inverted siphon is designed with nominal diameters of 8 and 10 inches. The siphon will be installed using high density polyethylene which will result in the equivalent 8- and 10-inch diameters for PVC pipe. The capacity of the smaller diameter portion of the inverted siphon will be 1,022 gallons per minute. Normal flow will be directed to the smaller diameter portion of this inverted siphon, and should the flows exceed this capacity, excess flow will be diverted into the larger diameter portion of the inverted siphon. At the design flow of 740 gpm, the velocity of flows should be approximately 3.8 ft./sec.

The gravity reach above the siphon consists of 6-inch and 8-inch sewers, with a combined capacity of approximately 2,300 gpm. The gravity reach below the inverted siphon is 18-inch PVC and ductile iron pipe, and has a capacity of 1,700 gpm under gravity flow and 2,700 gpm under only 1 foot of surcharge.

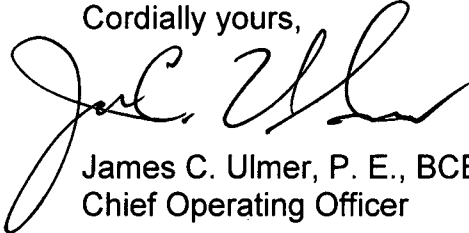
One additional infrastructure improvement shown on sheet C8 of the Plans is an 8-inch water line crossing of Highway 233 in northern Batesville. This 8-inch water line provides service to a previously underserved area across the highway.

Enclosed is our check number 346838 in the amount of \$500 to cover the review fee.

By copy of this letter we are forwarding these Plans and Specifications for sewer system improvements to ADEQ as an update to the city's Consent Administrative Order regarding sewer system improvements.

If we can provide additional information, please feel free to give us a call.

Cordially yours,



James C. Ulmer, P. E., BCEE
Chief Operating Officer

JCU:sc

Enclosures

cc/encl: Mr. Miles Johnson, Enforcement Analyst, Water Division, ADEQ
Mr. Damon Johnson, P. E., City Engineer

Basin 16A Inverted Siphon

Service Area	148 Acres
Customers	149
Estimated Population	382 at 2.562 persons per customer

Service Type	Mixed Residential and small fraction Commercial	
Average Monthly Usage	934,400 gal/mo	From Geo-coded Water Usage Data
Average Daily Usage	33,371 gal	
Service Density	1.007 Customers per ac	
Average Usage	6,271 gal per customer per month	
Average Usage	87.36 gal per capita per day	
Max Day Usage	66,743 gal at 2X Ave Day	
Max Day Ave Usage	46.35 gpm	
Max Hour Usage	92.70 gpm at 2X Max Day	
Max Hour Usage	139.05 gpm at 3X Max Day	
Max Hour Usage	185.40 gpm at 4X max Day	

If the Service Area builds out at 2 services per acre, then above design flows are multiplied by 2.

The design flow could range between 185 and 370 gpm.

Increasing these flow rates by 2X for I/I results in a **max design rate of 740 gpm.**

Polk Bayou Inverted Siphom
Batesville, Arkansas
Project Number Ba138B5I

10" HDPE Siphon

Pressure Reach	Station	Length, ft	Line Dia, in.	Q, mgd	Elev, ft	Minor Losses, ft	Available Head, ft	s, ft/ft	C	K _i	Q, cfs	V, fps	Area, ft ²	Hydraulic Radius	(0.001) ^{-0.04}	v ² /2g	Sum of K Losses	Minor Losses, ft	Q, gpm
Jct Box @ High Point	1,444.00				267.19														
MH @ Discharge	762.50	681.50	8.90	1.47		0.43	8.95	0.013133	120.00	23.64	2.277903	5.27	0.432024	0.1854	1.318257	0.431688	1	0.431688	1,022

12" HDPE Siphon

Pressure Reach	Station	Length, ft	Line Dia, in.	Q, mgd	Elev, ft	Minor Losses, ft	Available Head, ft	s, ft/ft	C	K _i	Q, cfs	V, fps	Area, ft ²	Hydraulic Radius	(0.001) ^{-0.04}	v ² /2g	Sum of K Losses	Minor Losses, ft	Q, gpm
Jct Box @ High Point	1,444.00				267.95														
MH @ Discharge	762.50	681.50	10.62	2.41		0.53	9.46	0.013881	120.00	37.62	3.735457	6.07	0.615143	0.2213	1.318257	0.572597	1	0.572597	1,677

6" Gravity Reach above Siphon

Gravity Reach	Station	Length, ft	Line Dia, in.	Q, mgd	Elev, ft	Minor Losses, ft	Available Head, ft	s, ft/ft	n	K'	Q, cfs	V, fps	Area, ft ²	Hydraulic Radius	(0.001) ^{-0.04}	v ² /2g	Sum of K Losses	Minor Losses, ft	Q, gpm
Upstream MH	370.00				287.56														
Downstream MH	0.00	370.00	6.00	0.8900		0.00	22.30	0.060270	0.013	0.463000	1.377027	7.01	0.19635	0.1250	1.318257	0.763729	0	0	618

10" Gravity Reach above Siphon

Gravity Reach	Station	Length, ft	Line Dia, in.	Q, mgd	Elev, ft	Minor Losses, ft	Available Head, ft	s, ft/ft	n	K'	Q, cfs	V, fps	Area, ft ²	Hydraulic Radius	(0.001) ^{-0.04}	v ² /2g	Sum of K Losses	Minor Losses, ft	Q, gpm
Upstream MH	290.00				274.49														
Downstream MH	0.00	290.00	10.00	2.5254		0.00	9.23	0.031828	0.013	0.463000	3.907445	7.16	0.545415	0.2083	1.318257	0.796963	0	0	1,754

Gravity Reach Below Siphon

Gravity Reach	Station	Length, ft	Line Dia, in.	Q, mgd	Elev, ft	Minor Losses, ft	Available Head, ft	s, ft/ft	n	K'	Q, cfs	V, fps	Area, ft ²	Hydraulic Radius	(0.001) ^{-0.04}	v ² /2g	Sum of K Losses	Minor Losses, ft	Q, gpm
Upstream MH	760.00				256.97														
Downstream MH	375.00	385.00	17.26	2.4792		0.00	0.46	0.001195	0.011	0.463000	3.83586	2.36	1.625022	0.3596	1.318257	0.086521	0	0	1,722

Gravity Reach Below Siphon - Under Surge

1.00 Surge, ft

Pressure Reach	Station	Length, ft	Line Dia, in.	Q, mgd	Elev, ft	Minor Losses, ft	Available Head, ft	s, ft/ft	C	K _i	Q, cfs	V, fps	Area, ft ²	Hydraulic Radius	(0.001) ^{-0.04}	v ² /2g	Sum of K Losses	Minor Losses, ft	Q, gpm
Upstream MH	760.00				258.41														
Downstream MH	375.00	385.00	17.26	3.9345		0.22	1.24	0.003221	120.000	134.9410	6.087554	3.75	1.624834	0.3596	1.318257	0.217963	1	0.217963	2,732

SPECIFICATIONS AND CONTRACT DOCUMENTS

SANITARY SEWER REHABILITATION

Basin 5 Interceptor and
Polk Bayou Double Siphon

FOR THE
CITY OF BATESVILLE, ARKANSAS

Plans No. BA-138B5I
August 2012



McGoodwin Williams & Yates
Engineering Confidence

Fayetteville, Arkansas

©2012 McGoodwin, Williams and Yates

SPECIFICATIONS AND CONTRACT DOCUMENTS

SANITARY SEWER REHABILITATION

Basin 5 Interceptor and
Polk Bayou Double Siphon

FOR THE
CITY OF BATESVILLE, ARKANSAS

Plans No. BA-138B5I
August 2012



McGoodwin Williams & Yates
Engineering Confidence

Fayetteville, Arkansas

©2012 McGoodwin, Williams and Yates

TABLE OF CONTENTS

1	ADVERTISEMENT FOR BIDS
2	INSTRUCTIONS TO BIDDERS
4	ARKANSAS PREVAILING WAGE DETERMINATION
5	BID
6	AGREEMENT
7	PERFORMANCE BOND AND PAYMENT BOND
8	STANDARD GENERAL CONDITIONS
SC	SUPPLEMENTARY CONDITIONS

DIVISION 1 – GENERAL REQUIREMENTS

01110	Summary of Work
01125	Methods of Measurement and Payment
01330	Submittals

DIVISION 2 – SITE CONSTRUCTION

02110	Clearing and Protection of Right-of-Way
02113	Surface Removal
02211	Classification of Excavation for Construction
02230	Site Clearing
02240	Dewatering
02270	Environmental Specifications
02273	Stone Riprap and Filter Fabric
02320	Blasting
02446	Horizontal Directional Drilling
02512	Arkansas State Highway Crossings
02533	High-Density Polyethylene (HDPE) Pipe and Fittings
02534	Pipe Bedding Material for Gravity Sewers
02535	Placing Pipe Protection Cover and Compacted Backfill
02538	Cast-in-Place Manholes
02540	Protective Coating for Manholes
02565	Ductile Iron Pipe and Fittings for Water Line
02566	Polyethylene Encasement
02598	Polyvinyl Chloride (PVC) Pipe and Fittings for Sewer Line, Force Main, and Water Line
02639	Fire Hydrants
02642	Valves for Water Service
02643	Flushing, Hydrostatic Testing, Disinfection & Dynamic Testing of Water Lines
02645	Low-Pressure Air Testing of Gravity Sewer Lines
02741	Hot-Mix Asphalt Paving
02821	Chain-Link Fences and Gates
02920	Cleanup, Seeding, and Sod

DIVISION 3 – CONCRETE

- 03300 Cast-In-Place Concrete
- 03310 Concrete Joints, Waterstops, Sealants and Appurtenant Concrete Materials
- 03315 Grouts
- 03320 Finishing and Repairs for Cast-In-Place Concrete

ADVERTISEMENT FOR BIDS

Notice is hereby given that, pursuant to an order of the City Council of the City of Batesville, Arkansas, sealed bids will be received at City Hall, 500 E. Main Street, until 2:00 p.m. on Wednesday, October 10, 2012, for furnishing all tools, materials and labor, and performing the necessary work for construction of Sanitary Sewer Rehabilitation – Basin 5 Interceptor and Polk Bayou Double Siphon. At this time the bids received will be publicly opened and read aloud. The work generally consists of:

Construction of approximately 1,550 linear feet of 24-inch, 3,800 linear feet of 18-inch sanitary sewer with manholes and appurtenances and a double siphon approximately 700 linear feet in length, including 600 linear feet of directional bore and installation of HDPE pipe, together with junction boxes and 12-inch and 8-inch PVC sewer. Also included is an AHTD highway crossing including bore and encasement, and approximately 180 linear feet of 8-inch ductile iron water line, for a complete installation.

Plans and specifications are on file and may be examined at the Batesville City Hall, 500 E. Main Street, Batesville, Arkansas, and in the office of McGoodwin, Williams and Yates, Inc., Consulting Engineers, 302 E. Millsap Road, Fayetteville, Arkansas 72703. Copies of these documents may be obtained from the office of said engineers upon request and upon the payment of \$100.00 for plans and specifications, which is not refundable.

The contractors shall make such inspection and studies of the site of the work as to familiarize themselves with all conditions to be encountered.

A mandatory Prebid Conference will be held at City Hall, 500 E. Main Street, at 2:00 p.m. on Tuesday, October 2, 2012.

Each bid must be accompanied by an acceptable statement of bidder's qualifications. The requirements of the bidder's statement of qualifications will be furnished to prospective bidders with plans and specifications.

Each bid must be accompanied by an acceptable form of bid guaranty in the amount equal to at least five percent of the whole bid, and such bid bond or cashier's check shall be subject to the conditions provided in the Instructions to Bidders.

Bids must be made upon the official bid sheets contained in the specifications, and such bid sheets shall not be removed from the remainder of the Specifications and Contract Documents. All bids shall be sealed and the envelopes addressed to the Mayor, City of Batesville, 500 E. Main Street, Batesville, Arkansas 72501. All bids shall be plainly marked on the outside of the envelope specifying that it is a bid for construction of Sanitary Sewer Rehabilitation – Basin 5 Interceptor and Polk Bayou Double Siphon, the time for opening of bids, and the name and current contractor's license number of the bidder.

All bidders must be licensed under the terms of Act 150, Arkansas Acts of 1965, as amended.

Pursuant to Arkansas Code Annotated 22-9-203, the Owner encourages all qualified small, minority, and women business enterprises to bid on and receive contracts for goods, services and construction. The Owner also encourages all general contractors to subcontract portions of their contract to qualified small, minority, and women business enterprises.

The City of Batesville reserves the right to reject any and all bids and to waive any informalities in the proposal deemed to be in the best interests of the City. The City further reserves the right to withhold the awarding of the contract for a period not to exceed 60 days after the receipt of bids.

Dated this _____ day of _____, 2012.

Denise M. Johnston, City Clerk

INSTRUCTIONS TO BIDDERS

1. DEFINED TERMS. Terms used in these Instructions to Bidders which are defined in the Standard General Conditions of the Construction Contract (EJCDC C-700, 2007) have the meanings assigned to them in the General Conditions. Certain additional terms used in these Instructions to Bidders have the meanings indicated below which are applicable to both the singular and plural thereof.

1.1 "Bidder" means one who submits a Bid directly to Owner, as distinguished from a sub-bidder, who submits a bid to a Bidder.

1.2 "Issuing Office" means the office from which the Bidding Documents are to be issued and where the bidding procedures are to be administered.

1.3 "Successful Bidder" means the lowest, responsible and responsive Bidder to whom Owner (on the basis of Owner's evaluation as hereinafter provided) makes an award.

1.4 "Bidding Documents" includes the Advertisement or Invitation to Bid, Instructions to Bidders, the Bid Form, and the proposed Specifications and Contract Documents (including all Addenda issued prior to receipt of Bids).

2. COPIES OF BIDDING DOCUMENTS

2.1 Complete sets of the Bidding Documents in the number and for the amount, if any, stated in the Advertisement or Invitation to Bid may be obtained from the Engineer upon request.

2.2 Complete sets of Bidding Documents must be used in preparing Bids; neither Owner nor Engineer assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bidding Documents.

2.3 Owner and Engineer in making copies of Bidding Documents available on the above terms do so only for the purpose of obtaining Bids on the Work and do not confer a license or grant for any other use.

3. QUALIFICATIONS OF BIDDERS. To demonstrate qualifications to perform the Work, each Bidder must be prepared to submit within five days after Bid opening upon Owner's request detailed written evidence such as financial data, previous experience, present commitments, and other such data as may be called for below (or in the Supplementary Instructions). Each Bid must contain evidence of Bidder's qualification to do business in the state where the Project is located or covenant to obtain such qualification prior to award of the contract.

STATEMENT OF BIDDER'S QUALIFICATIONS

All questions must be answered and the data given must be clear and comprehensive. This statement must be notarized. If necessary, questions may be answered on separate attached sheets. The Bidder may submit any additional information he desires.

Instructions
to Bidders

- 1) Name of Bidder.
- 2) Permanent main office address.
- 3) When organized.
- 4) If a corporation, where incorporated.
- 5) List state contractor licenses.
- 6) How many years have you been engaged in the contracting business under your present firm or trade name?
- 7) Contracts on hand. (Schedule these, showing amount of each contract and the appropriate anticipated dates of completion.)
- 8) General character of work performed by your company.
- 9) Have you ever failed to complete any work awarded to you?
- 10) Have you ever defaulted on a contract? If so, where and why?
- 11) List the more important projects recently completed by your company, stating the approximate cost for each, and the month and year completed.
- 12) List your major equipment available for this contract.
- 13) Experience in construction similar in size to this project, along with project owners and engineers.
- 14) Background and experience of the principal members of your organization, including the officers.
- 15) Credit available: \$ _____
- 16) Give bank reference: _____
- 17) Will you, upon request, fill out a detailed financial statement and furnish any other information that may be required by the Owner?

Dated at _____ this _____ day
of _____, _____.

Name of Organization: _____

By _____

Title _____

State of _____)

County of _____)

_____ being duly sworn deposes and says
that he (she) is the _____ of
_____, Contractor(s), and that answers to
the foregoing questions and all statements therein contained are true and correct.

Subscribed and sworn before me this _____ day of _____,

Notary Public

My commission expires _____
(Seal)

4. EXAMINATION OF CONTRACT DOCUMENTS AND SITE

4.1 It is the responsibility of each Bidder before submitting a Bid:

4.1.1 to examine thoroughly the Contract Documents and other related data identified in the Bidding Documents (including "technical data" referred to below);

4.1.2 to visit the site to become familiar with and satisfy Bidder as to the general, local and site conditions that may affect cost, progress, performance or furnishing of the Work;

4.1.3 to consider federal, state and local Laws and Regulations that may affect cost, progress, performance or furnishing of the Work;

4.1.4 to study and carefully correlate Bidder's knowledge and observations with the Contract Documents and such other related data;

4.1.5 to promptly notify Engineer of all conflicts, errors, ambiguities or discrepancies which Bidder has discovered in or between the Contract Documents and such other related documents.

4.2 Reference is made to the Supplementary Conditions for identification of:

4.2.1 those reports of explorations and tests of subsurface conditions at or contiguous to the site which have been utilized by Engineer in preparation of the Contract Documents. Bidder may rely upon the general accuracy of the "technical data" contained in such reports but not upon other data, interpretations, opinions or information contained in such reports or otherwise relating to the subsurface conditions at the site, nor upon the completeness thereof for the purposes of bidding or construction.

Instructions to Bidders

4.2.2 those drawings of physical conditions in or relating to existing surface and subsurface conditions (except Underground Facilities) which are at or contiguous to the site which have been utilized by Engineer in preparation of the Contract Documents. Bidder may rely upon the general accuracy of the "technical data" contained in such drawings but not upon other data, interpretations, opinions or information shown or indicated in such drawings or otherwise relating to such structures, nor upon the completeness thereof for the purposes of bidding or construction.

Copies of such reports and drawings will be made available by Owner to any Bidder on request. Those reports and drawings are not part of the Contract Documents, but the "technical data" contained therein upon which Bidder is entitled to rely as provided in paragraph 4.02 of the General Conditions has been identified and established in paragraph SC-4.02 of the Supplementary Conditions. Bidder is responsible for any interpretation or conclusion drawn from any "technical data" or any such data, interpretations, opinions or information.

4.3 Information and data shown or indicated in the Contract Documents with respect to Underground Facilities at or contiguous to the site is based upon information and data furnished to Owner and Engineer by owners of such Underground Facilities or others, and Owner and Engineer do not assume responsibility for the accuracy or completeness thereof unless it is expressly provided otherwise in the Supplementary Conditions.

4.4 Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and Underground Facilities, and possible changes in the Contract Documents due to differing or unanticipated conditions appear in paragraphs 4.02, 4.03 and 4.04 of the General Conditions.

4.5 Before submitting a Bid, each Bidder will, at Bidder's own expense, be responsible to obtain such additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise, which may affect cost, progress, performance or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences or procedures of construction to be employed by Bidder and safety precautions and programs incident thereto or which Bidder deems necessary to determine its Bid for performing and furnishing the Work in accordance with the time, price and other terms and conditions of the Contract Documents.

4.6 On request in advance, Owner will provide each Bidder access to the site to conduct such examinations, investigations, explorations, tests and studies as each Bidder deems necessary for submission of a Bid. Bidder shall fill all holes and clean up and restore the site to its former condition upon completion of such explorations, investigations, tests and studies.

4.7 Reference is made to the Supplementary Conditions for the identification of the general nature of work that is to be performed at the site by Owner or others (such as utilities and other prime contractors) that relates to the work for which a Bid is to be submitted. On request, Owner will provide to each Bidder for examination access to or copies of Contract Documents (other than portions thereof related to price) for such work.

4.8 The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with every requirement of this Article 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Contract Documents and such means, methods, techniques, sequences or procedures of construction as may be indicated or expressly required by the Contract Documents, the Bidder has given Engineer written notice of all conflicts, errors, ambiguities and discrepancies that Bidder has discovered in the Contract Documents and the written resolutions thereof by Engineer is acceptable to Bidder, and that the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

4.9 The provisions of 4.01 through 4.06, inclusive, do not apply to Asbestos, Polychlorinated biphenyls (PCBs), Petroleum, Hazardous Waste or Radioactive Material covered by paragraph 4.06 of the General Conditions.

5. AVAILABILITY OF LANDS FOR WORK, ETC. The lands upon which the Work is to be performed, rights-of-way and easements for access thereto and other lands designated for use by Contractor in performing the Work are identified in the Contract Documents. All additional lands and access thereto required for temporary construction facilities, construction equipment or storage of materials and equipment to be incorporated in the Work are to be obtained and paid for by Contractor. Easements for permanent structures or permanent changes in existing facilities are to be obtained and paid for by Owner unless otherwise provided in the Contract Documents.

6. INTERPRETATIONS AND ADDENDA

6.1 All questions about the meaning or intent of the Bidding Documents are to be directed to Engineer. Interpretations or clarifications considered necessary by Engineer in response to such questions will be issued by Addenda mailed or delivered to all parties recorded by Engineer as having received the Bidding Documents. Questions received less than ten days prior to the date for opening of Bids may not be answered. Only questions answered by formal written Addenda will be binding. Oral and other interpretations or clarifications will be without legal effect.

6.2 Addenda may also be issued to modify the Bidding Documents as deemed advisable by Owner or Engineer.

7. PREBID CONFERENCE. A mandatory Prebid Conference will be held at 2:00 p.m. on Tuesday, October 2, 2012, at Batesville City Hall, 500 E. Main Street, Batesville, Arkansas. Representatives of the Owner and Engineer will be present to discuss the Project. Engineer will transmit to all prospective Bidders of record such Addenda as Engineer considers necessary in response to questions arising at the conference. Oral statements may not be relied upon and will not be binding or legally effective.

8. BID SECURITY

8.1 Each Bid must be accompanied by Bid security made payable to Owner in an amount of five percent of the Bidder's maximum Bid price and in the form of a certified or bank check or a Bid Bond (on form attached, if a form is prescribed) issued by a surety meeting the requirements of paragraph 5.02 and SC-5.02A of the General Conditions.

Instructions
to Bidders

8.2 The Bid security of the Successful Bidder will be retained until such Bidder has executed the Agreement, furnished the required contract security and met the other conditions of the Notice of Award, whereupon the Bid security will be returned. If the Successful Bidder fails to execute and deliver the Agreement and furnish the required contract security within 15 days after the Notice of Award, Owner may annul the Notice of Award and the Bid security of that Bidder will be forfeited. The Bid security of other Bidders whom Owner believes to have a reasonable chance of receiving the award may be retained by Owner until the earlier of the seventh day after the Effective Date of the Agreement or the 61st day after the Bid opening, whereupon Bid security furnished by such Bidders will be returned. Bid security with Bids which are not competitive will be returned within seven days after the Bid opening.

9. CONTRACT TIMES. The numbers of days within which, or the dates by which, the Work is to be substantially completed and also completed and ready for final payment (the term "Contract Times" is defined in paragraph 1.01.A.14 of the General Conditions) are set forth in the Agreement (or incorporated therein by reference to the attached Bid Form).

10. LIQUIDATED DAMAGES. Provisions for liquidated damages, if any, are set forth in the Agreement.

11. SUBSTITUTE OR "OR-EQUAL" ITEMS. The contract, if awarded, will be on the basis of materials and equipment described in the Drawings or specified in the Specifications without consideration of possible substitute or "or-equal" items. Whenever it is indicated in the Drawings or specified in the Specifications that a substitute or "or-equal" item of materials or equipment may be furnished or used by Contractor if acceptable to Engineer, application for such acceptance will not be considered by Engineer until after the Effective Date of the Agreement. The procedure for submission of any such application by Contractor and consideration by Engineer is set forth in paragraph 6.05 of the General Conditions and may be supplemented in the General Requirements.

12. SUBCONTRACTORS, SUPPLIERS AND OTHERS. The Contractor shall not assign or sublet all or any part of this Contract without the prior written approval of the Owner nor shall the Contractor allow such Subcontractor to commence Work until he has provided such workers' compensation and public liability insurance as may be required. The approval of each subcontract by the Owner will in no manner release the Contractor from any of his obligations as set out in the Plans, Specifications, Contract and Bonds.

13. BID FORM

13.1 The Bid Form is included with the Bidding Documents; additional copies may be obtained from Engineer (or the issuing office).

13.2 All blanks on the Bid Form must be completed in ink or by typewriter.

13.3 Bids by corporations must be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and the corporate seal must be affixed and attested by the secretary or an assistant

secretary. The corporate address and state of incorporation must be shown below the signature.

13.4 Bids by partnerships must be executed in the partnership name and signed by a partner, whose title must appear under the signature and the official address of the partnership must be shown below the signature.

13.5 All names must be typed or printed below the signature.

13.6 The Bid shall contain an acknowledgment of receipt of all Addenda (the numbers of which must be filled in on the Bid Form).

13.7 The address and telephone number for communications regarding the Bid must be shown.

13.8 Evidence of authority to conduct business as an out-of-state corporation in the state where the Work is to be performed shall be provided in accordance with paragraph 3 above. State contractor license number must also be shown.

13.9 Bid Table A will be provided to Bidders in both printed form and digital form in Excel Format. Bidders shall complete, print, and attach the table to the Bid Form.

14. SUBMISSION OF BIDS. Bids shall be submitted at the time and place indicated in the Advertisement or Invitation to Bid and shall be enclosed in an opaque sealed envelope, marked with the Project title (and, if applicable, the designated portion of the Project for which the Bid is submitted) and name and address of the Bidder and accompanied by the Bid security and other required documents. If the Bid is sent through the mail or other delivery system, the sealed envelope shall be enclosed in a separate envelope with the notation "BID ENCLOSED" on the face of it. THE BID FORM SHALL NOT BE REMOVED FROM THE SPECIFICATIONS AND CONTRACT DOCUMENTS.

15. MODIFICATION AND WITHDRAWAL OF BIDS

15.1 Bids may be modified or withdrawn by an appropriate document duly executed (in the manner that a Bid must be executed) and delivered to the place where Bids are to be submitted at any time prior to the opening of Bids.

15.2 If, within 24 hours after Bids are opened, any Bidder files a duly signed, written notice with Owner and promptly thereafter demonstrates to the reasonable satisfaction of Owner that there was a material and substantial mistake in the preparation of its Bid, that Bidder may withdraw its Bid and the Bid security will be returned. Thereafter, that Bidder will be disqualified from further bidding on the Work to be provided under the Contract Documents.

16. OPENING OF BIDS. Bids will be opened and (unless obviously nonresponsive) read aloud publicly at the place where Bids are to be submitted. A tabulation of the amounts of the base Bids and major alternates (if any) will be made available to Bidders after preparation by the Engineer.

Instructions
to Bidders

17. BIDS TO REMAIN SUBJECT TO ACCEPTANCE. All bids will remain subject to acceptance for 60 days after the day of the Bid opening, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to that date.

18. AWARD OF CONTRACT

18.1 Owner reserves the right to reject any and all Bids, including without limitation the rights to reject any or all nonconforming, nonresponsive, unbalanced or conditional Bids and to reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder, whether because the Bid is not responsive or the Bidder is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criteria established by Owner. Owner also reserves the right to waive all informalities not involving price, time or changes in the Work and to negotiate contract terms with the Successful Bidder. Discrepancies in the multiplication of units of Work and unit prices will be resolved in favor of the unit prices. Discrepancies between the indicated sum of any column of figures and the correct sum thereof will be resolved in favor of the correct sum. Discrepancies between words and figures will be resolved in favor of the words.

18.2 In evaluating Bids, Owner will consider the qualifications of the Bidders, whether or not the Bids comply with the prescribed requirements, and such alternates, unit prices and other data, as may be requested in the Bid Form or prior to the Notice of Award.

18.3 Owner may consider the qualifications and experience of Subcontractors, Suppliers, and other persons and organizations proposed for those portions of the Work as to which the identity of Subcontractors, Suppliers, and other persons and organizations must be submitted as provided in the Supplementary Conditions. Owner also may consider the operating costs, maintenance requirements, performance data and guarantees of major items of materials and equipment proposed for incorporation in the Work when such data is required to be submitted prior to the Notice of Award.

18.4 Owner may conduct such investigations as Owner deems necessary to assist in the evaluation of any Bid and to establish the responsibility, qualifications and financial ability of Bidders, proposed Subcontractors, Suppliers and other persons and organizations to perform and furnish the Work in accordance with the Contract Documents to Owner's satisfaction within the prescribed time.

18.5 If the contract is to be awarded, it will be awarded to the lowest responsive, responsible Bidder whose evaluation by Owner indicates to Owner that the award will be in the best interests of the Project.

18.6 If the contract is to be awarded, Owner will give the Successful Bidder a Notice of Award within 60 days after the day of the Bid opening.

18.7 If at any time this contract is to be awarded, the total bid submitted by a responsible Bidder exceeds the funds then estimated by the Owner as available, the Owner may reject all bids or may award the contract on the total bid combined with such deductible alternates applied in numerical order in which they are listed in the Form of Bid, as produces a net amount which is within the available funds, if applicable. The Bidder understands that the contract will be awarded to the Bidder with the lowest Total

Bid for the pavement alternative selected by the Owner, i.e., either the Composite or P.C.C. Pavement, regardless of the comparative costs of the alternatives.

19. CONTRACT SECURITY. Paragraph 5.01 of the General Conditions and the Supplementary Conditions set forth Owner's requirements as to Performance and Payment Bonds. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by the required Performance and Payment Bonds.

20. SIGNING OF AGREEMENT. When Owner gives Notice of Award to the Successful Bidder, it will be accompanied by the required number of unsigned counterparts of the Agreement with all other written Contract Documents attached. Within 15 days thereafter Contractor shall sign and deliver the required number of counterparts of the Agreement and attached documents to Owner with the required Bonds. Within ten days thereafter Owner shall deliver one fully signed counterpart to Contractor. Each counterpart is to be accompanied by a complete set of the Drawings with appropriate identification.

21. COMPLIANCE WITH STATE LICENSING LAW. Contractors must be licensed in accordance with the requirements of Act 150, Arkansas Acts of 1965, the "Arkansas State Licensing Law for Contractors." Bidders who submit Bids in excess of \$20,000 must submit evidence of their having a contractor's license before their bids will be considered, and shall note their license number on the outside of their Bid.

22. LABOR LAWS. The Contractor shall abide by all federal, state and local laws governing labor. The Contractor further agrees to save the Owner harmless from the payment of any contribution under the State Unemployment Compensation Act, and the Contractor agrees that if he is subject to the Arkansas State Unemployment Act, he will make whatever contributions are required under and by virtue of the provisions of said Act.

23. WAGES AND LABOR. Minimum wage rates shall be equal to basic rates as established by common usage in the city and adjacent community for the various types of labor and skills performed. In case wage rates are specified in the Contract Documents, the rates as specified shall be the minimum rates which apply to the Project. Whenever available, local common labor shall be used and whenever practical, skilled and semi-skilled labor, if available, shall be used.

The Contractor and each Subcontractor, where the contract amount exceeds \$75,000, shall comply with the provisions of Act 74, as amended by Act 275 of 1969 (Ark. Stat. 14-630). The provisions are summarized below.

The Contractor and Subcontractor shall:

- 1) pay the minimum prevailing wage rates for each craft or type of workman and the prevailing wage rate for holiday and overtime work, as determined by the Arkansas Department of Labor.
- 2) post the scale of wages in a prominent and easily accessible place at the site of the Work.
- 3) keep an accurate record showing the names and occupation and hours worked of all workmen employed by them, and the actual wages paid to each of the workmen, which record shall be open at all reasonable hours to

Instructions
to Bidders

the inspection of the Department of Labor or the Owner, its officers and agents.

The Owner shall have the right to withhold from amounts due the Contractor so much of accrued payments as may be considered necessary to pay the workmen employed by the Contractor or any Subcontractor, the difference between the rates of wages required by this Contract and the rates of wages received by such workmen.

If it is found that any workmen employed by the Contractor or a Subcontractor has been or is being paid a rate of wages less than the rate of wages required by this Contract, the Owner may by written notice to the Contractor, terminate his right to proceed with the Work or such party of the Work as to which there has been a failure to pay the required wages and to prosecute the Work to completion by Contract or otherwise, and the Contractor and his sureties shall be liable for any excess costs occasioned thereby.

24. COMPLIANCE WITH ACT 125, ARKANSAS ACTS OF 1965. The attention of all Bidders is called to the provisions of Act 125, Arkansas Acts of 1965. This act provides for payment for certain taxes on materials and equipment brought into the state. It further provides for methods of collecting said taxes. All provisions of this Act will be complied with under this Contract.

25. WITHHOLDING STATE INCOME TAXES. The Contractor shall deduct and withhold Arkansas income taxes, as required by Arkansas law, from wages paid to employees, whether such employees are residents or nonresidents of Arkansas.

26. COMPLIANCE WITH RULES AND REGULATIONS FOR THE ENFORCEMENT AND ADMINISTRATION OF ACT 162, ARKANSAS ACTS OF 1987. The attention of all NON-RESIDENT BIDDERS is called to the provision of Act 162, Arkansas Acts of 1987. This act provides for non-resident contractors and subcontractors notice and bond regulations by the Commissioner of Revenues, Department of Finance and Administration, Post Office Box 1272, Little Rock, Arkansas 72203 prior to commencing work or undertaking to perform any duties under any contract within the State of Arkansas.

27. COMPLIANCE WITH ARKANSAS CODE ANNOTATED 22-9-203. Pursuant to Arkansas Code Annotated 22-9-203, the Owner encourages all qualified small, minority, and women business enterprises to bid on and receive contracts for goods, services, and construction. The Owner also encourages all general contractors to subcontract portions of their contract to qualified small, minority, and women business enterprises.

28. COMPLIANCE WITH ARKANSAS CODE ANNOTATED 22-9-204. Contractors shall comply with Arkansas Code Annotated 22-9-204, and all subcontractors referenced in this section and listed by the Contractor in the Bid Form shall be licensed by the State of Arkansas at the time of bid.

MIKE BEEBE
GOVERNOR



STATE OF ARKANSAS
ARKANSAS DEPARTMENT OF LABOR
PREVAILING WAGE DIVISION

JAMES SALKELD
DIRECTOR

10421 WEST MARKHAM • LITTLE ROCK, AR 72205-2190
Phone: 501-682-4536 Fax: 501-682-4508 TRS: 800-285-1131

June 7, 2012

Richard Cantrell
McGoodwin Williams and Yates Inc
302 E Millsap Road
Fayetteville, AR 72703

Re: SANITARY SEWER REHABILITATION:
BASIN 5 INTERCEPTOR
AND POLK BAYOU DOUBLE SIPHON
BATESVILLE, ARKANSAS
INDEPENDENCE COUNTY

Dear Mr. Cantrell:

In response to your request, enclosed is Arkansas Prevailing Wage Determination Number 11-588 establishing the minimum wage rates to be paid on the above-referenced project. These rates were established pursuant to the Arkansas Prevailing Wage Law, Ark. Code Ann. §§ 22-9-301 to 22-9-315 and the administrative regulations promulgated thereunder.

If the work is subject to the Arkansas Prevailing Wage Law, every specification shall include minimum prevailing wage rates for each craft or type of worker as determined by the Arkansas Department of Labor, Ark. Code Ann. § 22-9-308 (b) (2). Also, the public body awarding the contract shall cause to be inserted in the contract a stipulation to the effect that not less than the prevailing hourly rate of wages shall be paid to all workers performing work under the contract. Ark. Code Ann. § 22-9-308 (c).

Additionally, the scale of wages shall be posted by the contractor in a prominent and easily accessible place at the work site. Ark. Code Ann. § 22-9-309 (a).

Also enclosed is a "Statement of Intent to Pay Prevailing Wages" form that should be put in your specifications along with the wage determination. The General/Prime Contractor is responsible for getting this form filled out and returned to this office within 30 days of the Notice to Proceed for this project.

When you issue the Notice to Proceed for this project, please send a copy of the notice to my office.

If you have any questions, please call me at (501) 682-4536 or fax (501) 682-4508.

Sincerely,

Lorna Kay Smith

Lorna K. Smith
Prevailing Wage Division

Enclosures

**Arkansas Department of Labor
 Prevailing Wage Determination
 HEAVY RATES**

Determination #: 11-588
Expiration Date: 12/7/2012
Survey#: 711-AH18

Date: 6/7/2012

Project: Sanitary Sewer Rehabilitation: Basin 5 Interceptor and Polk Bayou Double Siphon

Site:

City: Batesville, Arkansas

Project County: Independence

CLASSIFICATION	Basic Hourly Rate	Fringe Benefits
Bricklayer/Pointer, Cleaner, Caulker, Stone Mason	\$12.35	
Carpenter	\$13.85	
Concrete Finisher/Cement Mason	\$12.35	
Electrician/Alarm Installer	\$20.00	\$2.20
Ironworker (Including Reinforcing Work)	\$12.35	
Laborer	\$11.45	
Painter/Sheet Rock Finisher	\$12.35	
Pipelayer	\$12.35	
Truck Driver (Excludes Dump Truck)	\$11.55	
Asphalt Paving Machine	\$12.35	
Bulldozer, finish	\$15.25	
Bulldozer, rough	\$15.25	
Concrete Paver	\$12.35	
Concrete Spreader	\$12.35	
Crane, Derrick, Dragline, Shovel & Backhoe, 1.5 yards or less	\$15.05	
Crane, Derrick, Dragline, Shovel & Backhoe, over 1.5 yards	\$18.00	
Distributor	\$12.35	
End Dump (Dump Truck)	\$12.35	
Forklift	\$12.35	
Mechanic	\$12.35	
Motor Patrol, finish	\$12.35	
Oiler and Greaser	\$12.35	
Pile Driver	\$12.35	
Pugg Mill	\$12.35	
Roller	\$12.35	
Scraper, finish	\$12.35	
Scraper, rough	\$12.35	
Tractor	\$12.35	

Welders-receive rate prescribed for craft performing operation to which welding is incidental.

Certified 7/1/2011

Classifications that are required, but not listed above, must be requested in writing from the Arkansas Department of Labor, Prevailing Wage Division. Please call (501) 682-4536 for a request form.

STATEMENT OF INTENT TO PAY PREVAILING WAGES

PROJECT: **SANITARY SEWER REHABILITATION: BASIN 5 INTERCEPTOR AND POLK BAYOU DOUBLE SIPHON
BATESVILLE, ARKANSAS
INDEPENDENCE COUNTY**

This is to certify that we, the following listed contractors, are aware of the wage requirements of the Arkansas Prevailing Wage Law and by signature below indicate our intent to pay no less than the rates established by **Arkansas Prevailing Wage Determination Number 11-588** for work performed on the above noted public project. I understand that contractors who violate prevailing wage laws, i.e., incorrect classification/scope of work of workers, improper payments of prevailing wages, etc., are subject to fines and will be required to pay back wages due to workers.

	Business Name	Address	Phone#	Signature and Title of Business Official
	General/Prime Contractor			
4-3	Electrical Subcontractor			
	Mechanical Subcontractor			
	Plumbing Subcontractor			
	Roofing/ Sheet Metal Subcontractor			

THE GENERAL/PRIME CONTRACTOR IS RESPONSIBLE FOR GETTING THIS FORM FILLED OUT AND RETURNING IT TO THE ARKANSAS DEPARTMENT OF LABOR ***WITHIN 30 DAYS OF THE NOTICE TO PROCEED*** FOR THIS PROJECT. RETURN COMPLETED FORM TO THE ARKANSAS DEPARTMENT OF LABOR, PREVAILING WAGE DIVISION, 10421 W. MARKHAM, LITTLE ROCK, ARKANSAS, 72205.

B I D

SANITARY SEWER REHABILITATION

**Basin 5 Interceptor and
Polk Bayou Double Siphon**

City of Batesville
Batesville, Arkansas

Plans No. Ba-138B5I

Dated August 2012

Mayor Rick Elumbaugh
Members of the City Council
City of Batesville
500 E. Main Street
Batesville, Arkansas 72501

To Mayor Elumbaugh and the City Council:

1. The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an agreement with Owner in the form included in the Contract Documents to perform and furnish all Work as specified or indicated in the Contract Documents for the Contract Price and within the Contract Time indicated in this Bid and in accordance with the other terms and conditions of the Contract Documents.
2. Bidder accepts all of the terms and conditions of the Advertisement or Invitation to Bid and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for sixty days after the day of Bid opening. Bidder will sign and submit the Contract Agreement with the Bonds and other documents required by the bidding requirements within fifteen days after the date of Owner's Notice of Award.
3. In submitting this Bid, Bidder represents, as more fully set forth in the Contract Agreement, that:
 - a) Bidder has examined copies of all the Bidding Documents and of the following addenda (receipt of which is hereby acknowledged)

Date

Number

and such addenda are attached to the Bid.

- b) Bidder has visited the site and become familiar with and is satisfied as to the general, local and site conditions that may affect cost, progress, performance and furnishing of the Work.
- c) Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress, performance and furnishing of the Work.
- d) Bidder has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions. Bidder accepts the determination set forth in paragraph SC-4.02 of the Supplementary Conditions of the extent of the "technical data" contained in such reports and drawings upon which Bidder is entitled to rely as provided in paragraph 4.02 of the General Conditions. Bidder acknowledges that such reports and drawings are not Contract Documents and may not be complete for Bidder's purposes. Bidder acknowledges that Owner and Engineer do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Bidding Documents with respect to Underground Facilities at or contiguous to the site. Bidder has obtained and carefully studied (or assumes responsibility for having done so) all such additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences and procedures of construction to be employed by Bidder and safety precautions and programs incident thereto. Bidder does not consider that any additional examinations, investigations, explorations, tests, studies or data are necessary for the determination of this Bid for performance and furnishing of the Work in accordance with the times, price and other terms and conditions of the Contract Documents.
- e) Bidder is aware of the general nature of Work to be performed by Owner and others at the site that relates to Work for which this Bid is submitted as indicated in the Contract Documents.
- f) Bidder has correlated the information known to Bidder, information and observations obtained from visits to the site, reports and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies and data with the Contract Documents.
- g) Bidder has given Engineer written notice of all conflicts, errors, ambiguities or discrepancies that Bidder has discovered in the Contract Documents and the written resolution thereof by Engineer is acceptable to Bidder, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work for which this Bid is submitted.

h) This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any other Bidder to submit a false or sham Bid; Bidder has not solicited or induced any person, firm or corporation to refrain from bidding; and Bidder has not sought by collusion to obtain for itself any advantage over any other Bidder or over Owner.

4. The following documents are attached to and made a condition of this Bid. Required Bid Security in the form of bid bond or certified or cashier's check for _____ (\$_____).

5. The Bidder will complete the Work for the following unit or lump sum prices:

Item No.	Estimated Quantity	Description of Item and Unit or Lump Sum Price Bid	Total Amount
1.	1,368	Linear Feet, 24-Inch SDR-26 PVC Gravity Sewer Pipe, complete in place	
		dollars (_____)/L.F.	\$ _____
		(Amount written in Words)	(In Figures) (Total Amount in Figures)
2.	178	Linear Feet, 24-Inch Pressure Class 250 Restrained Joint Ductile Iron Gravity Sewer Pipe, complete in place	
		dollars (_____)/L.F.	
3.	290	Linear Feet, 18-Inch SDR-26 PVC Gravity Sewer Pipe, complete in place	
		dollars (_____)/L.F.	
4.	2,578	Linear Feet, Remove and Dispose of Existing Concrete Pipe and Install 18-Inch SDR-26 PVC Gravity Sewer Pipe, complete in place	
		dollars (_____)/L.F.	
5.	948	Linear Feet, 18-Inch Pressure Class 250 Restrained Joint Ductile Iron Gravity Sewer Pipe, complete in place	
		dollars (_____)/L.F.	
6.	Lump Sum	Double Siphon (±700 feet in length), 5-foot manhole, concrete inlet box, 12" and 8" gravity sewer with manholes, complete in place	
		dollars	\$ _____

Item No.	Estimated Quantity	Description of Item and Unit or Lump Sum Price Bid	Total Amount
7.	1,700	Linear Feet, Extra Depth Trench, 6-8' in Depth, complete in place	
		dollars ()/L.F.	\$ _____
8.	500	Linear Feet, Extra Depth Trench, 8-10' in Depth, complete in place	
		dollars ()/L.F.	_____
9.	200	Linear Feet, Extra Depth Trench, 10-12' in Depth, complete in place	
		dollars ()/L.F.	_____
10.	100	Linear Feet, Extra Depth Trench, 12-14' in Depth, complete in place	
		dollars ()/L.F.	_____
11.	8	Each, 5' Diameter Cast-In-Place Manhole 0-6' in depth, including stubout and connection to existing sewer as shown on Plans, complete in place	
		dollars ()/Each	_____
12.	20	Each, 4' Diameter Cast-In-Place Manhole 0-6' in depth, including stubout and connection to existing sewer as shown on Plans, complete in place	
		dollars ()/Each	_____
13.	20	Each, 5-Foot Diameter Manhole Barrel Extension, complete in place	
		dollars ()/Each	_____
14.	30	Each, 4-Foot Diameter Manhole Barrel Extension, complete in place	
		dollars ()/Each	_____

Item No.	Estimated Quantity	Description of Item and Unit or Lump Sum Price Bid	Total Amount
15.	15	Each, Watertight Manhole Ring and Lid (in lieu of standard ring and lid), complete in place dollars ()/Each	\$ _____
16.	3,500	Square Feet, Protective Coating for Manholes, complete in place dollars ()/S.F.	_____
17.	2,800	Linear Feet, Testing Gravity Sewers with Live Flow, including manholes, complete in place dollars ()/L.F.	_____
18.	17	Each, Remove and Dispose of Existing Concrete Manholes, complete in place dollars ()/Each	_____
19.	6	Each, 6, 8, or 10-Inch Manhole Drop Assembly, complete in place dollars ()/Each	_____
20.	200	Cubic Yards, Rock Excavation, complete in place dollars ()/C.Y.	_____
21.	5	Each, 24-Inch x 4-Inch Sewer Service Wyes including plug (no connection), complete in place dollars ()/Each	_____
22.	20	Each, 18-Inch x 4-Inch Sewer Service Wyes including 4-inch service line, repair clamp and connection, complete in place dollars ()/Each	_____

Item No.	Estimated Quantity	Description of Item and Unit or Lump Sum Price Bid	Total Amount
23.	6	Each, Street Repair including full depth base and street repair, complete in place	
		dollars ()/Each	\$ _____
24.	Lump Sum	Construct four (4) Reinforced Concrete Piers as shown on Sheet C6 of the Plans, complete in place	
		dollars	_____
25.	100	Cubic Yards, Class B Concrete Pipe Support and Cover, complete in place	
		dollars ()/C.Y.	_____
26.	200	Tons, Stone Riprap, complete in place	
		dollars ()/Ton	_____
27.	Lump Sum	Erosion Control, complete in place	
		dollars	_____
28.	Lump Sum	Highway Crossing and Water Line including steel casing, and water line together with all valves and fittings, complete in place	
		dollars	_____
29.	Lump Sum	Trench and Excavation Safety System, as required by Act 291 of the 1993 Arkansas General Assembly	
		dollars	_____
TOTAL BID			\$ _____

5. (continued)

The contract, if awarded, will be based on the lowest bid accepted by the City of Batesville, Arkansas.

Unit prices have been computed in accordance with paragraph 11.03 of the General Conditions.

Bidder acknowledges that quantities are not guaranteed and final payment will be based on actual quantities determined as provided in the Contract Documents.

Amounts are to be shown in both words and figures. In case of discrepancy, the amount shown in words, unless obviously incorrect, will govern.

The above unit and lump sum prices shall include all labor, materials, bailing, shoring, removal, overhead, profit, insurance, etc., to cover the finished work of the several kinds called for.

The Bidder understands that the Owner reserves the right to reject any or all bids and to waive any informalities in the bidding.

6. The Bidder agrees that the Work will be substantially complete within 210 calendar days after the date when the Contract Times commence to run as provided in paragraph 2.03 of the General Conditions, and completed and ready for final payment in accordance with paragraph 14.07 of the General Conditions within 240 calendar days after the date when the Contract Times commence to run.

Bidder accepts the provisions of the Contract Agreement as to liquidated damages in the event of failure to complete the Work within the times specified in the Agreement.

7. Communications concerning this Bid shall be addressed to the address of Bidder indicated below.
8. Terms used in this Bid which are defined in the General Conditions or Instructions will have the meanings indicated in the General Conditions or Instructions.

Submitted this _____ day of _____, _____.

Respectfully submitted,

(Firm Name)

By _____

Title _____

Attest: _____
(Seal, if bid is by corporation.)

Arkansas License No. _____

(Business Address & Zip Code)

AGREEMENT

THIS AGREEMENT is dated as of the _____ day of _____,
in the year _____ by and between _____

(hereinafter called OWNER) and

(hereinafter called CONTRACTOR).

Owner and Contractor, in consideration of the mutual covenants hereinafter set forth, agree as follows:

Article 1. WORK

Contractor shall complete all Work as specified or indicated in the Contract Documents. The Work is generally described as follows:

Sanitary Sewer Rehabilitation – Basin 5 Interceptor and Polk Bayou Double Siphon, including appurtenances and other items of work, which consists of all items of work as set out in the Bid and these Specifications and Plans No. Ba-138B5I, dated August 2012, for the unit and lump sum prices bid in the Bid, including all work required for a complete installation.

Article 2. ENGINEER

The Project has been designed by McGoodwin, Williams and Yates, Inc., who is hereinafter called Engineer and who is to act as Owner's representative, assume all duties and responsibilities and have the rights and authority assigned to Engineer in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

Article 3. CONTRACT TIMES

3.1 The Work will be substantially completed and placed in service within Two Hundred Ten (210) days after the date when the Contract Times commence to run as provided in paragraph 2.03 of the General Conditions, and completed and ready for final payment in accordance with paragraph 14.07 of the General Conditions within Two Hundred Forty (240) days after the date when the Contract Times commence to run. These Contract Times include delays for normal (average) weather-related events, such as rain, snow, and freezing temperatures which may affect the progress of the construction in the following amounts on a per-month basis as hereinafter set out. Only weather-related delays in excess of these amounts will be considered for time extensions, if requested by the Contractor.

Days Included in Contract Times for Normal Weather Days
(On A Monthly Basis)

January	15
February	12
March	8
April	6
May	6
June	3
July	3
August	3
September	3
October	3
November	6
December	12

The Contractor shall include within the Contract Times the respective number of days (as shown above for each month during the Contract) for normal weather-related events which may cause delays in the progress of the Work, and place a sufficient work force on the project to ensure completion of the Work within the Contract Times.

3.2 Liquidated Damages. Owner and Contractor recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified in paragraph 3.1 above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense and difficulties involved in proving the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty) Contractor shall pay Owner five hundred dollars (\$500.00) for each day that expires after the time specified in paragraph 3.1 for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse or fail to complete the remaining Work within the time specified in paragraph 3.1 for completion and readiness for final payment or any proper extension thereof granted by Owner, Contractor shall pay Owner five hundred dollars (\$500.00) for each day that expires after the time specified in paragraph 3.1 for completion and readiness for final payment.

Article 4. CONTRACT PRICE

Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds for the performance of the Contract in accordance with the accepted Bid therefor, subject to additions and deductions, as provided in the Specifications, for unit and lump sum prices in the Bid, the total sum being

_____ (\$ _____).
(use words) (figures)

As provided in paragraph 11.03 of the General Conditions estimated quantities are not guaranteed, and determinations of actual quantities and classification are to be made by Engineer as provided in paragraph 9.07 of the General Conditions. Unit prices have been computed as provided in paragraph 11.03 of the General Conditions.

Article 5. PAYMENT PROCEDURES

Contractor shall submit Applications for Payment in accordance with Article 14 of the General Conditions. Applications for Payment will be processed by Engineer as provided in the General Conditions.

5.1 Progress Payments; Retainage. Owner shall make progress payments on account of the Contract Price on the basis of Contractor's Applications for Payment as recommended by Engineer. The date for payment shall be defined as the third Friday of each month, except in months containing five Fridays. In that event, the payment date shall be the fourth Friday of the month during construction as provided in paragraph 5.1.1 below. All such payments will be measured by the schedule of values established in paragraph 2.05 of the General Conditions (and in the case of Unit Price Work based on the number of units completed) or, in the event there is no schedule of values, as provided in the General Requirements.

5.1.1 Progress payments will be made in an amount equal to the percentage indicated below, but, in each case, less the aggregate of payments previously made and less such amounts as Engineer shall determine, or Owner may withhold, in accordance with paragraph 14.02 of the General Conditions.

95% of Work completed (with the balance being retainage).

100% of materials and equipment not incorporated in the Work (but delivered, suitably stored and accompanied by documentation satisfactory to Owner as provided in paragraph 14.02 of the General Conditions).

5.2 Final Payment. Upon final completion and acceptance of the Work in accordance with paragraph 14.07 of the General Conditions, Owner shall pay the remainder of the Contract Price as recommended by Engineer as provided in said paragraph 14.07.

Article 6. CONTRACTOR'S REPRESENTATIONS

In order to induce Owner to enter into this Agreement, Contractor makes the following representations:

6.1 Contractor has examined and carefully studied the Contract Documents (including the Addenda listed in paragraph 7 and the other related data identified in the Bidding Documents including "technical data."

6.2 Contractor has visited the site and become familiar with and is satisfied as to the general, local and site conditions that may affect cost, progress, performance or furnishing of the Work.

6.3 Contractor is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress, performance and furnishing of the Work.

6.4 Contractor has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except

Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions. Contractor accepts the determination set forth in paragraph SC-4.02 of the Supplementary Conditions of the extent of the "technical data" contained in such reports and drawings upon which Contractor is entitled to rely as provided in paragraph 4.02 of the General Conditions. Contractor acknowledges that such reports and drawings are not Contract Documents and may not be complete for Contractor's purposes. Contractor acknowledges that Owner and Engineer do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Contract Documents with respect to Underground Facilities at or contiguous to the site. Contractor has obtained and carefully studied (or assumes responsibility for having done so) all such additional supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto. Contractor does not consider that any additional examinations, investigations, explorations, tests, studies or data are necessary for the performance and furnishing of the Work at the Contract Price, within the Contract Times and in accordance with the other terms and conditions of the Contract Documents.

6.5 Contractor is aware of the general nature of Work to be performed by Owner and others at the site that relates to the Work as indicated in the Contract Documents.

6.6 Contractor has correlated the information known to Contractor, information and observations obtained from visits to the site, reports and drawings identified in the Contract Documents and all additional examinations, investigations, explorations, tests, studies and data with the Contract Documents.

6.7 Contractor has given Engineer written notice of all conflicts, errors, ambiguities or discrepancies that Contractor has discovered in the Contract Documents and the written resolution thereof by Engineer is acceptable to Contractor, and the Contract Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performance and furnishing of the Work.

Article 7. CONTRACT DOCUMENTS

The Contract Documents which comprise the entire agreement between Owner and Contractor concerning the Work consist of the following:

- 7.1 This Agreement.
- 7.2 Exhibits to this Agreement.
- 7.3 Performance, Payment and other Bonds.
- 7.4 Notice to Proceed.
- 7.5 General Conditions.
- 7.6 Supplementary Conditions.

- 7.7 Specifications consisting of divisions and sections as listed in the Table of Contents.
- 7.8 Drawings consisting of 12 sheets.
- 7.9 Addenda numbers ____ to ____, inclusive.
- 7.10 Contractor's bid.
- 7.11 Documentation submitted by Contractor prior to Notice of Award.
- 7.12 The following which may be delivered or issued after the Effective Date of the Agreement and are not attached hereto: All Written Amendments and other documents amending, modifying or supplementing the Contract Documents pursuant to paragraph 3.04 of the General Conditions.

The documents listed in paragraphs 7.2 et seq. above are attached to this Agreement (except as expressly noted otherwise above).

There are no Contract Documents other than those listed above in this Article. The Contract Documents may only be amended, modified or supplemented as provided in paragraph 3.04 of the General Conditions.

Article 8. MISCELLANEOUS

- 8.1 Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.
- 8.2 The Contractor and all Subcontractors shall pay not less than the minimum prevailing hourly wage rates as found by the Arkansas Department of Labor or as determined by the Court on appeal to all workmen performing work under the Contract.
- 8.3 No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.
- 8.4 Owner and Contractor each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns and legal representatives in respect to all covenants, agreements and obligations contained in the Contract Documents.
- 8.5 Any provision or part of the Contract Documents held to be void or unenforceable under any Law or Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

IN WITNESS WHEREOF, Owner and Contractor have signed this Agreement. One counterpart each has been delivered to Owner, Contractor and Engineer. All portions of the Contract Documents have been signed, initialed or identified by Owner and Contractor or identified by Engineer on their behalf.

This Agreement will be effective on _____, _____ (which is the Effective Date of the Agreement).

OWNER:

CONTRACTOR:

By: _____

By: _____

[Corporate Seal]

[Corporate Seal]

Attest _____

Attest _____

Address for Giving Notices

Address for Giving Notices

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: That we (1) _____
_____ a (2) _____ hereinafter
called "Principal" and (3) _____
of _____, State of _____, hereinafter called
the "Surety," are held and firmly bound unto (4) _____
_____, hereinafter called the "Owner," in the penal sum of

_____ dollars (\$ _____) in lawful money of the United States, for the payment of
which sum well and truly to be made, we bind ourselves, our heirs, executors,
administrators and successors, jointly and severally, firmly by these presents.

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

Sanitary Sewer Rehabilitation: Basin 5 Interceptor and Polk Bayou Double Siphon;
City of Batesville, Arkansas; Project No. Ba-138B5I.

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

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

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

This bond is given in compliance with Act 351, Arkansas Acts of 1953, and Act 209, Arkansas Acts of 1957, the same appearing as Arkansas Statutes (1957), Section 51-635, Cumulative Supplement.

IN WITNESS WHEREOF, this instrument is executed in six (6) counterparts, each one of which shall be deemed as original, this the _____ day of _____, _____.

Attest:

Principal

(Principal) Secretary
(Seal)

By _____

Witness as to Principal

Address

Address

Attest:

Surety

(Surety) Secretary

By _____

(Seal)

Attorney-in-Fact

Witness as to Surety

Address

Address

NOTE: Date of bond must not be prior to date of contract.

- (1) Correct name of Contractor.
- (2) A corporation, a partnership, or an individual, as the case may be.
- (3) Correct name of Surety.
- (4) Correct name of Owner.
- (5) If Contractor is a partnership, all partners should execute bond.
- (6) This bond must be filed with the Circuit Clerk of the county where the work is to be performed prior to the start of construction.

PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: That we (1) _____

_____ a (2) _____ hereinafter

called "Principal" and (3) _____

of _____, State of _____, hereinafter called

the "Surety," are held and firmly bound unto (4) _____

_____ hereinafter called the "Owner," in the penal sum of

_____ dollars (\$ _____) in lawful money of the United States, for the payment of which sum well and truly to be made, we bind ourselves, our heirs, executors, administrators and successors, jointly and severally, firmly by these presents.

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

Sanitary Sewer Rehabilitation: Basin 5 Interceptor and Polk Bayou Double Siphon;
City of Batesville, Arkansas; Project No. Ba-138B5I.

NOW THEREFORE, if the Principal shall promptly make payment to all persons, firms, subcontractors and corporations furnishing materials for or performing labor in the prosecution of the work provided for in such contract, and any authorized extension or modification thereof, all amounts due for but not limited to, materials, lubricants, oil, gasoline, coal and coke, repair on machinery, equipment and tools, consumed or used in connection with the construction of said work, fuel oil, camp equipment, food for men, feed for animals, premium for bonds and liability and workmen's compensation insurance, rentals on machinery, equipment and draft animals; also for taxes or payments due the State of Arkansas or any political subdivision thereof which shall have arisen on account of or in connection with the wages earned by workmen covered by the bond; and for all labor, performed in such work whether by subcontractor or otherwise, then this obligation shall be void, otherwise to remain in full force and effect.

The Surety agrees the terms of this bond shall cover the payment by the Principal of not less than the prevailing hourly rate of wages as found by the Arkansas Department of Labor or as determined by the court on appeal to all workmen performing work under the contract.

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

contract or to the work or to the specifications.

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

This bond is given in compliance with Act 351, Arkansas Acts of 1953, and Act 209, Arkansas Acts of 1957, the same appearing as Arkansas Statutes (1957), Section 51-635, Cumulative Supplement.

IN WITNESS WHEREOF, this instrument is executed in six (6) counterparts, each one of which shall be deemed as original, this the _____ day of _____, _____.

Attest:

(Principal) Secretary
(Seal)

Witness as to Principal

Address

Attest:

(Surety) Secretary

(Seal)

Witness as to Surety

Address

Principal

By _____

Address

Surety

By _____

Attorney-in-Fact

Address

NOTE: Date of bond must not be prior to date of contract.

- (1) Correct name of Contractor.
- (2) A corporation, a partnership, or an individual, as the case may be.
- (3) Correct name of Surety.
- (4) Correct name of Owner.
- (5) If Contractor is a partnership, all partners should execute bond.
- (6) This bond must be filed with the Circuit Clerk of the county where the work is to be performed prior to the start of construction.

This document has important legal consequences; consultation with an attorney is encouraged with respect to its use or modification. This document should be adapted to the particular circumstances of the contemplated Project and the controlling Laws and Regulations.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

Prepared by

ENGINEERS JOINT CONTRACT DOCUMENTS COMMITTEE

and

Issued and Published Jointly by

ACEC

AMERICAN COUNCIL OF ENGINEERING COMPANIES



ASCE American Society
of Civil Engineers

**National Society of
Professional Engineers**
Professional Engineers in Private Practice

AMERICAN COUNCIL OF ENGINEERING COMPANIES

ASSOCIATED GENERAL CONTRACTORS OF AMERICA

AMERICAN SOCIETY OF CIVIL ENGINEERS

PROFESSIONAL ENGINEERS IN PRIVATE PRACTICE
A Practice Division of the
NATIONAL SOCIETY OF PROFESSIONAL ENGINEERS

Endorsed by



CONSTRUCTION SPECIFICATIONS INSTITUTE

These General Conditions have been prepared for use with the Suggested Forms of Agreement Between Owner and Contractor (EJCDC C-520 or C-525, 2007 Editions). Their provisions are interrelated and a change in one may necessitate a change in the other. Comments concerning their usage are contained in the Narrative Guide to the EJCDC Construction Documents (EJCDC C-001, 2007 Edition). For guidance in the preparation of Supplementary Conditions, see Guide to the Preparation of Supplementary Conditions (EJCDC C-800, 2007 Edition).

Copyright © 2007 National Society of Professional Engineers
1420 King Street, Alexandria, VA 22314-2794
(703) 684-2882
www.nspe.org

American Council of Engineering Companies
1015 15th Street N.W., Washington, DC 20005
(202) 347-7474
www.acec.org

American Society of Civil Engineers
1801 Alexander Bell Drive, Reston, VA 20191-4400
(800) 548-2723
www.asce.org

Associated General Contractors of America
2300 Wilson Boulevard, Suite 400, Arlington, VA 22201-3308
(703) 548-3118
www.agc.org

The copyright for this EJCDC document is owned jointly by the four EJCDC sponsoring organizations and held in trust for their benefit by NSPE.

STANDARD GENERAL CONDITIONS OF THE CONSTRUCTION CONTRACT

TABLE OF CONTENTS

	Page
Article 1 – Definitions and Terminology.....	1
1.01 Defined Terms.....	1
1.02 Terminology.....	5
Article 2 – Preliminary Matters.....	6
2.01 Delivery of Bonds and Evidence of Insurance.....	6
2.02 Copies of Documents.....	6
2.03 Commencement of Contract Times; Notice to Proceed.....	6
2.04 Starting the Work.....	7
2.05 Before Starting Construction.....	7
2.06 Preconstruction Conference; Designation of Authorized Representatives.....	7
2.07 Initial Acceptance of Schedules.....	7
Article 3 – Contract Documents: Intent, Amending, Reuse.....	8
3.01 Intent.....	8
3.02 Reference Standards.....	8
3.03 Reporting and Resolving Discrepancies.....	9
3.04 Amending and Supplementing Contract Documents.....	9
3.05 Reuse of Documents.....	10
3.06 Electronic Data.....	10
Article 4 – Availability of Lands; Subsurface and Physical Conditions; Hazardous Environmental Conditions; Reference Points.....	11
4.01 Availability of Lands.....	11
4.02 Subsurface and Physical Conditions.....	11
4.03 Differing Subsurface or Physical Conditions.....	12
4.04 Underground Facilities.....	13
4.05 Reference Points.....	14
4.06 Hazardous Environmental Condition at Site.....	14
Article 5 – Bonds and Insurance.....	16
5.01 Performance, Payment, and Other Bonds.....	16
5.02 Licensed Sureties and Insurers.....	16
5.03 Certificates of Insurance.....	17
5.04 Contractor’s Insurance.....	17
5.05 Owner’s Liability Insurance.....	19
5.06 Property Insurance.....	19
5.07 Waiver of Rights.....	20
5.08 Receipt and Application of Insurance Proceeds.....	21

5.09	Acceptance of Bonds and Insurance; Option to Replace	21
5.10	Partial Utilization, Acknowledgment of Property Insurer	22
Article 6 – Contractor’s Responsibilities		22
6.01	Supervision and Superintendence	22
6.02	Labor; Working Hours	22
6.03	Services, Materials, and Equipment	22
6.04	Progress Schedule	23
6.05	Substitutes and “Or-Equals”	23
6.06	Concerning Subcontractors, Suppliers, and Others	25
6.07	Patent Fees and Royalties	27
6.08	Permits	27
6.09	Laws and Regulations	28
6.10	Taxes	28
6.11	Use of Site and Other Areas	28
6.12	Record Documents	29
6.13	Safety and Protection	29
6.14	Safety Representative	30
6.15	Hazard Communication Programs	30
6.16	Emergencies	30
6.17	Shop Drawings and Samples	31
6.18	Continuing the Work	32
6.19	Contractor’s General Warranty and Guarantee	33
6.20	Indemnification	33
6.21	Delegation of Professional Design Services	34
Article 7 – Other Work at the Site		35
7.01	Related Work at Site	35
7.02	Coordination	35
7.03	Legal Relationships	36
Article 8 – Owner’s Responsibilities		36
8.01	Communications to Contractor	36
8.02	Replacement of Engineer	36
8.03	Furnish Data	36
8.04	Pay When Due	36
8.05	Lands and Easements; Reports and Tests	36
8.06	Insurance	36
8.07	Change Orders	37
8.08	Inspections, Tests, and Approvals	37
8.09	Limitations on Owner’s Responsibilities	37
8.10	Undisclosed Hazardous Environmental Condition	37
8.11	Evidence of Financial Arrangements	37
8.12	Compliance with Safety Program	37
Article 9 – Engineer’s Status During Construction		37
9.01	Owner’s Representative	37

9.02	Visits to Site	37
9.03	Project Representative.....	38
9.04	Authorized Variations in Work.....	38
9.05	Rejecting Defective Work.....	38
9.06	Shop Drawings, Change Orders and Payments	39
9.07	Determinations for Unit Price Work.....	39
9.08	Decisions on Requirements of Contract Documents and Acceptability of Work	39
9.09	Limitations on Engineer's Authority and Responsibilities.....	39
9.10	Compliance with Safety Program	40
Article 10 – Changes in the Work; Claims.....		40
10.01	Authorized Changes in the Work.....	40
10.02	Unauthorized Changes in the Work.....	41
10.03	Execution of Change Orders	41
10.04	Notification to Surety	41
10.05	Claims.....	41
Article 11 – Cost of the Work; Allowances; Unit Price Work		42
11.01	Cost of the Work	42
11.02	Allowances	45
11.03	Unit Price Work.....	45
Article 12 – Change of Contract Price; Change of Contract Times.....		46
12.01	Change of Contract Price	46
12.02	Change of Contract Times	47
12.03	Delays	47
Article 13 – Tests and Inspections; Correction, Removal or Acceptance of Defective Work		48
13.01	Notice of Defects	48
13.02	Access to Work	48
13.03	Tests and Inspections.....	49
13.04	Uncovering Work	49
13.05	Owner May Stop the Work	50
13.06	Correction or Removal of Defective Work	50
13.07	Correction Period	50
13.08	Acceptance of Defective Work	51
13.09	Owner May Correct Defective Work.....	52
Article 14 – Payments to Contractor and Completion		52
14.01	Schedule of Values.....	52
14.02	Progress Payments.....	52
14.03	Contractor's Warranty of Title.....	55
14.04	Substantial Completion	55
14.05	Partial Utilization	56
14.06	Final Inspection	57
14.07	Final Payment.....	57
14.08	Final Completion Delayed	58

14.09 Waiver of Claims	58
Article 15 – Suspension of Work and Termination.....	59
15.01 Owner May Suspend Work.....	59
15.02 Owner May Terminate for Cause.....	59
15.03 Owner May Terminate For Convenience	60
15.04 Contractor May Stop Work or Terminate.....	60
Article 16 – Dispute Resolution.....	61
16.01 Methods and Procedures	61
Article 17 – Miscellaneous	61
17.01 Giving Notice	61
17.02 Computation of Times.....	62
17.03 Cumulative Remedies	62
17.04 Survival of Obligations	62
17.05 Controlling Law.....	62
17.06 Headings	62

ARTICLE 1 – DEFINITIONS AND TERMINOLOGY

1.01 *Defined Terms*

- A. Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.
1. *Addenda*—Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.
 2. *Agreement*—The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.
 3. *Application for Payment*—The form acceptable to Engineer which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.
 4. *Asbestos*—Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.
 5. *Bid*—The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.
 6. *Bidder*—The individual or entity who submits a Bid directly to Owner.
 7. *Bidding Documents*—The Bidding Requirements and the proposed Contract Documents (including all Addenda).
 8. *Bidding Requirements*—The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.
 9. *Change Order*—A document recommended by Engineer which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.
 10. *Claim*—A demand or assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, or other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.
 11. *Contract*—The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

12. *Contract Documents*—Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.
13. *Contract Price*—The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).
14. *Contract Times*—The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any; (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Engineer's written recommendation of final payment.
15. *Contractor*—The individual or entity with whom Owner has entered into the Agreement.
16. *Cost of the Work*—See Paragraph 11.01 for definition.
17. *Drawings*—That part of the Contract Documents prepared or approved by Engineer which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.
18. *Effective Date of the Agreement*—The date indicated in the Agreement on which it becomes effective, but if no such date is indicated, it means the date on which the Agreement is signed and delivered by the last of the two parties to sign and deliver.
19. *Engineer*—The individual or entity named as such in the Agreement.
20. *Field Order*—A written order issued by Engineer which requires minor changes in the Work but which does not involve a change in the Contract Price or the Contract Times.
21. *General Requirements*—Sections of Division 1 of the Specifications.
22. *Hazardous Environmental Condition*—The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Waste, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.
23. *Hazardous Waste*—The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.
24. *Laws and Regulations; Laws or Regulations*—Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.
25. *Liens*—Charges, security interests, or encumbrances upon Project funds, real property, or personal property.
26. *Milestone*—A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

27. *Notice of Award*—The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the conditions precedent listed therein, Owner will sign and deliver the Agreement.
28. *Notice to Proceed*—A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.
29. *Owner*—The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.
30. *PCBs*—Polychlorinated biphenyls.
31. *Petroleum*—Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.
32. *Progress Schedule*—A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.
33. *Project*—The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.
34. *Project Manual*—The bound documentary information prepared for bidding and constructing the Work. A listing of the contents of the Project Manual, which may be bound in one or more volumes, is contained in the table(s) of contents.
35. *Radioactive Material*—Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.
36. *Resident Project Representative*—The authorized representative of Engineer who may be assigned to the Site or any part thereof.
37. *Samples*—Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work and which establish the standards by which such portion of the Work will be judged.
38. *Schedule of Submittals*—A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.
39. *Schedule of Values*—A schedule, prepared and maintained by Contractor, allocating portions of the Contract Price to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

40. *Shop Drawings*—All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.
41. *Site*—Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights-of-way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.
42. *Specifications*—That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.
43. *Subcontractor*—An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.
44. *Substantial Completion*—The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms “substantially complete” and “substantially completed” as applied to all or part of the Work refer to Substantial Completion thereof.
45. *Successful Bidder*—The Bidder submitting a responsive Bid to whom Owner makes an award.
46. *Supplementary Conditions*—That part of the Contract Documents which amends or supplements these General Conditions.
47. *Supplier*—A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.
48. *Underground Facilities*—All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water, wastewater, storm water, other liquids or chemicals, or traffic or other control systems.
49. *Unit Price Work*—Work to be paid for on the basis of unit prices.
50. *Work*—The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.
51. *Work Change Directive*—A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Engineer ordering an

addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.02 Terminology

A. The words and terms discussed in Paragraph 1.02.B through F are not defined but, when used in the Bidding Requirements or Contract Documents, have the indicated meaning.

B. *Intent of Certain Terms or Adjectives:*

1. The Contract Documents include the terms "as allowed," "as approved," "as ordered," "as directed" or terms of like effect or import to authorize an exercise of professional judgment by Engineer. In addition, the adjectives "reasonable," "suitable," "acceptable," "proper," "satisfactory," or adjectives of like effect or import are used to describe an action or determination of Engineer as to the Work. It is intended that such exercise of professional judgment, action, or determination will be solely to evaluate, in general, the Work for compliance with the information in the Contract Documents and with the design concept of the Project as a functioning whole as shown or indicated in the Contract Documents (unless there is a specific statement indicating otherwise). The use of any such term or adjective is not intended to and shall not be effective to assign to Engineer any duty or authority to supervise or direct the performance of the Work, or any duty or authority to undertake responsibility contrary to the provisions of Paragraph 9.09 or any other provision of the Contract Documents.

C. *Day:*

1. The word "day" means a calendar day of 24 hours measured from midnight to the next midnight.

D. *Defective:*

1. The word "defective," when modifying the word "Work," refers to Work that is unsatisfactory, faulty, or deficient in that it:
 - a. does not conform to the Contract Documents; or
 - b. does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or
 - c. has been damaged prior to Engineer's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

E. *Furnish, Install, Perform, Provide:*

1. The word "furnish," when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.
 2. The word "install," when used in connection with services, materials, or equipment, shall mean to put into use or place in final position said services, materials, or equipment complete and ready for intended use.
 3. The words "perform" or "provide," when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.
 4. When "furnish," "install," "perform," or "provide" is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, "provide" is implied.
- F. Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

ARTICLE 2 – PRELIMINARY MATTERS

2.01 *Delivery of Bonds and Evidence of Insurance*

- A. When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.
- B. *Evidence of Insurance:* Before any Work at the Site is started, Contractor and Owner shall each deliver to the other, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance which either of them or any additional insured may reasonably request) which Contractor and Owner respectively are required to purchase and maintain in accordance with Article 5.

2.02 *Copies of Documents*

- A. Owner shall furnish to Contractor up to ten printed or hard copies of the Drawings and Project Manual. Additional copies will be furnished upon request at the cost of reproduction.

2.03 *Commencement of Contract Times; Notice to Proceed*

- A. The Contract Times will commence to run on the thirtieth day after the Effective Date of the Agreement or, if a Notice to Proceed is given, on the day indicated in the Notice to Proceed. A Notice to Proceed may be given at any time within 30 days after the Effective Date of the Agreement. In no event will the Contract Times commence to run later than the sixtieth day after the day of Bid opening or the thirtieth day after the Effective Date of the Agreement, whichever date is earlier.

2.04 *Starting the Work*

- A. Contractor shall start to perform the Work on the date when the Contract Times commence to run. No Work shall be done at the Site prior to the date on which the Contract Times commence to run.

2.05 *Before Starting Construction*

- A. *Preliminary Schedules:* Within 10 days after the Effective Date of the Agreement (unless otherwise specified in the General Requirements), Contractor shall submit to Engineer for timely review:
 - 1. a preliminary Progress Schedule indicating the times (numbers of days or dates) for starting and completing the various stages of the Work, including any Milestones specified in the Contract Documents;
 - 2. a preliminary Schedule of Submittals; and
 - 3. a preliminary Schedule of Values for all of the Work which includes quantities and prices of items which when added together equal the Contract Price and subdivides the Work into component parts in sufficient detail to serve as the basis for progress payments during performance of the Work. Such prices will include an appropriate amount of overhead and profit applicable to each item of Work.

2.06 *Preconstruction Conference; Designation of Authorized Representatives*

- A. Before any Work at the Site is started, a conference attended by Owner, Contractor, Engineer, and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in Paragraph 2.05.A, procedures for handling Shop Drawings and other submittals, processing Applications for Payment, and maintaining required records.
- B. At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.07 *Initial Acceptance of Schedules*

- A. At least 10 days before submission of the first Application for Payment a conference attended by Contractor, Engineer, and others as appropriate will be held to review for acceptability to Engineer as provided below the schedules submitted in accordance with Paragraph 2.05.A. Contractor shall have an additional 10 days to make corrections and adjustments and to complete and resubmit the schedules. No progress payment shall be made to Contractor until acceptable schedules are submitted to Engineer.
 - 1. The Progress Schedule will be acceptable to Engineer if it provides an orderly progression of the Work to completion within the Contract Times. Such acceptance will not impose on

Engineer responsibility for the Progress Schedule, for sequencing, scheduling, or progress of the Work, nor interfere with or relieve Contractor from Contractor's full responsibility therefor.

2. Contractor's Schedule of Submittals will be acceptable to Engineer if it provides a workable arrangement for reviewing and processing the required submittals.
3. Contractor's Schedule of Values will be acceptable to Engineer as to form and substance if it provides a reasonable allocation of the Contract Price to component parts of the Work.

ARTICLE 3 – CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 *Intent*

- A. The Contract Documents are complementary; what is required by one is as binding as if required by all.
- B. It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for, at no additional cost to Owner.
- C. Clarifications and interpretations of the Contract Documents shall be issued by Engineer as provided in Article 9.

3.02 *Reference Standards*

A. Standards, Specifications, Codes, Laws, and Regulations

1. Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
2. No provision of any such standard, specification, manual, or code, or any instruction of a Supplier, shall be effective to change the duties or responsibilities of Owner, Contractor, or Engineer, or any of their subcontractors, consultants, agents, or employees, from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 *Reporting and Resolving Discrepancies*

A. *Reporting Discrepancies:*

1. *Contractor's Review of Contract Documents Before Starting Work:* Before undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Engineer any conflict, error, ambiguity, or discrepancy which Contractor discovers, or has actual knowledge of, and shall obtain a written interpretation or clarification from Engineer before proceeding with any Work affected thereby.
2. *Contractor's Review of Contract Documents During Performance of Work:* If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Engineer in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.04.
3. Contractor shall not be liable to Owner or Engineer for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof.

B. *Resolving Discrepancies:*

1. Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:
 - a. the provisions of any standard, specification, manual, or code, or the instruction of any Supplier (whether or not specifically incorporated by reference in the Contract Documents); or
 - b. the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 *Amending and Supplementing Contract Documents*

- A. The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by either a Change Order or a Work Change Directive.
- B. The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:

1. A Field Order;
2. Engineer's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17.D.3); or
3. Engineer's written interpretation or clarification.

3.05 *Reuse of Documents*

A. Contractor and any Subcontractor or Supplier shall not:

1. have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of Engineer or its consultants, including electronic media editions; or
2. reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Engineer and specific written verification or adaptation by Engineer.

B. The prohibitions of this Paragraph 3.05 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.06 *Electronic Data*

- A. Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Engineer to Contractor, or by Contractor to Owner or Engineer, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.
- B. Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60-day acceptance period will be corrected by the transferring party.
- C. When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

**ARTICLE 4 – AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS;
HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS**

4.01 *Availability of Lands*

- A. Owner shall furnish the Site. Owner shall notify Contractor of any encumbrances or restrictions not of general application but specifically related to use of the Site with which Contractor must comply in performing the Work. Owner will obtain in a timely manner and pay for easements for permanent structures or permanent changes in existing facilities. If Contractor and Owner are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, as a result of any delay in Owner's furnishing the Site or a part thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.
- B. Upon reasonable written request, Owner shall furnish Contractor with a current statement of record legal title and legal description of the lands upon which the Work is to be performed and Owner's interest therein as necessary for giving notice of or filing a mechanic's or construction lien against such lands in accordance with applicable Laws and Regulations.
- C. Contractor shall provide for all additional lands and access thereto that may be required for temporary construction facilities or storage of materials and equipment.

4.02 *Subsurface and Physical Conditions*

- A. *Reports and Drawings:* The Supplementary Conditions identify:
 - 1. those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and
 - 2. those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).
- B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
 - 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or
 - 2. other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or
 - 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 *Differing Subsurface or Physical Conditions*

A. *Notice:* If Contractor believes that any subsurface or physical condition that is uncovered or revealed either:

1. is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or
2. is of such a nature as to require a change in the Contract Documents; or
3. differs materially from that shown or indicated in the Contract Documents; or
4. is of an unusual nature, and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents;

then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Engineer in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

B. *Engineer's Review:* After receipt of written notice as required by Paragraph 4.03.A, Engineer will promptly review the pertinent condition, determine the necessity of Owner's obtaining additional exploration or tests with respect thereto, and advise Owner in writing (with a copy to Contractor) of Engineer's findings and conclusions.

C. *Possible Price and Times Adjustments:*

1. The Contract Price or the Contract Times, or both, will be equitably adjusted to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for, performance of the Work; subject, however, to the following:
 - a. such condition must meet any one or more of the categories described in Paragraph 4.03.A; and
 - b. with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.
2. Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:
 - a. Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or
 - b. the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and

contiguous areas required by the Bidding Requirements or Contract Documents to be conducted by or for Contractor prior to Contractor's making such final commitment; or

- c. Contractor failed to give the written notice as required by Paragraph 4.03.A.
3. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 *Underground Facilities*

A. *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the Site is based on information and data furnished to Owner or Engineer by the owners of such Underground Facilities, including Owner, or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

1. Owner and Engineer shall not be responsible for the accuracy or completeness of any such information or data provided by others; and
2. the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:
 - a. reviewing and checking all such information and data;
 - b. locating all Underground Facilities shown or indicated in the Contract Documents;
 - c. coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and
 - d. the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

B. *Not Shown or Indicated:*

1. If an Underground Facility is uncovered or revealed at or contiguous to the Site which was not shown or indicated, or not shown or indicated with reasonable accuracy in the Contract Documents, Contractor shall, promptly after becoming aware thereof and before further disturbing conditions affected thereby or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), identify the owner of such Underground Facility and give written notice to that owner and to Owner and Engineer. Engineer will promptly review the Underground Facility and determine the extent, if any, to which a change is required in the Contract Documents to reflect and document the

consequences of the existence or location of the Underground Facility. During such time, Contractor shall be responsible for the safety and protection of such Underground Facility.

2. If Engineer concludes that a change in the Contract Documents is required, a Work Change Directive or a Change Order will be issued to reflect and document such consequences. An equitable adjustment shall be made in the Contract Price or Contract Times, or both, to the extent that they are attributable to the existence or location of any Underground Facility that was not shown or indicated or not shown or indicated with reasonable accuracy in the Contract Documents and that Contractor did not know of and could not reasonably have been expected to be aware of or to have anticipated. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment in Contract Price or Contract Times, Owner or Contractor may make a Claim therefor as provided in Paragraph 10.05.

4.05 *Reference Points*

- A. Owner shall provide engineering surveys to establish reference points for construction which in Engineer's judgment are necessary to enable Contractor to proceed with the Work. Contractor shall be responsible for laying out the Work, shall protect and preserve the established reference points and property monuments, and shall make no changes or relocations without the prior written approval of Owner. Contractor shall report to Engineer whenever any reference point or property monument is lost or destroyed or requires relocation because of necessary changes in grades or locations, and shall be responsible for the accurate replacement or relocation of such reference points or property monuments by professionally qualified personnel.

4.06 *Hazardous Environmental Condition at Site*

- A. *Reports and Drawings:* The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.
- B. *Limited Reliance by Contractor on Technical Data Authorized:* Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Engineer, or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors with respect to:
 1. the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or
 2. other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or
 3. any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions or information.

- C. Contractor shall not be responsible for any Hazardous Environmental Condition uncovered or revealed at the Site which was not shown or indicated in Drawings or Specifications or identified in the Contract Documents to be within the scope of the Work. Contractor shall be responsible for a Hazardous Environmental Condition created with any materials brought to the Site by Contractor, Subcontractors, Suppliers, or anyone else for whom Contractor is responsible.
- D. If Contractor encounters a Hazardous Environmental Condition or if Contractor or anyone for whom Contractor is responsible creates a Hazardous Environmental Condition, Contractor shall immediately: (i) secure or otherwise isolate such condition; (ii) stop all Work in connection with such condition and in any area affected thereby (except in an emergency as required by Paragraph 6.16.A); and (iii) notify Owner and Engineer (and promptly thereafter confirm such notice in writing). Owner shall promptly consult with Engineer concerning the necessity for Owner to retain a qualified expert to evaluate such condition or take corrective action, if any. Promptly after consulting with Engineer, Owner shall take such actions as are necessary to permit Owner to timely obtain required permits and provide Contractor the written notice required by Paragraph 4.06.E.
- E. Contractor shall not be required to resume Work in connection with such condition or in any affected area until after Owner has obtained any required permits related thereto and delivered written notice to Contractor: (i) specifying that such condition and any affected area is or has been rendered safe for the resumption of Work; or (ii) specifying any special conditions under which such Work may be resumed safely. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of any adjustment in Contract Price or Contract Times, or both, as a result of such Work stoppage or such special conditions under which Work is agreed to be resumed by Contractor, either party may make a Claim therefor as provided in Paragraph 10.05.
- F. If after receipt of such written notice Contractor does not agree to resume such Work based on a reasonable belief it is unsafe, or does not agree to resume such Work under such special conditions, then Owner may order the portion of the Work that is in the area affected by such condition to be deleted from the Work. If Owner and Contractor cannot agree as to entitlement to or on the amount or extent, if any, of an adjustment in Contract Price or Contract Times as a result of deleting such portion of the Work, then either party may make a Claim therefor as provided in Paragraph 10.05. Owner may have such deleted portion of the Work performed by Owner's own forces or others in accordance with Article 7.
- G. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition, provided that such Hazardous Environmental Condition: (i) was not shown or indicated in the Drawings or Specifications or identified in the Contract Documents to be included within the scope of the Work, and (ii) was not created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.G shall obligate Owner to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.

- H. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to a Hazardous Environmental Condition created by Contractor or by anyone for whom Contractor is responsible. Nothing in this Paragraph 4.06.H shall obligate Contractor to indemnify any individual or entity from and against the consequences of that individual's or entity's own negligence.
- I. The provisions of Paragraphs 4.02, 4.03, and 4.04 do not apply to a Hazardous Environmental Condition uncovered or revealed at the Site.

ARTICLE 5 – BONDS AND INSURANCE

5.01 *Performance, Payment, and Other Bonds*

- A. Contractor shall furnish performance and payment bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all of Contractor's obligations under the Contract Documents. These bonds shall remain in effect until one year after the date when final payment becomes due or until completion of the correction period specified in Paragraph 13.07, whichever is later, except as provided otherwise by Laws or Regulations or by the Contract Documents. Contractor shall also furnish such other bonds as are required by the Contract Documents.
- B. All bonds shall be in the form prescribed by the Contract Documents except as provided otherwise by Laws or Regulations, and shall be executed by such sureties as are named in the list of "Companies Holding Certificates of Authority as Acceptable Sureties on Federal Bonds and as Acceptable Reinsuring Companies" as published in Circular 570 (amended) by the Financial Management Service, Surety Bond Branch, U.S. Department of the Treasury. All bonds signed by an agent or attorney-in-fact must be accompanied by a certified copy of that individual's authority to bind the surety. The evidence of authority shall show that it is effective on the date the agent or attorney-in-fact signed each bond.
- C. If the surety on any bond furnished by Contractor is declared bankrupt or becomes insolvent or its right to do business is terminated in any state where any part of the Project is located or it ceases to meet the requirements of Paragraph 5.01.B, Contractor shall promptly notify Owner and Engineer and shall, within 20 days after the event giving rise to such notification, provide another bond and surety, both of which shall comply with the requirements of Paragraphs 5.01.B and 5.02.

5.02 *Licensed Sureties and Insurers*

- A. All bonds and insurance required by the Contract Documents to be purchased and maintained by Owner or Contractor shall be obtained from surety or insurance companies that are duly licensed or authorized in the jurisdiction in which the Project is located to issue bonds or insurance policies for the limits and coverages so required. Such surety and insurance companies shall also

meet such additional requirements and qualifications as may be provided in the Supplementary Conditions.

5.03 *Certificates of Insurance*

- A. Contractor shall deliver to Owner, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Owner or any other additional insured) which Contractor is required to purchase and maintain.
- B. Owner shall deliver to Contractor, with copies to each additional insured and loss payee identified in the Supplementary Conditions, certificates of insurance (and other evidence of insurance requested by Contractor or any other additional insured) which Owner is required to purchase and maintain.
- C. Failure of Owner to demand such certificates or other evidence of Contractor's full compliance with these insurance requirements or failure of Owner to identify a deficiency in compliance from the evidence provided shall not be construed as a waiver of Contractor's obligation to maintain such insurance.
- D. Owner does not represent that insurance coverage and limits established in this Contract necessarily will be adequate to protect Contractor.
- E. The insurance and insurance limits required herein shall not be deemed as a limitation on Contractor's liability under the indemnities granted to Owner in the Contract Documents.

5.04 *Contractor's Insurance*

- A. Contractor shall purchase and maintain such insurance as is appropriate for the Work being performed and as will provide protection from claims set forth below which may arise out of or result from Contractor's performance of the Work and Contractor's other obligations under the Contract Documents, whether it is to be performed by Contractor, any Subcontractor or Supplier, or by anyone directly or indirectly employed by any of them to perform any of the Work, or by anyone for whose acts any of them may be liable:
 - 1. claims under workers' compensation, disability benefits, and other similar employee benefit acts;
 - 2. claims for damages because of bodily injury, occupational sickness or disease, or death of Contractor's employees;
 - 3. claims for damages because of bodily injury, sickness or disease, or death of any person other than Contractor's employees;
 - 4. claims for damages insured by reasonably available personal injury liability coverage which are sustained:

- a. by any person as a result of an offense directly or indirectly related to the employment of such person by Contractor, or
 - b. by any other person for any other reason;
5. claims for damages, other than to the Work itself, because of injury to or destruction of tangible property wherever located, including loss of use resulting therefrom; and
 6. claims for damages because of bodily injury or death of any person or property damage arising out of the ownership, maintenance or use of any motor vehicle.
- B. The policies of insurance required by this Paragraph 5.04 shall:
1. with respect to insurance required by Paragraphs 5.04.A.3 through 5.04.A.6 inclusive, be written on an occurrence basis, include as additional insureds (subject to any customary exclusion regarding professional liability) Owner and Engineer, and any other individuals or entities identified in the Supplementary Conditions, all of whom shall be listed as additional insureds, and include coverage for the respective officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of all such additional insureds, and the insurance afforded to these additional insureds shall provide primary coverage for all claims covered thereby;
 2. include at least the specific coverages and be written for not less than the limits of liability provided in the Supplementary Conditions or required by Laws or Regulations, whichever is greater;
 3. include contractual liability insurance covering Contractor's indemnity obligations under Paragraphs 6.11 and 6.20;
 4. contain a provision or endorsement that the coverage afforded will not be canceled, materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other additional insured identified in the Supplementary Conditions to whom a certificate of insurance has been issued (and the certificates of insurance furnished by the Contractor pursuant to Paragraph 5.03 will so provide);
 5. remain in effect at least until final payment and at all times thereafter when Contractor may be correcting, removing, or replacing defective Work in accordance with Paragraph 13.07; and
 6. include completed operations coverage:
 - a. Such insurance shall remain in effect for two years after final payment.
 - b. Contractor shall furnish Owner and each other additional insured identified in the Supplementary Conditions, to whom a certificate of insurance has been issued, evidence satisfactory to Owner and any such additional insured of continuation of such insurance at final payment and one year thereafter.

5.05 *Owner's Liability Insurance*

- A. In addition to the insurance required to be provided by Contractor under Paragraph 5.04, Owner, at Owner's option, may purchase and maintain at Owner's expense Owner's own liability insurance as will protect Owner against claims which may arise from operations under the Contract Documents.

5.06 *Property Insurance*

- A. Unless otherwise provided in the Supplementary Conditions, Owner shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof (subject to such deductible amounts as may be provided in the Supplementary Conditions or required by Laws and Regulations). This insurance shall:
1. include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee;
 2. be written on a Builder's Risk "all-risk" policy form that shall at least include insurance for physical loss or damage to the Work, temporary buildings, falsework, and materials and equipment in transit, and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood), and such other perils or causes of loss as may be specifically required by the Supplementary Conditions.
 3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);
 4. cover materials and equipment stored at the Site or at another location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;
 5. allow for partial utilization of the Work by Owner;
 6. include testing and startup; and
 7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other loss payee to whom a certificate of insurance has been issued.
- B. Owner shall purchase and maintain such equipment breakdown insurance or additional property insurance as may be required by the Supplementary Conditions or Laws and Regulations which will include the interests of Owner, Contractor, Subcontractors, and Engineer, and any other individuals or entities identified in the Supplementary Conditions, and the officers, directors,

members, partners, employees, agents, consultants and subcontractors of each and any of them, each of whom is deemed to have an insurable interest and shall be listed as a loss payee.

- C. All the policies of insurance (and the certificates or other evidence thereof) required to be purchased and maintained in accordance with this Paragraph 5.06 will contain a provision or endorsement that the coverage afforded will not be canceled or materially changed or renewal refused until at least 30 days prior written notice has been given to Owner and Contractor and to each other loss payee to whom a certificate of insurance has been issued and will contain waiver provisions in accordance with Paragraph 5.07.
- D. Owner shall not be responsible for purchasing and maintaining any property insurance specified in this Paragraph 5.06 to protect the interests of Contractor, Subcontractors, or others in the Work to the extent of any deductible amounts that are identified in the Supplementary Conditions. The risk of loss within such identified deductible amount will be borne by Contractor, Subcontractors, or others suffering any such loss, and if any of them wishes property insurance coverage within the limits of such amounts, each may purchase and maintain it at the purchaser's own expense.
- E. If Contractor requests in writing that other special insurance be included in the property insurance policies provided under this Paragraph 5.06, Owner shall, if possible, include such insurance, and the cost thereof will be charged to Contractor by appropriate Change Order. Prior to commencement of the Work at the Site, Owner shall in writing advise Contractor whether or not such other insurance has been procured by Owner.

5.07 *Waiver of Rights*

- A. Owner and Contractor intend that all policies purchased in accordance with Paragraph 5.06 will protect Owner, Contractor, Subcontractors, and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) in such policies and will provide primary coverage for all losses and damages caused by the perils or causes of loss covered thereby. All such policies shall contain provisions to the effect that in the event of payment of any loss or damage the insurers will have no rights of recovery against any of the insureds or loss payees thereunder. Owner and Contractor waive all rights against each other and their respective officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for all losses and damages caused by, arising out of or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work; and, in addition, waive all such rights against Subcontractors and Engineer, and all other individuals or entities identified in the Supplementary Conditions as loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) under such policies for losses and damages so caused. None of the above waivers shall extend to the rights that any party making such waiver may have to the proceeds of insurance held by Owner as trustee or otherwise payable under any policy so issued.
- B. Owner waives all rights against Contractor, Subcontractors, and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them for:

1. loss due to business interruption, loss of use, or other consequential loss extending beyond direct physical loss or damage to Owner's property or the Work caused by, arising out of, or resulting from fire or other perils whether or not insured by Owner; and
 2. loss or damage to the completed Project or part thereof caused by, arising out of, or resulting from fire or other insured peril or cause of loss covered by any property insurance maintained on the completed Project or part thereof by Owner during partial utilization pursuant to Paragraph 14.05, after Substantial Completion pursuant to Paragraph 14.04, or after final payment pursuant to Paragraph 14.07.
- C. Any insurance policy maintained by Owner covering any loss, damage or consequential loss referred to in Paragraph 5.07.B shall contain provisions to the effect that in the event of payment of any such loss, damage, or consequential loss, the insurers will have no rights of recovery against Contractor, Subcontractors, or Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them.

5.08 *Receipt and Application of Insurance Proceeds*

- A. Any insured loss under the policies of insurance required by Paragraph 5.06 will be adjusted with Owner and made payable to Owner as fiduciary for the loss payees, as their interests may appear, subject to the requirements of any applicable mortgage clause and of Paragraph 5.08.B. Owner shall deposit in a separate account any money so received and shall distribute it in accordance with such agreement as the parties in interest may reach. If no other special agreement is reached, the damaged Work shall be repaired or replaced, the moneys so received applied on account thereof, and the Work and the cost thereof covered by an appropriate Change Order.
- B. Owner as fiduciary shall have power to adjust and settle any loss with the insurers unless one of the parties in interest shall object in writing within 15 days after the occurrence of loss to Owner's exercise of this power. If such objection be made, Owner as fiduciary shall make settlement with the insurers in accordance with such agreement as the parties in interest may reach. If no such agreement among the parties in interest is reached, Owner as fiduciary shall adjust and settle the loss with the insurers and, if required in writing by any party in interest, Owner as fiduciary shall give bond for the proper performance of such duties.

5.09 *Acceptance of Bonds and Insurance; Option to Replace*

- A. If either Owner or Contractor has any objection to the coverage afforded by or other provisions of the bonds or insurance required to be purchased and maintained by the other party in accordance with Article 5 on the basis of non-conformance with the Contract Documents, the objecting party shall so notify the other party in writing within 10 days after receipt of the certificates (or other evidence requested) required by Paragraph 2.01.B. Owner and Contractor shall each provide to the other such additional information in respect of insurance provided as the other may reasonably request. If either party does not purchase or maintain all of the bonds and insurance required of such party by the Contract Documents, such party shall notify the other party in writing of such failure to purchase prior to the start of the Work, or of such failure to maintain prior to any change in the required coverage. Without prejudice to any other right or remedy, the other party may elect to obtain equivalent bonds or insurance to protect such other party's

interests at the expense of the party who was required to provide such coverage, and a Change Order shall be issued to adjust the Contract Price accordingly.

5.10 *Partial Utilization, Acknowledgment of Property Insurer*

- A. If Owner finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work as provided in Paragraph 14.05, no such use or occupancy shall commence before the insurers providing the property insurance pursuant to Paragraph 5.06 have acknowledged notice thereof and in writing effected any changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be canceled or permitted to lapse on account of any such partial use or occupancy.

ARTICLE 6 – CONTRACTOR’S RESPONSIBILITIES

6.01 *Supervision and Superintendence*

- A. Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Engineer in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.
- B. At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Engineer except under extraordinary circumstances.

6.02 *Labor; Working Hours*

- A. Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.
- B. Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner’s written consent (which will not be unreasonably withheld) given after prior written notice to Engineer.

6.03 *Services, Materials, and Equipment*

- A. Unless otherwise specified in the Contract Documents, Contractor shall provide and assume full responsibility for all services, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities, and all other facilities and incidentals necessary for the performance, testing, start-up, and completion of the Work.

- B. All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Engineer, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.
- C. All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 *Progress Schedule*

- A. Contractor shall adhere to the Progress Schedule established in accordance with Paragraph 2.07 as it may be adjusted from time to time as provided below.
 - 1. Contractor shall submit to Engineer for acceptance (to the extent indicated in Paragraph 2.07) proposed adjustments in the Progress Schedule that will not result in changing the Contract Times. Such adjustments will comply with any provisions of the General Requirements applicable thereto.
 - 2. Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order.

6.05 *Substitutes and "Or-Equals"*

- A. Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. Unless the specification or description contains or is followed by words reading that no like, equivalent, or "or-equal" item or no substitution is permitted, other items of material or equipment or material or equipment of other Suppliers may be submitted to Engineer for review under the circumstances described below.
 - 1. "*Or-Equal*" Items: If in Engineer's sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Engineer as an "or-equal" item, in which case review and approval of the proposed item may, in Engineer's sole discretion, be accomplished without compliance with some or all of the requirements for approval of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:
 - a. in the exercise of reasonable judgment Engineer determines that:
 - 1) it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

- 2) it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and
 - 3) it has a proven record of performance and availability of responsive service.
- b. Contractor certifies that, if approved and incorporated into the Work:
- 1) there will be no increase in cost to the Owner or increase in Contract Times; and
 - 2) it will conform substantially to the detailed requirements of the item named in the Contract Documents.

2. *Substitute Items:*

- a. If in Engineer's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or-equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.
- b. Contractor shall submit sufficient information as provided below to allow Engineer to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Engineer from anyone other than Contractor.
- c. The requirements for review by Engineer will be as set forth in Paragraph 6.05.A.2.d, as supplemented by the General Requirements, and as Engineer may decide is appropriate under the circumstances.
- d. Contractor shall make written application to Engineer for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:
 - 1) shall certify that the proposed substitute item will:
 - a) perform adequately the functions and achieve the results called for by the general design,
 - b) be similar in substance to that specified, and
 - c) be suited to the same use as that specified;
 - 2) will state:
 - a) the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time,
 - b) whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item, and

- c) whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;
 - 3) will identify:
 - a) all variations of the proposed substitute item from that specified, and
 - b) available engineering, sales, maintenance, repair, and replacement services; and
 - 4) shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.
- B. *Substitute Construction Methods or Procedures:* If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Engineer. Contractor shall submit sufficient information to allow Engineer, in Engineer's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Engineer will be similar to those provided in Paragraph 6.05.A.2.
- C. *Engineer's Evaluation:* Engineer will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.B. Engineer may require Contractor to furnish additional data about the proposed substitute item. Engineer will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Engineer's review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved Shop Drawing for an "or equal." Engineer will advise Contractor in writing of any negative determination.
- D. *Special Guarantee:* Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.
- E. *Engineer's Cost Reimbursement:* Engineer will record Engineer's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A.2 and 6.05.B. Whether or not Engineer approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the reasonable charges of Engineer for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the reasonable charges of Engineer for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.
- F. *Contractor's Expense:* Contractor shall provide all data in support of any proposed substitute or "or-equal" at Contractor's expense.

6.06 *Concerning Subcontractors, Suppliers, and Others*

- A. Contractor shall not employ any Subcontractor, Supplier, or other individual or entity (including those acceptable to Owner as indicated in Paragraph 6.06.B), whether initially or as a replacement, against whom Owner may have reasonable objection. Contractor shall not be

required to employ any Subcontractor, Supplier, or other individual or entity to furnish or perform any of the Work against whom Contractor has reasonable objection.

- B. If the Supplementary Conditions require the identity of certain Subcontractors, Suppliers, or other individuals or entities to be submitted to Owner in advance for acceptance by Owner by a specified date prior to the Effective Date of the Agreement, and if Contractor has submitted a list thereof in accordance with the Supplementary Conditions, Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bidding Documents or the Contract Documents) of any such Subcontractor, Supplier, or other individual or entity so identified may be revoked on the basis of reasonable objection after due investigation. Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Engineer to reject defective Work.
- C. Contractor shall be fully responsible to Owner and Engineer for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:
1. shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Engineer and any such Subcontractor, Supplier or other individual or entity; nor
 2. shall create any obligation on the part of Owner or Engineer to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.
- D. Contractor shall be solely responsible for scheduling and coordinating the Work of Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.
- E. Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Engineer through Contractor.
- F. The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.
- G. All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Engineer. Whenever any such agreement is with a Subcontractor or Supplier who is listed as a loss payee on the property insurance provided in Paragraph 5.06, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner,

Contractor, Engineer, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or loss payees (and the officers, directors, members, partners, employees, agents, consultants, and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 *Patent Fees and Royalties*

- A. Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if, to the actual knowledge of Owner or Engineer, its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.
- B. To the fullest extent permitted by Laws and Regulations, Owner shall indemnify and hold harmless Contractor, and its officers, directors, members, partners, employees, agents, consultants, and subcontractors from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals, and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device specified in the Contract Documents, but not identified as being subject to payment of any license fee or royalty to others required by patent rights or copyrights.
- C. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.08 *Permits*

- A. Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids, or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.09 *Laws and Regulations*

- A. Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Engineer shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.
- B. If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.
- C. Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10 *Taxes*

- A. Contractor shall pay all sales, consumer, use, and other similar taxes required to be paid by Contractor in accordance with the Laws and Regulations of the place of the Project which are applicable during the performance of the Work.

6.11 *Use of Site and Other Areas*

A. *Limitation on Use of Site and Other Areas:*

- 1. Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and shall not unreasonably encumber the Site and other areas with construction equipment or other materials or equipment. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.
- 2. Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by arbitration or other dispute resolution proceeding or at law.
- 3. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought

by any such owner or occupant against Owner, Engineer, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

- B. *Removal of Debris During Performance of the Work:* During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.
- C. *Cleaning:* Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.
- D. *Loading Structures:* Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 *Record Documents*

- A. Contractor shall maintain in a safe place at the Site one record copy of all Drawings, Specifications, Addenda, Change Orders, Work Change Directives, Field Orders, and written interpretations and clarifications in good order and annotated to show changes made during construction. These record documents together with all approved Samples and a counterpart of all approved Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents, Samples, and Shop Drawings will be delivered to Engineer for Owner.

6.13 *Safety and Protection*

- A. Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:
 - 1. all persons on the Site or who may be affected by the Work;
 - 2. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and
 - 3. other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.
- B. Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and

shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

- C. Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.
- D. Contractor shall inform Owner and Engineer of the specific requirements of Contractor's safety program with which Owner's and Engineer's employees and representatives must comply while at the Site.
- E. All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Engineer or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).
- F. Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.B that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 *Safety Representative*

- A. Contractor shall designate a qualified and experienced safety representative at the Site whose duties and responsibilities shall be the prevention of accidents and the maintaining and supervising of safety precautions and programs.

6.15 *Hazard Communication Programs*

- A. Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations.

6.16 *Emergencies*

- A. In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Engineer prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Engineer determines that a change in the Contract Documents is

required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 *Shop Drawings and Samples*

A. Contractor shall submit Shop Drawings and Samples to Engineer for review and approval in accordance with the accepted Schedule of Submittals (as required by Paragraph 2.07). Each submittal will be identified as Engineer may require.

1. *Shop Drawings:*

- a. Submit number of copies specified in the General Requirements.
- b. Data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials, and similar data to show Engineer the services, materials, and equipment Contractor proposes to provide and to enable Engineer to review the information for the limited purposes required by Paragraph 6.17.D.

2. *Samples:*

- a. Submit number of Samples specified in the Specifications.
- b. Clearly identify each Sample as to material, Supplier, pertinent data such as catalog numbers, the use for which intended and other data as Engineer may require to enable Engineer to review the submittal for the limited purposes required by Paragraph 6.17.D.

B. Where a Shop Drawing or Sample is required by the Contract Documents or the Schedule of Submittals, any related Work performed prior to Engineer's review and approval of the pertinent submittal will be at the sole expense and responsibility of Contractor.

C. *Submittal Procedures:*

1. Before submitting each Shop Drawing or Sample, Contractor shall have:

- a. reviewed and coordinated each Shop Drawing or Sample with other Shop Drawings and Samples and with the requirements of the Work and the Contract Documents;
- b. determined and verified all field measurements, quantities, dimensions, specified performance and design criteria, installation requirements, materials, catalog numbers, and similar information with respect thereto;
- c. determined and verified the suitability of all materials offered with respect to the indicated application, fabrication, shipping, handling, storage, assembly, and installation pertaining to the performance of the Work; and
- d. determined and verified all information relative to Contractor's responsibilities for means, methods, techniques, sequences, and procedures of construction, and safety precautions and programs incident thereto.

2. Each submittal shall bear a stamp or specific written certification that Contractor has satisfied Contractor's obligations under the Contract Documents with respect to Contractor's review and approval of that submittal.
3. With each submittal, Contractor shall give Engineer specific written notice of any variations that the Shop Drawing or Sample may have from the requirements of the Contract Documents. This notice shall be both a written communication separate from the Shop Drawings or Sample submittal; and, in addition, by a specific notation made on each Shop Drawing or Sample submitted to Engineer for review and approval of each such variation.

D. *Engineer's Review:*

1. Engineer will provide timely review of Shop Drawings and Samples in accordance with the Schedule of Submittals acceptable to Engineer. Engineer's review and approval will be only to determine if the items covered by the submittals will, after installation or incorporation in the Work, conform to the information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
2. Engineer's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.
3. Engineer's review and approval shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has complied with the requirements of Paragraph 6.17.C.3 and Engineer has given written approval of each such variation by specific written notation thereof incorporated in or accompanying the Shop Drawing or Sample. Engineer's review and approval shall not relieve Contractor from responsibility for complying with the requirements of Paragraph 6.17.C.1.

E. *Resubmittal Procedures:*

1. Contractor shall make corrections required by Engineer and shall return the required number of corrected copies of Shop Drawings and submit, as required, new Samples for review and approval. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

6.18 *Continuing the Work*

- A. Contractor shall carry on the Work and adhere to the Progress Schedule during all disputes or disagreements with Owner. No Work shall be delayed or postponed pending resolution of any disputes or disagreements, except as permitted by Paragraph 15.04 or as Owner and Contractor may otherwise agree in writing.

6.19 *Contractor's General Warranty and Guarantee*

- A. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Engineer and its officers, directors, members, partners, employees, agents, consultants, and subcontractors shall be entitled to rely on representation of Contractor's warranty and guarantee.
- B. Contractor's warranty and guarantee hereunder excludes defects or damage caused by:
1. abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or
 2. normal wear and tear under normal usage.
- C. Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:
1. observations by Engineer;
 2. recommendation by Engineer or payment by Owner of any progress or final payment;
 3. the issuance of a certificate of Substantial Completion by Engineer or any payment related thereto by Owner;
 4. use or occupancy of the Work or any part thereof by Owner;
 5. any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Engineer;
 6. any inspection, test, or approval by others; or
 7. any correction of defective Work by Owner.

6.20 *Indemnification*

- A. To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Engineer, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to the performance of the Work, provided that any such claim, cost, loss, or damage is attributable to bodily injury, sickness, disease, or death, or to injury to or destruction of tangible property (other than the Work itself), including the loss of use resulting therefrom but only to the extent caused by any negligent act or omission of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work or anyone for whose acts any of them may be liable.

- B. In any and all claims against Owner or Engineer or any of their officers, directors, members, partners, employees, agents, consultants, or subcontractors by any employee (or the survivor or personal representative of such employee) of Contractor, any Subcontractor, any Supplier, or any individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, the indemnification obligation under Paragraph 6.20.A shall not be limited in any way by any limitation on the amount or type of damages, compensation, or benefits payable by or for Contractor or any such Subcontractor, Supplier, or other individual or entity under workers' compensation acts, disability benefit acts, or other employee benefit acts.
- C. The indemnification obligations of Contractor under Paragraph 6.20.A shall not extend to the liability of Engineer and Engineer's officers, directors, members, partners, employees, agents, consultants and subcontractors arising out of:
 - 1. the preparation or approval of, or the failure to prepare or approve maps, Drawings, opinions, reports, surveys, Change Orders, designs, or Specifications; or
 - 2. giving directions or instructions, or failing to give them, if that is the primary cause of the injury or damage.

6.21 *Delegation of Professional Design Services*

- A. Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.
- B. If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Engineer will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Engineer.
- C. Owner and Engineer shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Engineer have specified to Contractor all performance and design criteria that such services must satisfy.
- D. Pursuant to this Paragraph 6.21, Engineer's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Engineer's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.D.1.

- E. Contractor shall not be responsible for the adequacy of the performance or design criteria required by the Contract Documents.

ARTICLE 7 – OTHER WORK AT THE SITE

7.01 *Related Work at Site*

- A. Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have other work performed by utility owners. If such other work is not noted in the Contract Documents, then:
 - 1. written notice thereof will be given to Contractor prior to starting any such other work; and
 - 2. if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.
- B. Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner, and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' work with the written consent of Engineer and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.
- C. If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Engineer in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 *Coordination*

- A. If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:
 - 1. the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;
 - 2. the specific matters to be covered by such authority and responsibility will be itemized; and
 - 3. the extent of such authority and responsibilities will be provided.

- B. Unless otherwise provided in the Supplementary Conditions, Owner shall have sole authority and responsibility for such coordination.

7.03 *Legal Relationships*

- A. Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.
- B. Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's wrongful actions or inactions.
- C. Contractor shall be liable to Owner and any other contractor under direct contract to Owner for the reasonable direct delay and disruption costs incurred by such other contractor as a result of Contractor's wrongful action or inactions.

ARTICLE 8 – OWNER'S RESPONSIBILITIES

8.01 *Communications to Contractor*

- A. Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Engineer.

8.02 *Replacement of Engineer*

- A. In case of termination of the employment of Engineer, Owner shall appoint an engineer to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Engineer.

8.03 *Furnish Data*

- A. Owner shall promptly furnish the data required of Owner under the Contract Documents.

8.04 *Pay When Due*

- A. Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.C and 14.07.C.

8.05 *Lands and Easements; Reports and Tests*

- A. Owner's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.05. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of physical conditions relating to existing surface or subsurface structures at the Site.

8.06 *Insurance*

- A. Owner's responsibilities, if any, with respect to purchasing and maintaining liability and property insurance are set forth in Article 5.

8.07 *Change Orders*

A. Owner is obligated to execute Change Orders as indicated in Paragraph 10.03.

8.08 *Inspections, Tests, and Approvals*

A. Owner's responsibility with respect to certain inspections, tests, and approvals is set forth in Paragraph 13.03.B.

8.09 *Limitations on Owner's Responsibilities*

A. The Owner shall not supervise, direct, or have control or authority over, nor be responsible for, Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Owner will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

8.10 *Undisclosed Hazardous Environmental Condition*

A. Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.06.

8.11 *Evidence of Financial Arrangements*

A. Upon request of Contractor, Owner shall furnish Contractor reasonable evidence that financial arrangements have been made to satisfy Owner's obligations under the Contract Documents.

8.12 *Compliance with Safety Program*

A. While at the Site, Owner's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Owner has been informed pursuant to Paragraph 6.13.D.

ARTICLE 9 – ENGINEER'S STATUS DURING CONSTRUCTION

9.01 *Owner's Representative*

A. Engineer will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Engineer as Owner's representative during construction are set forth in the Contract Documents.

9.02 *Visits to Site*

A. Engineer will make visits to the Site at intervals appropriate to the various stages of construction as Engineer deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Engineer, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Engineer will not be required to make exhaustive or

continuous inspections on the Site to check the quality or quantity of the Work. Engineer's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Engineer will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

- B. Engineer's visits and observations are subject to all the limitations on Engineer's authority and responsibility set forth in Paragraph 9.09. Particularly, but without limitation, during or as a result of Engineer's visits or observations of Contractor's Work, Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work.

9.03 *Project Representative*

- A. If Owner and Engineer agree, Engineer will furnish a Resident Project Representative to assist Engineer in providing more extensive observation of the Work. The authority and responsibilities of any such Resident Project Representative and assistants will be as provided in the Supplementary Conditions, and limitations on the responsibilities thereof will be as provided in Paragraph 9.09. If Owner designates another representative or agent to represent Owner at the Site who is not Engineer's consultant, agent or employee, the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 *Authorized Variations in Work*

- A. Engineer may authorize minor variations in the Work from the requirements of the Contract Documents which do not involve an adjustment in the Contract Price or the Contract Times and are compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. These may be accomplished by a Field Order and will be binding on Owner and also on Contractor, who shall perform the Work involved promptly. If Owner or Contractor believes that a Field Order justifies an adjustment in the Contract Price or Contract Times, or both, and the parties are unable to agree on entitlement to or on the amount or extent, if any, of any such adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

9.05 *Rejecting Defective Work*

- A. Engineer will have authority to reject Work which Engineer believes to be defective, or that Engineer believes will not produce a completed Project that conforms to the Contract Documents or that will prejudice the integrity of the design concept of the completed Project as a functioning whole as indicated by the Contract Documents. Engineer will also have authority to require special inspection or testing of the Work as provided in Paragraph 13.04, whether or not the Work is fabricated, installed, or completed.

9.06 *Shop Drawings, Change Orders and Payments*

- A. In connection with Engineer's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.
- B. In connection with Engineer's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.
- C. In connection with Engineer's authority as to Change Orders, see Articles 10, 11, and 12.
- D. In connection with Engineer's authority as to Applications for Payment, see Article 14.

9.07 *Determinations for Unit Price Work*

- A. Engineer will determine the actual quantities and classifications of Unit Price Work performed by Contractor. Engineer will review with Contractor the Engineer's preliminary determinations on such matters before rendering a written decision thereon (by recommendation of an Application for Payment or otherwise). Engineer's written decision thereon will be final and binding (except as modified by Engineer to reflect changed factual conditions or more accurate data) upon Owner and Contractor, subject to the provisions of Paragraph 10.05.

9.08 *Decisions on Requirements of Contract Documents and Acceptability of Work*

- A. Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Engineer in writing within 30 days of the event giving rise to the question.
- B. Engineer will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Engineer's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.
- C. Engineer's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.
- D. When functioning as interpreter and judge under this Paragraph 9.08, Engineer will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 *Limitations on Engineer's Authority and Responsibilities*

- A. Neither Engineer's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Engineer in good faith either to exercise

or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Engineer shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Engineer to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

- B. Engineer will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Engineer will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.
- C. Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.
- D. Engineer's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.A will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with, the Contract Documents.
- E. The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to the Resident Project Representative, if any, and assistants, if any.

9.10 *Compliance with Safety Program*

- A. While at the Site, Engineer's employees and representatives shall comply with the specific applicable requirements of Contractor's safety programs of which Engineer has been informed pursuant to Paragraph 6.13.D.

ARTICLE 10 – CHANGES IN THE WORK; CLAIMS

10.01 *Authorized Changes in the Work*

- A. Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).
- B. If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.02 *Unauthorized Changes in the Work*

- A. Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Times with respect to any work performed that is not required by the Contract Documents as amended, modified, or supplemented as provided in Paragraph 3.04, except in the case of an emergency as provided in Paragraph 6.16 or in the case of uncovering Work as provided in Paragraph 13.04.D.

10.03 *Execution of Change Orders*

- A. Owner and Contractor shall execute appropriate Change Orders recommended by Engineer covering:
 - 1. changes in the Work which are: (i) ordered by Owner pursuant to Paragraph 10.01.A, (ii) required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or (iii) agreed to by the parties;
 - 2. changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and
 - 3. changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Engineer pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.04 *Notification to Surety*

- A. If the provisions of any bond require notice to be given to a surety of any change affecting the general scope of the Work or the provisions of the Contract Documents (including, but not limited to, Contract Price or Contract Times), the giving of any such notice will be Contractor's responsibility. The amount of each applicable bond will be adjusted to reflect the effect of any such change.

10.05 *Claims*

- A. *Engineer's Decision Required:* All Claims, except those waived pursuant to Paragraph 14.09, shall be referred to the Engineer for decision. A decision by Engineer shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.
- B. *Notice:* Written notice stating the general nature of each Claim shall be delivered by the claimant to Engineer and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data

shall be delivered to the Engineer and the other party to the Contract within 60 days after the start of such event (unless Engineer allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Engineer and the claimant within 30 days after receipt of the claimant's last submittal (unless Engineer allows additional time).

- C. *Engineer's Action:* Engineer will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:
1. deny the Claim in whole or in part;
 2. approve the Claim; or
 3. notify the parties that the Engineer is unable to resolve the Claim if, in the Engineer's sole discretion, it would be inappropriate for the Engineer to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.
- D. In the event that Engineer does not take action on a Claim within said 30 days, the Claim shall be deemed denied.
- E. Engineer's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.
- F. No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

ARTICLE 11 – COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

11.01 *Cost of the Work*

- A. *Costs Included:* The term Cost of the Work means the sum of all costs, except those excluded in Paragraph 11.01.B, necessarily incurred and paid by Contractor in the proper performance of the Work. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, the costs to be reimbursed to Contractor will be only those additional or incremental costs required because of the change in the Work or because of the event giving rise to the Claim. Except as otherwise may be agreed to in writing by Owner, such costs shall be in amounts no higher than those prevailing in the locality of the Project, shall not include any of the costs itemized in Paragraph 11.01.B, and shall include only the following items:

1. Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.
2. Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.
3. Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive bids from subcontractors acceptable to Owner and Contractor and shall deliver such bids to Owner, who will then determine, with the advice of Engineer, which bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.
4. Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.
5. Supplemental costs including the following:
 - a. The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.
 - b. Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.
 - c. Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements approved by Owner with the advice of Engineer, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of

said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

- d. Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.
- e. Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.
- f. Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Paragraph 5.06.D), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.
- g. The cost of utilities, fuel, and sanitary facilities at the Site.
- h. Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.
- i. The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

B. *Costs Excluded:* The term Cost of the Work shall not include any of the following items:

1. Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be considered administrative costs covered by the Contractor's fee.
2. Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.
3. Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.
4. Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not

limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

5. Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.
- C. *Contractor's Fee:* When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.
- D. *Documentation:* Whenever the Cost of the Work for any purpose is to be determined pursuant to Paragraphs 11.01.A and 11.01.B, Contractor will establish and maintain records thereof in accordance with generally accepted accounting practices and submit in a form acceptable to Engineer an itemized cost breakdown together with supporting data.

11.02 Allowances

- A. It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Engineer.
- B. *Cash Allowances:*
1. Contractor agrees that:
 - a. the cash allowances include the cost to Contractor (less any applicable trade discounts) of materials and equipment required by the allowances to be delivered at the Site, and all applicable taxes; and
 - b. Contractor's costs for unloading and handling on the Site, labor, installation, overhead, profit, and other expenses contemplated for the cash allowances have been included in the Contract Price and not in the allowances, and no demand for additional payment on account of any of the foregoing will be valid.
- C. *Contingency Allowance:*
1. Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.
- D. Prior to final payment, an appropriate Change Order will be issued as recommended by Engineer to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 Unit Price Work

- A. Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to

the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

- B. The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Engineer subject to the provisions of Paragraph 9.07.
- C. Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.
- D. Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:
 - 1. the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and
 - 2. there is no corresponding adjustment with respect to any other item of Work; and
 - 3. Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to agree as to the amount of any such increase or decrease.

ARTICLE 12 – CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

12.01 Change of Contract Price

- A. The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:
 - 1. where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or
 - 2. where the Work involved is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2); or
 - 3. where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).

C. *Contractor's Fee*: The Contractor's fee for overhead and profit shall be determined as follows:

1. a mutually acceptable fixed fee; or
2. if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:
 - a. for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;
 - b. for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;
 - c. where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;
 - d. no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;
 - e. the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and
 - f. when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.02 *Change of Contract Times*

- A. The Contract Times may only be changed by a Change Order. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Engineer and the other party to the Contract in accordance with the provisions of Paragraph 10.05.
- B. Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 *Delays*

- A. Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. Delays beyond the control of Contractor shall include, but not be limited to, acts or

neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7, fires, floods, epidemics, abnormal weather conditions, or acts of God.

- B. If Owner, Engineer, or other contractors or utility owners performing other work for Owner as contemplated by Article 7, or anyone for whom Owner is responsible, delays, disrupts, or interferes with the performance or progress of the Work, then Contractor shall be entitled to an equitable adjustment in the Contract Price or the Contract Times, or both. Contractor's entitlement to an adjustment of the Contract Times is conditioned on such adjustment being essential to Contractor's ability to complete the Work within the Contract Times.
- C. If Contractor is delayed in the performance or progress of the Work by fire, flood, epidemic, abnormal weather conditions, acts of God, acts or failures to act of utility owners not under the control of Owner, or other causes not the fault of and beyond control of Owner and Contractor, then Contractor shall be entitled to an equitable adjustment in Contract Times, if such adjustment is essential to Contractor's ability to complete the Work within the Contract Times. Such an adjustment shall be Contractor's sole and exclusive remedy for the delays described in this Paragraph 12.03.C.
- D. Owner, Engineer, and their officers, directors, members, partners, employees, agents, consultants, or subcontractors shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.
- E. Contractor shall not be entitled to an adjustment in Contract Price or Contract Times for delays within the control of Contractor. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

ARTICLE 13 – TESTS AND INSPECTIONS; CORRECTION, REMOVAL OR ACCEPTANCE OF DEFECTIVE WORK

13.01 Notice of Defects

- A. Prompt notice of all defective Work of which Owner or Engineer has actual knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 Access to Work

- A. Owner, Engineer, their consultants and other representatives and personnel of Owner, independent testing laboratories, and governmental agencies with jurisdictional interests will have access to the Site and the Work at reasonable times for their observation, inspection, and testing. Contractor shall provide them proper and safe conditions for such access and advise them of Contractor's safety procedures and programs so that they may comply therewith as applicable.

13.03 *Tests and Inspections*

- A. Contractor shall give Engineer timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.
- B. Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:
 - 1. for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below;
 - 2. that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and
 - 3. as otherwise specifically provided in the Contract Documents.
- C. If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Engineer the required certificates of inspection or approval.
- D. Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Engineer's acceptance of materials or equipment to be incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Engineer.
- E. If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Engineer, Contractor shall, if requested by Engineer, uncover such Work for observation.
- F. Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice.

13.04 *Uncovering Work*

- A. If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.
- B. If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.

- C. If it is found that the uncovered Work is defective, Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such uncovering, exposure, observation, inspection, and testing, and of satisfactory replacement or reconstruction (including but not limited to all costs of repair or replacement of work of others); and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05.
- D. If the uncovered Work is not found to be defective, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 *Owner May Stop the Work*

- A. If the Work is defective, or Contractor fails to supply sufficient skilled workers or suitable materials or equipment, or fails to perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of Owner to stop the Work shall not give rise to any duty on the part of Owner to exercise this right for the benefit of Contractor, any Subcontractor, any Supplier, any other individual or entity, or any surety for, or employee or agent of any of them.

13.06 *Correction or Removal of Defective Work*

- A. Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Engineer, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).
- B. When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 *Correction Period*

- A. If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

1. repair such defective land or areas; or
 2. correct such defective Work; or
 3. if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and
 4. satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.
- B. If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.
- C. In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so provided in the Specifications.
- D. Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.
- E. Contractor's obligations under this Paragraph 13.07 are in addition to any other obligation or warranty. The provisions of this Paragraph 13.07 shall not be construed as a substitute for, or a waiver of, the provisions of any applicable statute of limitation or repose.

13.08 *Acceptance of Defective Work*

- A. If, instead of requiring correction or removal and replacement of defective Work, Owner (and, prior to Engineer's recommendation of final payment, Engineer) prefers to accept it, Owner may do so. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) attributable to Owner's evaluation of and determination to accept such defective Work (such costs to be approved by Engineer as to reasonableness) and for the diminished value of the Work to the extent not otherwise paid by Contractor pursuant to this sentence. If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work, and Owner shall be entitled to an appropriate decrease in the Contract Price, reflecting the diminished value of Work so accepted. If the parties are unable to agree as to the amount thereof, Owner may make a Claim therefor as provided in Paragraph 10.05. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to Owner.

13.09 *Owner May Correct Defective Work*

- A. If Contractor fails within a reasonable time after written notice from Engineer to correct defective Work, or to remove and replace rejected Work as required by Engineer in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct, or remedy any such deficiency.
- B. In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Engineer and Engineer's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.
- C. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.
- D. Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 – PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 *Schedule of Values*

- A. The Schedule of Values established as provided in Paragraph 2.07.A will serve as the basis for progress payments and will be incorporated into a form of Application for Payment acceptable to Engineer. Progress payments on account of Unit Price Work will be based on the number of units completed.

14.02 *Progress Payments*

A. *Applications for Payments:*

- 1. At least 20 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Engineer for review an

Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied by such supporting documentation as is required by the Contract Documents. If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

2. Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.
3. The amount of retainage with respect to progress payments will be as stipulated in the Agreement.

B. Review of Applications:

1. Engineer will, within 10 days after receipt of each Application for Payment, either indicate in writing a recommendation of payment and present the Application to Owner or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application.
2. Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to Owner, based on Engineer's observations of the executed Work as an experienced and qualified design professional, and on Engineer's review of the Application for Payment and the accompanying data and schedules, that to the best of Engineer's knowledge, information and belief:
 - a. the Work has progressed to the point indicated;
 - b. the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, the results of any subsequent tests called for in the Contract Documents, a final determination of quantities and classifications for Unit Price Work under Paragraph 9.07, and any other qualifications stated in the recommendation); and
 - c. the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Engineer's responsibility to observe the Work.
3. By recommending any such payment Engineer will not thereby be deemed to have represented that:
 - a. inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or

involved detailed inspections of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents; or

- b. there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.
4. Neither Engineer's review of Contractor's Work for the purposes of recommending payments nor Engineer's recommendation of any payment, including final payment, will impose responsibility on Engineer:
 - a. to supervise, direct, or control the Work, or
 - b. for the means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or
 - c. for Contractor's failure to comply with Laws and Regulations applicable to Contractor's performance of the Work, or
 - d. to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or
 - e. to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.
 5. Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.2. Engineer may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Engineer's opinion to protect Owner from loss because:
 - a. the Work is defective, or completed Work has been damaged, requiring correction or replacement;
 - b. the Contract Price has been reduced by Change Orders;
 - c. Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or
 - d. Engineer has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

C. Payment Becomes Due:

1. Ten days after presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of Paragraph 14.02.D) become due, and when due will be paid by Owner to Contractor.

D. *Reduction in Payment:*

1. Owner may refuse to make payment of the full amount recommended by Engineer because:
 - a. claims have been made against Owner on account of Contractor's performance or furnishing of the Work;
 - b. Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;
 - c. there are other items entitling Owner to a set-off against the amount recommended; or
 - d. Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.5.a through 14.02.B.5.c or Paragraph 15.02.A.
2. If Owner refuses to make payment of the full amount recommended by Engineer, Owner will give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor remedies the reasons for such action.
3. Upon a subsequent determination that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1 and subject to interest as provided in the Agreement.

14.03 *Contractor's Warranty of Title*

- A. Contractor warrants and guarantees that title to all Work, materials, and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to Owner no later than the time of payment free and clear of all Liens.

14.04 *Substantial Completion*

- A. When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion.
- B. Promptly after Contractor's notification, Owner, Contractor, and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefor.
- C. If Engineer considers the Work substantially complete, Engineer will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before

final payment. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will, within 14 days after submission of the tentative certificate to Owner, notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Engineer considers the Work substantially complete, Engineer will, within said 14 days, execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from Owner.

- D. At the time of delivery of the tentative certificate of Substantial Completion, Engineer will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Engineer in writing prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendation will be binding on Owner and Contractor until final payment.
- E. Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to remove its property and complete or correct items on the tentative list.

14.05 *Partial Utilization*

- A. Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Engineer, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions:
 - 1. Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor, Owner, and Engineer will follow the procedures of Paragraph 14.04.A through D for that part of the Work.
 - 2. Contractor at any time may notify Owner and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work.
 - 3. Within a reasonable time after either such request, Owner, Contractor, and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify Owner and Contractor in writing giving the reasons therefor. If Engineer considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

4. No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Paragraph 5.10 regarding property insurance.

14.06 *Final Inspection*

- A. Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 *Final Payment*

A. *Application for Payment:*

1. After Contractor has, in the opinion of Engineer, satisfactorily completed all corrections identified during the final inspection and has delivered, in accordance with the Contract Documents, all maintenance and operating instructions, schedules, guarantees, bonds, certificates or other evidence of insurance, certificates of inspection, marked-up record documents (as provided in Paragraph 6.12), and other documents, Contractor may make application for final payment following the procedure for progress payments.
2. The final Application for Payment shall be accompanied (except as previously delivered) by:
 - a. all documentation called for in the Contract Documents, including but not limited to the evidence of insurance required by Paragraph 5.04.B.6;
 - b. consent of the surety, if any, to final payment;
 - c. a list of all Claims against Owner that Contractor believes are unsettled; and
 - d. complete and legally effective releases or waivers (satisfactory to Owner) of all Lien rights arising out of or Liens filed in connection with the Work.
3. In lieu of the releases or waivers of Liens specified in Paragraph 14.07.A.2 and as approved by Owner, Contractor may furnish receipts or releases in full and an affidavit of Contractor that: (i) the releases and receipts include all labor, services, material, and equipment for which a Lien could be filed; and (ii) all payrolls, material and equipment bills, and other indebtedness connected with the Work for which Owner might in any way be responsible, or which might in any way result in liens or other burdens on Owner's property, have been paid or otherwise satisfied. If any Subcontractor or Supplier fails to furnish such a release or receipt in full, Contractor may furnish a bond or other collateral satisfactory to Owner to indemnify Owner against any Lien.

B. *Engineer's Review of Application and Acceptance:*

1. If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying

documentation as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application for Payment to Owner for payment. At the same time Engineer will also give written notice to Owner and Contractor that the Work is acceptable subject to the provisions of Paragraph 14.09. Otherwise, Engineer will return the Application for Payment to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application for Payment.

C. Payment Becomes Due:

1. Thirty days after the presentation to Owner of the Application for Payment and accompanying documentation, the amount recommended by Engineer, less any sum Owner is entitled to set off against Engineer's recommendation, including but not limited to liquidated damages, will become due and will be paid by Owner to Contractor.

14.08 Final Completion Delayed

- A. If, through no fault of Contractor, final completion of the Work is significantly delayed, and if Engineer so confirms, Owner shall, upon receipt of Contractor's final Application for Payment (for Work fully completed and accepted) and recommendation of Engineer, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by Owner for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if bonds have been furnished as required in Paragraph 5.01, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

14.09 Waiver of Claims

- A. The making and acceptance of final payment will constitute:
 1. a waiver of all Claims by Owner against Contractor, except Claims arising from unsettled Liens, from defective Work appearing after final inspection pursuant to Paragraph 14.06, from failure to comply with the Contract Documents or the terms of any special guarantees specified therein, or from Contractor's continuing obligations under the Contract Documents; and
 2. a waiver of all Claims by Contractor against Owner other than those previously made in accordance with the requirements herein and expressly acknowledged by Owner in writing as still unsettled.

ARTICLE 15 – SUSPENSION OF WORK AND TERMINATION

15.01 *Owner May Suspend Work*

- A. At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Engineer which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed. Contractor shall be granted an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes a Claim therefor as provided in Paragraph 10.05.

15.02 *Owner May Terminate for Cause*

- A. The occurrence of any one or more of the following events will justify termination for cause:
1. Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule established under Paragraph 2.07 as adjusted from time to time pursuant to Paragraph 6.04);
 2. Contractor's disregard of Laws or Regulations of any public body having jurisdiction;
 3. Contractor's repeated disregard of the authority of Engineer; or
 4. Contractor's violation in any substantial way of any provisions of the Contract Documents.
- B. If one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:
1. exclude Contractor from the Site, and take possession of the Work and of all Contractor's tools, appliances, construction equipment, and machinery at the Site, and use the same to the full extent they could be used by Contractor (without liability to Contractor for trespass or conversion);
 2. incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere; and
 3. complete the Work as Owner may deem expedient.
- C. If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) sustained by Owner arising out of or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Engineer as to their reasonableness and, when

so approved by Engineer, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph, Owner shall not be required to obtain the lowest price for the Work performed.

- D. Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.
- E. Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of moneys due Contractor by Owner will not release Contractor from liability.
- F. If and to the extent that Contractor has provided a performance bond under the provisions of Paragraph 5.01.A, the termination procedures of that bond shall supersede the provisions of Paragraphs 15.02.B and 15.02.C.

15.03 *Owner May Terminate For Convenience*

- A. Upon seven days written notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):
 - 1. completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;
 - 2. expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;
 - 3. all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or arbitration or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and
 - 4. reasonable expenses directly attributable to termination.
- B. Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

15.04 *Contractor May Stop Work or Terminate*

- A. If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Engineer fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days

to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Engineer, and provided Owner or Engineer do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.

- B. In lieu of terminating the Contract and without prejudice to any other right or remedy, if Engineer has failed to act on an Application for Payment within 30 days after it is submitted, or Owner has failed for 30 days to pay Contractor any sum finally determined to be due, Contractor may, seven days after written notice to Owner and Engineer, stop the Work until payment is made of all such amounts due Contractor, including interest thereon. The provisions of this Paragraph 15.04 are not intended to preclude Contractor from making a Claim under Paragraph 10.05 for an adjustment in Contract Price or Contract Times or otherwise for expenses or damage directly attributable to Contractor's stopping the Work as permitted by this Paragraph.

ARTICLE 16 – DISPUTE RESOLUTION

16.01 *Methods and Procedures*

- A. Either Owner or Contractor may request mediation of any Claim submitted to Engineer for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.
- B. Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.
- C. If the Claim is not resolved by mediation, Engineer's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:
 - 1. elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions; or
 - 2. agrees with the other party to submit the Claim to another dispute resolution process; or
 - 3. gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

ARTICLE 17 – MISCELLANEOUS

17.01 *Giving Notice*

- A. Whenever any provision of the Contract Documents requires the giving of written notice, it will be deemed to have been validly given if:

1. delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended; or
2. delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 *Computation of Times*

- A. When any period of time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or on a day made a legal holiday by the law of the applicable jurisdiction, such day will be omitted from the computation.

17.03 *Cumulative Remedies*

- A. The duties and obligations imposed by these General Conditions and the rights and remedies available hereunder to the parties hereto are in addition to, and are not to be construed in any way as a limitation of, any rights and remedies available to any or all of them which are otherwise imposed or available by Laws or Regulations, by special warranty or guarantee, or by other provisions of the Contract Documents. The provisions of this Paragraph will be as effective as if repeated specifically in the Contract Documents in connection with each particular duty, obligation, right, and remedy to which they apply.

17.04 *Survival of Obligations*

- A. All representations, indemnifications, warranties, and guarantees made in, required by, or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 *Controlling Law*

- A. This Contract is to be governed by the law of the state in which the Project is located.

17.06 *Headings*

- A. Article and paragraph headings are inserted for convenience only and do not constitute parts of these General Conditions.

TABLE OF CONTENTS
OF SUPPLEMENTARY CONDITIONS

		<u>Page</u>
SC-1	Definitions and Terminology	SC-1
SC-2	Preliminary Matters	SC-2
SC-4	Availability of Lands; Subsurface and Physical Conditions; Hazardous Environmental Conditions; Reference Points	SC-3
SC-5	Bonds and Insurance	SC-3
SC-6	Contractor's Responsibilities	SC-7
SC-7	Other Work at the Site	SC-7
SC-8	Owner's Responsibilities	SC-8
SC-9	Engineer's Status During Construction	SC-8
SC-11	Cost of the Work; Allowances; Unit Price Work	SC-11
SC-12	Change of Contract Price; Change of Contract Times	SC-12
SC-14	Payments to Contractor and Completion	SC-12

SUPPLEMENTARY CONDITIONS

These Supplementary Conditions amend or supplement the Standard General Conditions of the Construction Contract (EJCDC C-700, 2007) and other provisions of the Contract Documents as indicated below. All provisions which are not so amended or supplemented remain in full force and effect.

The terms used in these Supplementary Conditions have the meanings stated in the General Conditions. Additional terms used in these Supplementary Conditions have the meanings stated below, which are applicable to both the singular and plural thereof.

The address system used in these Supplementary Conditions is the same as the address system used in the General Conditions, with the prefix "SC" added thereto.

SC-1 DEFINITIONS AND TERMINOLOGY

In addition to the provisions of Article 1, the following respective supplemental definitions apply:

The word "Owner" shall mean the City of Batesville, Arkansas, acting through its duly authorized representatives.

The words "City Council" shall mean the City Council of the City of Batesville, the duly elected or appointed governing body of the City of Batesville, Arkansas.

The words "Mayor" and "City Clerk" shall mean, respectively, the Mayor and City Clerk of the City of Batesville, Arkansas.

The word "Engineer" shall mean the engineering firm of McGoodwin, Williams and Yates, Inc., Consulting Engineers, or their duly authorized agent, who has been employed by the City of Batesville, Arkansas for this Work.

The words "Resident Project Representative" shall mean the authorized representative of the Engineer who is assigned to the site or any part thereof.

The word "surety" or "sureties" shall mean the bondsmen or party or parties who have made sure the fulfillments of the Contract by Bonds, and whose signatures are attached to said Bonds.

The word "Advertisement" shall mean all the legal publications pertaining to the Work of this Contract.

The word "Plans" shall mean, collectively, all of the Drawings pertaining to the Contract and made a part thereof, and also such Supplementary Drawings as the Engineer may issue from time to time in order to clarify the Drawings, or for the purpose of showing changes in the Work as authorized under the section "Modifications and Alterations," or for showing details which are not shown thereon.

The term "grade" used in these Specifications is understood to refer to and indicate the established elevations of the paving, flow line of sewers or other appurtenances as shown on the Plans on file in the office of the official designated in the "Advertisement for Bids."

Supplementary Conditions

The term "bonds" means bid, performance, and payment bonds and other instruments of surety.

Whenever the following abbreviations are used, they shall have the meanings given below:

AASHTO	-	American Society of State Highway Officials
ACI	-	American Concrete Institute
AGA	-	American Gas Association
AISC	-	American Institute of Steel Construction
ANSI	-	American National Standards Institute
APA	-	American Plywood Association
ASA	-	American Standards Association
ASTM	-	American Society for Testing Materials
AWG	-	American Wire Gauge
AWPA	-	American Wood Products Association
AWS	-	American Welding Society
AWWA	-	American Water Works Association
GSA	-	General Services Administration, U. S. Government
NBHA	-	National Builders Hardware Association
NEC	-	National Electrical Code
NEMA	-	National Electrical Manufacturers Association
NFPA	-	National Fire Protection Association
NPT	-	National Pipe Thread
SBC	-	Standard Building Code
SPA	-	Southern Products Association
UL	-	Underwriters' Laboratories
A	-	ampere
ABC	-	aggregate base course
cfm	-	cubic feet per minute
CGMP	-	corrugated galvanized metal pipe
DIP	-	ductile iron pipe
gpm	-	gallons per minute
Hp	-	horsepower
MGD	-	million gallons per day
N.C.	-	normally closed
N.O.	-	normally open
ppm	-	parts per million
psi	-	pounds per square inch
PVC	-	polyvinyl chloride (pipe)
R	-	motor starter relay
RCP	-	reinforced concrete pipe
rpm	-	revolutions per minute
T.D.	-	time delay
TDH	-	total dynamic head
V	-	volt

SC-2 PRELIMINARY MATTERS

Add the following language at the end of paragraph 2.02.A of the General Conditions:

SC-2.02.B Copies of Contract. Not less than four copies of the bound volumes of the proposal, Contract and stipulations shall be prepared, each containing the Bid, the Bond or Bonds properly executed and Contracts signed by both parties thereto. However, the Contractor and the surety executing the Bond shall not date the Contract or the Bond upon submission for execution by the Owner. These documents will be dated the date the Owner executes the Contract.

SC-4 AVAILABILITY OF LANDS; SUBSURFACE AND PHYSICAL CONDITIONS; HAZARDOUS ENVIRONMENTAL CONDITIONS; REFERENCE POINTS

SC-4.06 Hazardous Environmental Condition at the Site. Delete paragraphs 4.06.A and 4.06.B of the General Conditions in their entirety and insert the following:

- A. No reports or drawings related to Hazardous Environmental Conditions at the Site are known to Owner.
- B. Not used.

Add the following new paragraphs immediately after paragraph 4.06.I.

- J. In no way do the provisions of Section 4.06 imply responsibility for the protection of the environment, unless otherwise required by Laws and Regulations.
- K. Substances which may be defined as "hazardous" but do not meet the definition of "hazardous waste" as defined in Section 1.01, including but not limited to chlorine gas or other chemicals, which are openly used by the Owner on a consistent basis as a part of their normal operating procedures, are not required to be disclosed by the Owner to the Contractor in reports, drawings, or Contract Documents. Contractor takes full responsibility for all of Contractor's actions that result in damages to persons, property, or equipment as a result of a releases/spills of substances described in this paragraph.

SC-5 BONDS AND INSURANCE

Add a new paragraph immediately after paragraph 5.01.B of the General Conditions which is to read as follows:

SC-5.01.B.1 Resident Agent. The Contractor shall furnish bid, performance and payment bonds and other instruments of surety, as provided for in Article 5 of the General Conditions, executed by a resident or non-resident agent licensed by the Arkansas State Insurance Commissioner to represent the surety company executing said bonds, and filing with such bonds his power-of-attorney. The mere countersigning of the bonds by a resident or non-resident agent will not be sufficient.

SC-5.02.A Licensed Sureties and Insurers. Add the following sentences at the end of the existing paragraph 5.02.A of the General Conditions:

Supplementary Conditions

The surety on the bond shall be from a corporate surety company duly authorized to do business in the State of Arkansas. Bonds must be written by an 'A' rated bonding company.

SC-5.03 Certificates of Insurance. Delete paragraph 5.03.B of the General Conditions in its entirety.

SC-5.04 Contractor's Liability Insurance

Add the following paragraphs immediately after the respective paragraphs contained in SC-5.04 of the General Conditions:

SC-5.04 The limits of liability for the insurance required by paragraph 5.04 of the General Conditions shall provide coverage for not less than the following amounts or greater where required by Laws and Regulations:

SC-5.04.A.1 and SC-5.04.A.2 Workers' Compensation and Related Coverages under paragraphs 5.04.A.1 and 5.04.A.2 of the General Conditions:

- | | |
|--|-----------------|
| 1) State: | Statutory |
| 2) Applicable Federal (e.g. Longshoreman's): | Statutory |
| 3) Employer's Liability: \$ 500,000 | Each Occurrence |

Policies shall include the following waiver documented on certificates:

Contractor agrees to waive all rights of subrogation against McGoodwin, Williams and Yates, Inc., Consulting Engineers, and the Owner for Work performed under Contract.

SC-5.04.A.3 through SC-5.04.A.6 Contractor's General Liability (under paragraphs 5.04.A.3 through A.6 of the General Conditions) shall include completed operations and product liability coverages and eliminate the exclusion with respect to property under the care, custody and control of Contractor:

- | | |
|--|-------------|
| 1) General Aggregate | \$2,000,000 |
| 2) Products – Completed Operations Aggregate | \$2,000,000 |
| 3) Personal and Advertising Injury | \$1,000,000 |
| 4) Each Occurrence (Bodily Injury & Property Damage) | \$1,000,000 |
| 5) Property Damage liability insurance will provide Explosion, Collapse, and Underground coverages where applicable. | |

Policies will include premises/operations, products, completed operations, independent contractors, Explosion, Collapse, Underground Hazard, Broad Form Contractual, Personal Injury with employment exclusion deleted, and Broad Form Property Damage.

SC-5.04.A.6 Automobile Liability under paragraph 5.04.A.6 of the General Conditions:

Bodily Injury:	
Each Person	\$1,500,000
Each Accident	\$3,000,000
Property Damage:	
Each Accident	\$ 600,000
OR a Combined Single Limit of	\$2,000,000

SC-5.05 Owner's Liability Insurance. Delete paragraph 5.05 of the General Conditions in its entirety and insert the following in its place:

5.05 Owner's and Engineer's Contingent Protective Liability Insurance. The Contractor shall indemnify and save harmless the Owner and Engineer from and against all losses and claims, demands, payments, suits, actions, recoveries and judgments of every nature and description brought or recovered against them by reason of any omission or act of the Contractor, his agent or employees in the execution of the Work or in the guarding of it. The Contractor shall obtain in the name of the Owner and Engineer (either as co-insured or by endorsement), and shall maintain and pay the premiums for such insurance in an amount not less than \$2,000,000 for property damage and bodily injury limits, and with such provisions as will protect the Owner and Engineer from contingent liability under this Contract.

SC-5.06.A Property Insurance. Delete paragraph 5.06.A of the General Conditions in its entirety and insert the following in its place:

- A. Contractor shall purchase and maintain property insurance upon the Work at the Site in the amount of the full replacement cost thereof, but not less than an amount equal to the Total Bid Price. Contractor shall be responsible for any deductible or self-insured retention. This insurance shall:
1. include the interests of the Owner, Contractor, Subcontractors, Engineer, and the officers, directors, partners, employees, agents and other consultants and subcontractors of any of them, each of whom is deemed to have an insurable interest and shall be listed as an insured or loss payee;
 2. be written on a Builder's Risk "all-risk" policy form that shall at least include insurance for physical loss and damage to the Work, temporary buildings, falsework, and materials and equipment in transit and shall insure against at least the following perils or causes of loss: fire, lightning, extended coverage, theft, vandalism and malicious mischief, earthquake, collapse, debris removal, demolition occasioned by enforcement of Laws and Regulations, water damage (other than that caused by flood), and such other perils or causes of loss as may be specifically required by these Supplementary Conditions;
 3. include expenses incurred in the repair or replacement of any insured property (including but not limited to fees and charges of engineers and architects);
 4. cover materials and equipment stored at the Site or at another

Supplementary Conditions

location that was agreed to in writing by Owner prior to being incorporated in the Work, provided that such materials and equipment have been included in an Application for Payment recommended by Engineer;

5. allow for partial utilization of the Work by Owner;
6. include testing and startup;
7. be maintained in effect until final payment is made unless otherwise agreed to in writing by Owner, Contractor, and Engineer with 30 days written notice to each other loss payee to whom a certificate of insurance has been issued; and
8. comply with the requirements of paragraph 5.06.C of the General Conditions.

SC-5.06.B Other Insurance. Delete paragraph 5.06.B of the General Conditions in its entirety and insert the following in its place:

5.06.B.1 Other Insurance. The Contractor is to protect the Owner against all loss during the course of the Contract. If, due to the nature of the Project, insurance coverage other than that specified is needed by the Contractor to protect the Owner against all losses, the Contractor is responsible for determining the type of insurance needed and purchasing same.

SC-5.06.B Add the following immediately after paragraph 5.06.B:

"Will endeavor" and "but failure to mail such notice shall impose no obligation or liability of any kind upon the Company, its agents or representatives" wording will be deleted from certificates.

Policies shall also specify that insurance provided by Contractor will be considered primary and not contributory to any other insurance available to the Owner or the Engineer.

5.06.B.2 Blasting. If the Contractor is performing blasting on the Project, the following requirements shall be met:

1. The blasting contractor shall submit a certificate issued by an insurance company authorized to do business in the State of Arkansas certifying that the applicant has a public liability insurance policy in force for the blasting operation for this particular project. Such policy shall provide for personal injury and property damage protection with a minimum limit of Five (5) Million Dollars. Insurance shall cover blasting with XCU coverage on a per-occurrence basis. Certificate shall name the Project Owner, General Contractor and Project Engineer as Additional Insured for said Project.
2. The policy shall be maintained in full force during the life of the Project.
3. The policy shall include a rider requiring that the insurer notify the Owner whenever substantive changes are made in the policy including any termination or failure to renew.

SC-5.06.E Delete paragraph 5.06.E of the General Conditions in its entirety.

SC-5.08 Receipt and Application of Insurance Proceeds. Delete section 5.08 of the General Conditions in its entirety.

SC-5.09 Acceptance of Bonds and Insurance. Delete section 5.09 of the General Conditions in its entirety.

SC-6 CONTRACTOR'S RESPONSIBILITIES

SC-6.06 Add a new paragraph immediately after paragraph 6.06.G:

- H. Owner may furnish to any Subcontractor or Supplier, to the extent practicable, information about amounts paid to Contractor on account of Work performed for Contractor by a particular Subcontractor or Supplier.

SC-6.08.A Permits. Add the following language at the end of the existing paragraph 6.08.A of the General Conditions:

The Owner shall obtain a Permit for Discharge of Stormwater from Construction Activities as required by the Arkansas Department of Environmental Quality, as well as an NPDES Discharge permit if required by Laws and Regulations. The responsibility for complying with all applicable regulations shall be borne by the Contractor.

SC-6.09 Laws and Regulations. Add a new paragraph immediately after paragraph 6.09.B of the General Conditions which shall read as follows:

The Contractor shall prevent the pollution of drains and watercourses by sanitary wastes, sediment, debris, and other substances resulting from construction activities. No sanitary wastes will be permitted to enter any drain or watercourse other than sanitary sewers. No sediment, debris, or other substance will be permitted to enter sanitary sewers, and reasonable measures will be taken to prevent such materials from entering any drain or watercourse.

SC-6.17 Shop Drawings and Samples. Add the following language at the end of the first sentence of paragraph 6.17.A of the General Conditions:

The Shop Drawing Review by the Engineer is for general compliance with the Contract Documents. No responsibility is assumed by the Engineer for correctness of dimensions or details.

SC-7 OTHER WORK AT THE SITE

SC-7.04 Separate Contractor Claim. Add a new paragraph 7.04 immediately after paragraph 7.03 of the General Conditions which shall read as follows:

SC-7.04 Separate Contractor Claim.

- A. Should Contractor cause damage to the work or property of any other contractor at the Site, or should any claim arising out of Contractor's performance of the Work at the Site be made by any other contractor against Contractor, Owner, Engineer, or the construction coordinator, then Contractor (without involving Owner, Engineer, or construction coordinator) shall either 1) remedy the damage, 2) agree to compensate the other contractor for remedy of the damage, or 3) remedy the damage and attempt

Supplementary Conditions

- to settle with such other contractor by agreement or otherwise resolve the dispute by arbitration or at law.
- B. Contractor shall, to the fullest extent permitted by Laws and Regulations, indemnify and hold Owner, Engineer, the construction coordinator and the officers, directors, partners, employees, agents and other consultants and subcontractors of each and any of them from and against all claims, costs, losses and damages (including, but not limited to, fees and charges of engineers, architects, attorneys, and other professionals and court and arbitration costs) arising directly, indirectly or consequentially out of any action, legal or equitable, brought by any other contractor against Owner, Engineer, consultants, or the construction coordinator to the extent said claim is based on or arises out of Contractor's performance of the Work. Should another contractor cause damage to the Work or property of Contractor or should the performance of work by any other contractor at the Site give rise to any other Claim, Contractor shall not institute any action, legal or equitable, against Owner, Engineer, or the construction coordinator or permit any action against any of them to be maintained and continued in its name or for its benefit in any court or before any arbiter which seeks to impose liability on or to recover damages from Owner, Engineer, or the construction coordinator on account of any such damage or Claim.
- C. If Contractor is delayed at any time in performing or furnishing the Work by any act or neglect of another contractor, and Owner and Contractor are unable to agree as to the extent of any adjustment in Contract Times attributable thereto, Contractor may make a Claim for an extension of times in accordance with Article 12. An extension of the Contract Times shall be Contractor's exclusive remedy with respect to Owner, Engineer, and construction coordinator for any delay, disruption, interference, or hindrance caused by any other contractor. This paragraph does not prevent recovery from Owner, Engineer, or construction coordinator for activities that are their respective responsibilities.

SC-8 OWNER'S RESPONSIBILITIES

SC-8.06 Delete paragraph 8.06 of the General Conditions in its entirety.

SC-9 ENGINEER'S STATUS DURING CONSTRUCTION

SC-9.03 Add the following language at the end of paragraph 9.03.A of the General Conditions:

SC-9.03.B Duties, Responsibilities and Limitations of Authority of Resident Project Representative.

General

The Resident Project Representative (RPR), who is the Engineer's agent, will act as directed by and under the supervision of the Engineer and will confer with the Engineer regarding its actions. The Resident Project Representative's dealings in matters pertaining to the on-site Work shall, in general, be only with the Engineer and the Contractor, and dealings with subcontractors shall only be through or with the full knowledge of the Contractor. Written communication with the Owner will

be only through or as directed by the Engineer.

Duties and Responsibilities of RPR

- 1) Schedules. Review the progress schedule, schedule of Shop Drawing submittals and schedule of values prepared by Contractor and consult with Engineer concerning acceptability.
- 2) Conferences and Meetings. Attend meetings with Contractor, such as preconstruction conferences, progress meetings, job conferences and other project-related meetings, and prepare and circulate copies of minutes thereof.
- 3) Liaison.
 - a) Serve as Engineer's liaison with Contractor, working principally through Contractor's superintendent and assist in understanding the intent of the Contract Documents; and assist Engineer in serving as Owner's liaison with Contractor when Contractor's operations affect Owner's on-site operations.
 - b) Assist in obtaining from Owner additional details or information, when required for proper execution of the Work.
- 4) Shop Drawings and Samples.
 - a) Record date of receipt of Shop Drawings and samples.
 - b) Receive samples which are furnished at the site by Contractor, and notify Engineer of availability of samples for examination.
 - c) Advise Engineer and Contractor of the commencement of any Work requiring a Shop Drawing or sample if the submittal has not been approved by Engineer.
- 5) Review of Work, Rejection of Defective Work, Inspections and Tests.
 - a) Conduct on-site observations of the Work in progress to assist Engineer in determining if the Work is in general proceeding in accordance with the Contract Documents.
 - b) Report to Engineer whenever RPR believes that any Work is unsatisfactory, faulty or defective or does not conform to the Contract Documents, or has been damaged, or does not meet the requirements of any inspection, test or approval required to be made; and advise Engineer of Work that RPR believes should be corrected or rejected or should be uncovered for observation, or requires special testing, inspection or approval.
 - c) Verify that tests, equipment and systems startups and operating and maintenance training are conducted in the presence of appropriate personnel, and that Contractor maintains adequate records thereof; and observe, record and report to Engineer appropriate details relative to the test procedures and startups.
 - d) Accompany visiting inspectors representing public or other agencies having jurisdiction over the Project, record the results of these inspections and report to Engineer.
- 6) Interpretation of Contract Documents. Report to Engineer when clarifications and interpretations of the Contract Documents are needed and transmit to Contractor clarifications and interpretations as issued by Engineer.
- 7) Modifications. Consider and evaluate Contractor's suggestions for modifications in Drawings or Specifications and report with RPR's recommendations to

Supplementary Conditions

Engineer. Transmit to Contractor decisions as issued by Engineer.

8) Records.

- a) Maintain at the job site orderly files for correspondence, reports of job conferences, Shop Drawings and samples, reproductions of original Contract Documents including all Work Directive Changes, Addenda, Change Orders, Field Orders, additional Drawings issued subsequent to the execution of the Contract, Engineer's clarifications and interpretations of the Contract Documents, progress reports, and other Project related documents.
- b) Keep a diary or log book, recording Contractor hours on the job site, weather conditions, data relative to questions of Work Directive Changes, Change Orders or changed conditions, list of job site visitors, daily activities, decisions, observations in general, and specific observations in more detail as in the case of observing test procedures; and send copies to Engineer.
- c) Record names, addresses and telephone numbers of all contractors, subcontractors and major suppliers of materials and equipment.

9) Reports.

- a) Furnish Engineer periodic reports as required of progress of the Work and of Contractor's compliance with the progress schedule and schedule of Shop Drawings and sample submittals.
- b) Consult with Engineer in advance of scheduled major tests, inspections or start of important phases of the Work.
- c) Draft proposed Change Orders and Work Directive Changes, obtaining backup material from Contractor and recommend to Engineer Change Orders, Work Directive Changes, and Field Orders.
- d) Report immediately to Engineer and Owner upon the occurrence of any accident.

10) Payment Requests. Review applications for payment with Contractor for compliance with the established procedure for their submission and forward with recommendations to Engineer, noting particularly the relationship of the payment requested to the schedule of values, Work completed and materials and equipment delivered at the site but not incorporated in the Work.

11) Certificates, Maintenance and Operation Manuals. During the course of the Work, verify that certificates, maintenance and operation manuals and other data required to be assembled and furnished by Contractor are applicable to the items actually installed and in accordance with the Contract Documents, and have this material delivered to Engineer for review and forwarding to Owner prior to final payment for the Work.

12) Completion.

- a) Before Engineer issues a Certificate of Substantial Completion, submit to Contractor a list of observed items requiring completion or correction.
- b) Conduct final inspection in the company of Engineer, Owner and Contractor and prepare a final list of items to be completed or corrected.
- c) Observe that all items on final list have been completed or corrected and make recommendations to Engineer concerning acceptance.

Limitations of Authority (except upon written instruction of the Engineer).

Resident Project Representative:

shall not authorize any deviation from the Contract Documents or substitution of materials or equipment (including "or-equal" items), unless authorized by Engineer.

shall not exceed limitations of Engineer's authority as set forth in the Agreement or the Contract Documents.

shall not undertake any of the responsibilities of Contractor, subcontractors or Contractor's superintendent.

shall not advise on, issue directions relative to or assume control over any aspect of the means, methods, techniques, sequences or procedures of construction unless such advice or directions are specifically required by the Contract Documents.

shall not advise on, issue directions regarding or assume control over safety precautions and programs in connection with the Work.

shall not accept Shop Drawing or sample submittals from anyone other than Contractor.

shall not authorize Owner to occupy the Project in whole or in part.

shall not participate in specialized field or laboratory tests or inspections conducted by others except as specifically authorized by Engineer.

SC-11 COST OF THE WORK; ALLOWANCES; UNIT PRICE WORK

SC-11.03.D Unit Price Work. Delete paragraph 11.03.D of the General Conditions and add the following in its place:

- D. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:
1. if the Bid price of a particular item of Unit Price Work amounts to 5 percent or more of the Contract Price and the variation in the quantity of that particular item of Unit Price Work performed by Contractor differs by more than 25 percent from the estimated quantity of such item indicated in the Agreement; and
 2. if there is no corresponding adjustment with respect to any other item of Work; and
 3. if Contractor believes that Contractor has incurred additional expense as a result thereof or if Owner believes that the quantity variation entitles Owner to an adjustment in the unit price, either Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Article 10 if the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed.

Supplementary Conditions

SC-12 CHANGE OF CONTRACT PRICE; CHANGE OF CONTRACT TIMES

SC-12.01.C Contractor's Fee. Add the following paragraph 12.01.C.2.g:

- g. The maximum fee for overhead and profit when multiple tiers of subcontractors are involved is 27 percent, based on a maximum of three (3) tiers ($1.15 \times 1.05 \times 1.05 = 1.27$).

SC-14.02 PAYMENTS TO CONTRACTOR AND COMPLETION

SC-14.02.C.1 Payment Becomes Due. Delete paragraph 14.02.C.1 and replace with the following:

1. After presentation of the Application for Payment to Owner with Engineer's recommendation, the amount recommended will (subject to the provisions of paragraph 14.02.D) become due and be paid by Owner to Contractor within a reasonable amount of time consistent with standard business practices and the requirements of any governing agencies, if applicable.

SECTION 01110 - SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section summarizes the Work covered in detail in the complete Contract.
- B. Owner: City of Batesville, 500 E. Main Street, Batesville, AR 72501, is contracting for Work described in the Contract Documents.
 - 1. Contract Identification: Sanitary Sewer Rehabilitation consisting of Basin 5 Interceptor and Polk Bayou Double Siphon.
- C. Engineer: The Contract Documents were prepared by McGoodwin, Williams and Yates, Inc., 302 E. Millsap Rd., Fayetteville, AR 72703.

1.2 PROJECT DESCRIPTION

- A. The work consists of construction of approximately 1,550 linear feet of 24-inch, 3,800 linear feet of 18-inch sanitary sewer with manholes and appurtenances and a double siphon approximately 700 linear feet in length, including 600 linear feet of directional bore and installation of HDPE pipe, together with junction boxes and 12-inch and 8-inch PVC sewer. Also included is an AHTD highway crossing including bore and encasement, and approximately 180 linear feet of 8-inch ductile iron water line, for a complete installation

1.3 CONTRACTOR'S COORDINATION WITH THE UTILITY

- A. Limited Use:
 - 1. Maintain and conduct activities on easements provided by the Utility.
 - 2. Coordinate with Owner to avoid interference of operations.
 - 3. Conduct operations so as to ensure the least inconvenience to Owner and the general public.

1.4 LANDS AND RIGHTS OF WAY

- A. The work to be performed under this contract shall be on privately-owned land where the City of Batesville has obtained Utility Easements.
- B. All access to the rights-of-way across private property, other than along the route shown on the Plans, shall be exercised by the Contractor only after having obtained written permission from each landowner for that particular access.
- C. All construction activities shall be limited to those areas defined within the permanent easements and temporary construction easements. Any activities outside these areas across private property will require written permission from the landowner(s).

1.5 WORK SEQUENCE

- A. After the contract, bonds, and certificates of insurance have been furnished to the Owner, and the contract has been executed, the Engineer will issue a Notice to Proceed designating the date the contract time will commence. The Contractor shall complete the contract within the Contract Times set out in the Agreement.
- B. The AHTD highway crossing shall be completed in the first 30 days of the contract. The double siphon including directional bore and installation of HDPE pipe shall be scheduled to allow the project completion as set out.
- C. The Basin 5 Interceptor facilities constructed under this contract will be connected to the tunnel at Station 0+00. The 24-inch sewer portion and small part of the 18-inch sewer **will not** be placed in service under this contract, a plug will be temporarily placed in the pipe at Station 17+33 manhole. The first sewer to be installed is shown on Sheet C2 and is necessary to allow existing sewerage flow to maintain its flow to the existing lift station and not into the tunnel and [yet to be completed] wastewater treatment plant. Approximately 2,800 linear feet of the 18-inch interceptor will be placed in the same ditch at near the same grade as the existing sewer pipe. The Contractor will be required to bypass the sewerage during construction. Basin 5 Interceptor served an area generally up to Harrison Street and receives flow from the Sawmill Lift Station located north in a different drainage area. The Owner will work with the Contractor to operate the Lift Station to allow the Contractor long periods when no flow is received from the Lift Station. The Contractor shall design and put in place bypass pumping to handle the flow during construction. The Owner may elect to not test (Mandrel and Air Test) the portion of sewer having a live sewerage flow. However, the bid provides in Bid Item 17 testing of these facilities.
- D. The Contractor will cooperate in all respects with the City of Batesville Water Utility and personnel during the construction of the new facilities.

1.6 CONTRACTOR TO FURNISH EQUIPMENT, MATERIALS AND MANPOWER

- A. The Contractor shall furnish, without charge, competent men from his force and such tools, stakes and other materials as the Engineer may require for setting horizontal and vertical control monuments and in making measurements and surveys and in establishing temporary or permanent reference marks in connection with said work.
- B. The Engineer shall provide horizontal and vertical control monuments on-site. It shall be the Contractor's responsibility to protect these monuments during the course of the contract. Any replacement costs incurred to reset these monuments shall be at the Contractor's expense. All other stakeout on-site shall be by the Contractor.

1.7 TREE AND PLANT PROTECTION

- A. All trees and other vegetation which must be removed to perform the work shall be removed and disposed of by Contractor. However, care shall be taken in yard areas not to remove trees or cultured plants unless specifically called for on the Plans. Trees and plants not removed shall be protected from direct injury from Contractor operations.
- B. Trimming and repair of tree and plant damage shall be performed by qualified nursery workers or horticulturists.

1.8 SUNDAY, HOLIDAY AND NIGHT WORK

- A. No work shall be done between the hours of 6:00 p.m. and 7:00 a.m., or on Sundays or legal holidays, except work as is necessary for the proper care and protection of work already performed, or in case of any emergency.

1.9 USE OF EXPLOSIVES

- A. The use of explosives is allowed on this project.
- B. Competent rock may be encountered and may be hard and difficult to excavate. Heavy equipment and/or blasting may be needed to remove the harder rocks. Blasting, if selected for use by the Contractor, shall be in conformance with Specification Section 02320.

1.10 SECURITY

- A. The Contractor shall be responsible for protection of the site, and all Contractor's work, materials, equipment and existing facilities thereon against vandals and other unauthorized persons.
- B. No claim shall be made against the Owner by reason of any act of an employee or trespasser, and the Contractor shall make good all damage to Owner's property resulting from his failure to provide security.
- C. Security measures shall be at least equal to those usually provided by Owner to protect his existing facilities during normal operation, but shall also include such additional security fencing, barricades, lighting, watchman services, and other measures as required to protect the site.

1.11 STORAGE AND HANDLING OF MATERIALS

- A. The Contractor shall be responsible for all material furnished by him and shall replace at his own expense all such material found defective in manufacture or damaged in handling after delivery by the manufacturer. This shall include the furnishing of all material and labor required for the replacement of installed material discovered prior to the final acceptance of the work.
- B. The Contractor shall be responsible for the safe storage of material furnished by or to him and accepted by him, and intended for the work, until the Notice of Final Completion. All materials shall be stored in strict conformance to the manufacturer's recommendations.
- C. Pipe and accessories shall be loaded and unloaded by lifting with hoists or skidding so as to avoid shock or damage. Under no circumstances shall such materials be dropped. Pipe handled on skidways shall not be skidded or rolled against pipe already on the ground.

1.12 ACCESS ROADS

- A. The Contractor shall establish and maintain temporary access roads to various parts of the site as required to complete the project. Scheduling, materials and construction procedures are specified in other sections of the documents. Such roads shall be available for the use of all performing work or furnishing services in connection with the project.

- B. Any temporary access roads constructed by the Contractor shall be removed and the surface restored to original or better condition prior to final payment.

1.13 PARKING

- A. The Contractor shall provide and maintain suitable parking areas for the use of all construction workers and others performing work or furnishing services in connection with the project, as necessary, to avoid any need for parking personal vehicles where they may interfere with construction activities.

1.14 POLLUTION CONTROL

- A. Contractor shall comply with Section 02270 "Environmental Specifications."

1.15 MONTHLY ESTIMATES AND PAYMENT TO CONTRACTOR

- A. Monthly payments under this contract shall be made for work completed through the payment date. The payment date shall be defined as the fourth Friday of each month, except in months containing five Fridays. In that event, the payment date shall be the fourth Friday of the month. A pay period shall be defined as time between consecutive payment dates. Exceptions may be made for special circumstances upon mutual agreement between the Owner and the Contractor.
- B. On or before the payment date of each month the Engineer will make an approximate estimate of the value of the work done and materials furnished in place on the work during the previous calendar month. The Engineer will include the cost value (including freight) of materials properly stored on the job site or within a thirty-mile radius of the job site.
- C. The Contractor shall furnish to the Engineer such detailed information as he may request to aid him as a guide in the preparation of monthly estimates. After each such estimate shall have been approved by the Owner, the Owner shall pay to the Contractor the amount of such estimated value of materials furnished and work done during said previous calendar month, less retainage as provided by state law. If the Owner shall at any time fail to make the Contractor a monthly estimate at the time herein specified, such failure shall not be held to vitiate or void the contract.

1.16 BASIS OF PAYMENT

- A. Payment shall be made in accordance with the bid items as set out in Section 01125 "Methods of Measurement and Payment."

1.17 CONNECTIONS TO EXISTING FACILITIES

- A. Unless otherwise specified or indicated, the Contractor shall make necessary connections to existing utilities such as water, sewer, telephone and electric. In each case, the Contractor shall receive permission from the Owner or the owning utility prior to undertaking connections. The Contractor shall protect facilities against deleterious substances and damage.
- B. Connections to existing facilities which are in service shall be thoroughly planned in advance, and all required equipment, materials and labor shall be on hand at the time of undertaking the connections. Work shall proceed continuously (around the clock) if necessary to complete

connections in the minimum time. Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.

1.18 TESTING

- A. The Contractor shall be responsible for and shall pay all costs associated with any inspection or testing required in connection with Owner's or Engineer's acceptance of materials or equipment incorporated in the work, as provided for in Article 13 of the General Conditions.
- B. The Contractor shall be responsible for furnishing to the Engineer materials and equipment manufacturers' duly sworn certificates of compliance with all requirements and provisions of applicable standards such as, but not limited to, AWWA, ASTM, ANSI, AASHTO, AHTD, or others for all materials and equipment delivered to this project.
- C. Specific requirements for testing and certificates of compliance are set forth in the Technical Specifications for each item of work.

1.19 PROTECTING AND REPLACING UTILITY SERVICES

- A. In some instances the pipe will be installed under, alongside and over existing utility services. The Contractor shall be responsible for locating and protecting or repairing and replacing such services.
- B. Arkansas One Call: 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. The Owner 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.
- C. Where the Contractor cannot make adequate repairs to any utility damaged by the Contractor, the Contractor shall coordinate with the various utility companies to make repairs to all services, and such costs will be charged to the Contractor. The Contractor shall make arrangements for this service with the various utilities either before the bid is presented or before construction starts.
- D. Where the Drawings show a portion of the line to be laid adjacent to or under power lines, it shall be the responsibility of the Contractor to make any arrangements with the power company for stabilizing poles. It shall also be the responsibility of the Contractor to take whatever steps are necessary to provide for the safety of the workmen and equipment when working in the vicinity of these power lines.

1.20 ABBREVIATIONS AND SYMBOLS

- A. Abbreviations and symbols used in these Specifications are described in the Supplementary Conditions, Article SC-1.

1.21 CLEANUP

- A. During construction, the Contractor shall keep the construction area in a clean, neat and workmanlike condition at all times.
- B. Pipe, equipment, and all other material shall be stored and protected in an area away from the construction operations. As soon as practicable, the area around all structures shall be backfilled, and the entire area shall be maintained in a smooth condition at all times insofar as is practical.
- C. After construction work has been completed, the Contractor shall clean the entire area. Tops of structures, sidewalks, building walls (both exterior and interior), floors, equipment, and all painted and glass surfaces shall be cleaned of clay stain, mortar, or other materials, washing down with soap or other cleaning materials as required. Such touch-up work as required shall then be done to leave the area in a clean and neat condition.

1.22 CRITICAL PATH SCHEDULE

- A. The Contractor shall show various phases of work to be performed, submittals, materials and equipment orders, receipt of materials and equipment, manpower, skills, and equipment required, and completion dates of various phases of work to be performed for completion of the project.
- B. The Contractor shall submit an approvable critical path schedule at least ten days before submission of the first application for payment.
- C. Prior to preparation of the monthly partial payment estimate, the Contractor shall submit to the Engineer critical path progress status reports and revised schedules as required to show completion of the project within the agreed contract time set forth in the Contract Agreement.

1.23 SAFETY SYSTEMS

- A. 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, include in their specifications for the project the current edition of 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.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01110

SECTION 01125 – METHODS OF MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 SUMMARY

- A. Methods of measurement and payment as set out in the Specifications covering the various items of construction are hereby clarified and superseded as set out herein. Wherever they are not clarified or superseded herein, methods of payment as provided in the applicable section of the Specifications shall govern. Payment for all work under this contract shall be made at the unit and lump sum prices bid under the various items of the Bid as hereinafter set out.

1. Bid Items 1 through 5 – Sewer Pipe. Payment for sewer pipe shall be made at the unit price bid per linear foot for the various sizes and types of sewer pipe bid, complete in place. The unit price bid shall be full compensation for clearing timber (including trees shown to be removed) and brush disposal, right-of-way preparation, surface removal, stripping and stockpiling topsoil where required, remove and replace barbed wire, chain link and board fences, removal and replacement of existing Zoysia and Bermuda sod, excavation to 6-foot depth, trenching, dewatering, providing and placement of pipe bedding or embedment material, connecting to the existing 24-inch drop at Station 0+00 of Basin 5 Interceptor, connections of all existing sewers and bypass necessary at Station 0+00 of Polk Bayou sewer, furnishing and laying pipe, pipe protection cover, and earth backfill, compaction, cleanup, seeding, fertilizing and mulching as specified, and furnish, place and maintain Class 7 crushed stone at surface in street and driveway to maintain mud-free traffic area. Payment for dog pens, play area, etc. removed for pipe installation shall be included in this item. This item shall also include the required sewerage bypass pumping for Item No. 3 (where 18-inch sewer is placed in same ditch as existing 18-inch concrete sewer pipe), Mandrel testing, air testing, and vacuum testing of manholes for all sewers except where live sewerage flow is present.

Measurement shall be based on the total surveyed length of the line measured by the Engineer. No deduction shall be made for the length of manholes, wyes, or other appurtenances.

The Engineer shall withhold payment for work not completed. Payment of 80% of price bid will be made when pipe is placed, backfill is made, compacted, and the surface is brought to grade. An additional 10% will be made when cleanup, seeding, fertilizing and mulching is completed. An additional 10% shall be made when air testing and Mandrel testing is satisfactorily completed.

Payment for rock excavation meeting the definition of Section 02211 (Classification of Excavation) of these Specifications will be made under a separate bid item.

2. Bid Item 6 – Double Siphon. Payment for siphon shall be made at the lump sum price bid and shall include the 5-foot manhole at Station 7+60 and all facilities upstream from Station 7+60, including approximately 100 linear feet of 10-inch and 8-inch C 900 Class 18 PVC pipe double siphon, 600 linear feet of 12-inch and 10-inch HDPE installed by directional bore, the concrete inlet siphon box, 12-inch and 8-inch gravity sewer together with two manholes, concrete encasement, tie-in to existing sewer, and

abandonment of 100 feet of existing 12-inch sewer together with two manholes within the railroad right-of-way, for a complete installation.

No payment will be made for extra depth trench. Payment for any rock excavation will be made under a separate bid item.

3. Bid Items 7 through 10 – Extra Depth Sewer Trench. Payment for extra depth trench shall be made according to the unit price bid. The linear feet to be paid for under each item shall be determined by plotting the original ground surface as shown on the Drawings and the invert elevation of the gravity sewer line as constructed. By using these plotting procedures, the Engineer will determine the final quantity to be paid for under each item based on the total surveyed length of the line measured by the Engineer, with no reduction for appurtenances. EXAMPLE: If the ditch measures 10 feet 6 inches, payment will be made under the 10 foot to 12 foot classification. If the ditch measures 12 feet 6 inches, payment will be made under the 12 foot to 14 foot classification, and no payment will be made for the 10 foot to 12 foot classification.

4. Bid Items 11 and 12 – Manholes, 0-6 Feet Deep (Standard Ring and Lid). Payment for 5-foot and 4-foot diameter cast-in-place manholes from 0-6 feet deep shall be made at the various unit prices bid. The price bid shall be full compensation for every item of work to complete the manholes as shown on the Drawings and as specified, including excavation, forming of the barrel, transition from 1 foot of 2 foot barrel, concrete, concrete invert, standard manhole ring and lid as specified, backfill, and every other item required for a complete installation as shown on the Drawings and as specified.

Measurement shall be per each cast-in-place manhole completed.

5. Bid Items 13 and 14 – Manhole Barrel Extension. Payment for 5-foot and 4-foot diameter manhole barrel extensions for manholes above 6 feet in depth shall be made at the various unit prices bid. The price bid shall be full compensation for every item of work to complete the manhole barrel extensions as shown on the Drawings and as specified, including forming of the barrel, concrete, backfill, and every other item required for a complete installation as shown on the Drawings and as specified.

Measurement shall be by the vertical foot to the nearest 0.1 foot from 6 feet to the top or the manhole ring.

6. Bid Item 15 – Watertight Manhole Ring and Lid (in lieu of Standard Ring and Lid). Payment for watertight manhole rings and lids shall be made at the unit price given in the Bid. The unit price shall be the add-on price for furnishing and installing a watertight ring and lid in lieu of a standard manhole ring and lid where called for on the Drawings.

7. Bid Item 16 – Protective Coating for Manholes. Payment for the application of the protective coating for manholes shall be made at the unit price as given in the Bid. The bid price shall include initial manhole cleaning, control of sewer flow where necessary, application of the protective coating, testing, one-year warranty, and all other labor, materials, and equipment required to construct complete the protective coating.

8. Bid Item 17 – Testing Gravity Sewer with Live Flow at Station 17+33 to 44+24. Payment under this item shall be made at the unit price bid per linear foot. The Owner may elect to perform pressure test, Mandrel test and vacuum test of manhole in this

section of the interceptor. The decision will be made after the interceptor is installed to its completion. If the Owner chooses to test these sewers, the Contractor shall provide all equipment necessary to bypass pump, Mandrel test, air pressure test and vacuum test sewer lines and manhole within the area indicated. The price shall also include 4-inch PVC pipe and fittings.

9. Bid Item 18 – Remove and Dispose of Existing In-Line Concrete Manhole. Payment for the manhole removal shall be made at the unit price bid, and shall include all items to handle sewer flow, demolish the concrete manholes and remove from the site. Manhole ring and lid shall become the property of the Contractor.
10. Bid Item 19 – 6", 8" or 10" Manhole Drop Assembly. Payment for drop assembly shall be made for each 6, 8, or 10 inch drop installed including pipe, fittings, concrete and crushed limestone rock, complete in place, where shown on the Drawings and in accordance with Drop Manhole Detail as shown on the Drawings, along with Fernco couplings and every other item required for a complete installation.
11. Bid Item 20 – Rock Excavation. Payment for rock excavation shall be made in accordance with the unit price bid per cubic yard. Measurement for rock excavation shall be as specified. Trench excavation classified as "rock excavation," in accordance with the Specifications, shall be paid for under this Bid item.
12. Bid Items 21 and 22 – Sewer Service Wyes. Payment under these items shall be made in accordance with the various unit prices bid for the items. The price bid shall be full compensation for 24" x 4" or 18" x 4" wye. The price shall include the wye, 4" service line, coupling and connection to the existing 4" house service line. Where wye are shown to be installed on the 24-inch pipe and where no existing service is found by the contractor then the wye will be brought to point 4 feet below the ground surface using 4" PVC sewer pipe, plug and a marker. The marker may be steel post or 4" x 4" wood post existing 2 feet about and below ground.
13. Bid Item 23 – Street Repair. Payment under this item shall be made in accordance with the unit price bid. The price bid shall include traffic control, full depth SB-2, curb and gutter (where it exists), concrete surface complete in place.
14. Bid Item 24 – Reinforced Concrete Pier Construction. Payment under this item shall be made in accordance with the lump sum price bid. The price shall include the excavation, compaction, forming and placing steel and concrete for three piers and as shown on Sheet C6 of the Drawings and detailed on Sheet D1 of the Drawings.
15. Bid Item 25 – Class B Concrete Pipe Support and Cover. Payment under this item shall be made in accordance with the unit price bid per cubic yard. The price bid shall include transporting material to the project site, excavation and placing of pipe anchor or reinforcing steel as shown on details.
16. Bid Item 26 – Stone Riprap. Payment under this item shall be made in accordance with the unit price bid. The price shall include all cost related to purchase, delivery to site and place to depth and width as detailed on the plan or directed by the Engineer.
17. Bid Item 27 – Erosion Control. Payment for erosion control shall be made at the lump sum price bid, complete in place. The price bid shall be full compensation for all

qualified personnel, materials, equipment and labor required to construct and maintain adequate erosion control, including obtaining necessary Stormwater Pollution Prevention Drawings and permits as required by ADEQ, erosion control fencing, ditch checks, and all incidentals required for a complete installation.

18. Bid Item 28 – Highway Crossing and Water Line. Payment for the highway crossing and water line shall be made in accordance with the lump sum price bid. The price bid shall include the highway bore, casing pipe, tie to existing 10-inch water line, and all pipe, fittings, valves and fire hydrant. The price bid includes testing of facilities and cleanup of project site, and shall include any rock excavation, traffic control and safety measures, and providing all equipment, tools, materials and labor necessary to complete the installation.
19. Bid Item 29 – Trench and Excavation Safety System. Payment under this item shall be made in accordance with the lump sum price bid. The price bid shall be full compensation for trench or excavation safety system requirements in accordance with Act 291 of the 1993 Arkansas General Assembly. Payment under this item will not be made until project is completed, accepted, and the Contractor certifies that he has met all requirements as set out in said Act 291.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01125

SECTION 01330 - SUBMITTALS

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes procedure, instructions, requirements and additional information about informational and technical Submittals.

1.2 GENERAL INFORMATION

A. Definitions:

1. Shop Drawings, product data, and Samples are parts of the Technical Submittals prepared by the Contractor, Subcontractor, manufacturer, or Supplier and submitted by the Contractor to the Engineer as a basis for approval of the use of Equipment and Materials proposed for incorporation in the Work or needed to describe installation, operation, maintenance, or technical properties.
 - a. Shop Drawings include custom-prepared data of all types including drawings, diagrams, performance curves, material schedules, templates, instructions, and similar information not in standard printed form applicable to other projects.
 - b. Product data includes standard printed information on materials, products, and systems; not custom-prepared for this Project, other than the designation of selections from available choices.
 - c. Samples include both fabricated and unfabricated physical examples of materials, products, and Work; both as complete units and as smaller portions of units of Work; either for limited visual inspection or (where indicated) for more detailed testing and analysis. Mock-ups are a special form of Samples which are too large to be handled in the specified manner for transmittal of Sample Submittals.
2. Informational Submittals are those technical reports, administrative Submittals, certificates, and guarantees not defined as Shop Drawings, product data, or Samples.
 - a. Technical reports include laboratory reports, tests, technical procedures, technical records, and Contractor's design analysis.
 - b. Administrative Submittals are those nontechnical Submittals required by the Contract Documents or deemed necessary for administrative records. These Submittals include maintenance agreements, Bonds, Project photographs, physical work records, statements of applicability, copies of industry standards, Project record data, security/protection/safety data, and similar type Submittals.
 - c. Certificates and guarantees are those Submittals on Equipment and Materials where a written certificate or guarantee from the manufacturer or Supplier is called for in the Specifications.
3. Refer to Articles 1.3 and 1.4 of this Part for detailed lists of documents and specific requirements.

B. Quality Requirements:

1. Submittals such as Shop Drawings and product data shall be of suitable quality for legibility and reproduction purposes. Every line, character, and letter shall be clearly legible. Drawings such as reproducibles shall be useable for further reproduction to yield a legible hard copy.

2. Documents submitted to Engineer that do not conform to specified requirements shall be subject to rejection. Contractor shall resubmit conforming documents. If conforming Submittals cannot be obtained, such documents shall be retraced, redrawn, or photographically restored as may be necessary to meet such requirements. Contractor's (or his Subcontractor's) failure to initially satisfy the legibility quality requirements will not relieve Contractor (or his Subcontractors) from meeting the required schedule for Submittals.
- C. Language and Dimensions:
1. All words and dimensional units shall be in the English language.
 2. Metric dimensional unit equivalents may be stated in addition to the English units. However, English units of measurement shall prevail.
- D. Submittal Completeness:
1. Submittals shall be complete with respect to dimensions, design criteria, materials of construction, and other information specified to enable Engineer to review the information effectively.
 2. Where standard drawings are furnished which cover a number of variations of the general class of Equipment, each drawing shall be annotated to indicate exactly which parts of the drawing apply to the Equipment being furnished. Use hatch marks to indicate variations that do not apply to the Submittal. The use of "highlighting markers" will not be an acceptable means of annotating Submittals. Annotation shall also include proper identification of the Submittal permanently attached to the drawing.
 3. Reproductions or copies of Contract Drawings or portions thereof will not be accepted as complete fabrication or erection drawings. Contractor may use a reproduction of Contract Drawings for erection drawings to indicate information on erection or to identify detail drawing references. Whenever the Drawings are revised to show this additional Contractor information, Engineer's title block shall be replaced with a Contractor's title block, and Engineer's professional seal shall be removed from the drawing. The Contractor shall revise these erection drawings for subsequent Engineer revisions to the Contract Drawings.

1.3 TECHNICAL SUBMITTALS

- A. Items shall include, but not be limited to, the following:
1. Reference information shall include:
 - a. Specification Section name and number.
 - b. Structure number, identification number or other information identifying location of item submitted.
 2. Manufacturer's technical specification.
 3. Catalogs, or parts thereof, of manufactured Equipment.
 4. Shop drawings detailing fabrication.
 5. Data sheets showing model numbers.
 6. General outline drawings of Equipment showing:
 - a. Overall dimensions in plan and elevation views.
 - b. Location of major components.
 - c. Material and weights of major components, including overall weight to be supported by structure.
 - d. Location(s) of required building opening(s) and floor plate(s).
 7. Detailed Equipment installation drawings with suggested installation sequence showing:

- a. Dimensions in plan, elevation and section views.
 - b. Foundation details.
 - c. Anchor bolt size(s) and location(s).
 - d. Baseplate size(s).
 - e. Alignment and adjustment procedures.
 - f. Location, size, material and type of all connections to be made with item submitted.
 - g. Clearances required for:
 - 1) Erection
 - 2) Operation
 - 3) Disassembly for maintenance.
8. Electrical data including:
- a. Schematic diagrams for electrical items.
 - b. Motor size and description.
 - c. External connections with required loads.
 - d. Terminal block numbers.
 - e. Internal wiring diagrams.
 - f. One-line diagrams.
 - g. Control wiring diagrams.
9. Delivery and storage recommendations. Specific recommendations for equipment not to be immediately installed.
10. Recommended spare parts list specifically denoting long delivery items and all items convenient for stocking as optional replacement items.
11. Instruction, Operation and Maintenance Manual.
12. Detailed list of any exceptions taken to the requirements of the Technical Specification. Include proposed alternative with reason stated for exception.
13. Certification that the submitted material describes exactly the equipment to be provided. Substitutions of equipment subsequent to submittal approval will not be accepted.
- B. Instruction, Operation and Maintenance Manual: Equipment instruction books, operation and maintenance manuals prepared by the manufacturer shall include the following prepared specifically for this project rather than general instructions that are not designed for this project. Manuals shall be in addition to any instructions or parts lists packed with or attached to the equipment when delivered, or which may be required by the Contractor. Manuals shall include but not be limited to the following:
- 1. Equipment performance sheets.
 - 2. Performance data including equipment function, normal operating characteristics, and limiting conditions.
 - 3. Performance tests on equipment by manufacturers.
 - 4. Descriptive literature including cut sheet for all equipment items purchased from sub-vendors.
 - 5. Operating instructions including procedures for:
 - a. Startup.
 - b. Routine and normal operation and maintenance.
 - 1) Lubrication procedures with recommended grades of lubricants (if required).
 - c. Regulation and control.
 - d. Trouble shooting.
 - e. Replacing improperly functioning components subjected to wear.
 - f. Normal and emergency shutdown.
 - 6. Parts list, including predicted life of parts subjected to wear.

7. All drawings, catalogs or parts thereof, manufacturer's specifications and data, samples, instructions, and other information specified or necessary:
 - a. For Engineer to determine that the Equipment and Materials conform with the design concept and comply with the intent of the Contract Documents.
 - b. For the proper erection, installation, operation, and maintenance of the Equipment and Materials which Engineer will review for general content but not for basic details.
 - c. For Engineer to determine what supports, anchorages, structural details, connections, and services are required for the Equipment and Materials, and the effects on contiguous or related structures and Equipment and Materials.
8. Warranties and guarantees.
9. Customer contact list with a minimum of 10 contacts from similar sized installations.
10. Contact name and telephone number for each installation
11. Address and contact information of nearest manufacturer-authorized service facility.
12. Information listed above shall be bound into hard-back three-ring binders of Bok-Hinge Split Prong Binder or McBee Swing Hinge type. Manuals shall be temporarily bound in heavy paper covers bearing suitable identification.
 - a. A table of contents and index shall be furnished for all volumes containing data for three or more items of equipment.
 - b. Sheet size shall be 8-1/2 x 11 inches with standard three hole punching. All material shall be printed on heavy, first quality (minimum 20 pound) paper. Drawings and diagrams shall be reduced to 8-1/2 x 11 inches or 11 x 17 inches.
 - 1) Where reduction of drawings and figures is not practicable, larger drawings shall be folded separately and placed in envelopes, which are bound into the manuals. Each envelope shall bear suitable identification on the outside.
 - c. Binder color shall be black. Material shall be organized with tabs for ease of use. Capacity shall be a minimum of 1-1/2-inches, but sufficient to contain and use sheets with ease.
 - 1) Provide with following accessories:
 - a) Label holder.
 - b) Business card holder.
 - c) Sheetlifters.
 - d) Horizontal pockets.
 - 2) The following information shall be imprinted, inserted or affixed by label on the binder front cover:
 - a) Equipment name.
 - b) Manufacturer's name.
 - c) Project name.
 - d) Contract name and number.
 - 3) The following information shall be imprinted, inserted, or affixed by label on the binder spine:
 - a) Equipment name.
 - b) Manufacturer's name.
 - c) Volume number (if applicable).
13. In addition to hard copies of instruction, operation, and maintenance manuals, digital copies, in PDF format, consisting of instruction, operation, and maintenance manuals as described above, shall be furnished.

C. Samples:

1. Office Samples shall be of sufficient size and quantity to clearly illustrate the following:

- a. Functional characteristics of the product, with integrally related parts and attachment devices.
- b. Full range of color, texture, and pattern.
- 2. Field Samples and Mock-ups:
 - a. Contractor shall erect field Samples and mock-ups at the Project Site and at a location acceptable to Engineer.
 - b. Size or area shall be as specified in the respective Specification Section.
 - c. Fabricate each Sample and mock-up complete and finished.
 - d. Remove mock-ups at conclusion of Work or when acceptable to the Engineer if not a permanent part of construction.

D. Schedule of Submittals:

- 1. Prepare for Engineer's concurrence, a schedule for submission of all Submittals specified or necessary for Engineer's approval of the use of Equipment and Materials proposed for incorporation in the Work or needed for proper installation, operation, or maintenance. Submit the schedule with the procurement schedule and construction progress schedule. Schedule submission of all Submittals to permit review, fabrication, and delivery in time so as to not cause a delay in the Work of Contractor or his Subcontractors or any other contractors as described herein.
- 2. In establishing schedule for Submittals, allow 22 days after submittal to Engineer for reviewing original Submittals and 17 days after submittal to Engineer for reviewing resubmittals.
- 3. The schedule shall indicate the anticipated dates of original submission for each item and Engineer's approval thereof, and shall be based upon at least one resubmission of each item.
- 4. Schedule all Submittals required prior to fabrication or manufacture for submission within 90 days of the Notice to Proceed. Schedule Submittals pertaining to storage, installation, and operation at the Site for Engineer's approval prior to delivery of the Equipment and Materials.
- 5. Resubmit Submittals the number of times required for Engineer's "Submittal Approved." However, any need for resubmittals in excess of the number set forth in the accepted schedule, or any other delay in obtaining approval of Submittals, will not be grounds for extension of the Contract Times, provided Engineer completes his reviews within the times specified.

E. Transmittal of Submittals:

- 1. All Submittals for Equipment and Materials furnished by Contractor, Subcontractors, manufacturers, and Suppliers shall be submitted to Engineer by Contractor.
- 2. After checking and verifying all field measurements, transmit all Submittals to Engineer for approval as follows:
 - a. Submittal Information Block:
 - 1) Affix to all paper copies whether Submittal is prepared by Contractor, Subcontractor, or Supplier. Use transparent decal type Submittal Information Blocks for Shop Drawings and use gummed paper type for product data Submittals.
 - 2) An example of the Submittal Information Block is included as an appendix to this Section.
- 3. Mark each Submittal by Project name and number, Contract title and number, and the applicable Specification Section and Article number. Include in the letter of transmittal the Drawing number and title, sheet number (if applicable), revision number, and

- electronic filename (if applicable). Unidentified Submittals will be returned for proper identification.
4. Check and include Contractor's approval for Submittals of Subcontractors, Suppliers, and manufacturers prior to transmitting to Engineer. Contractor's approval shall constitute a representation to Owner and Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, or Contractor assumes full responsibility for doing so, and that Contractor has coordinated each Submittal with the requirements of the Work and the Contract Documents.
 - a. At the time of each submission, call to the attention of Engineer in the letter of transmittal any deviations from the requirements of the Contract Documents.
 - b. Make all modifications noted or indicated by Engineer and return revised Submittals until approved. Direct specific attention in writing, or on revised Submittals, to changes other than the modifications called for by Engineer on previous Submittals. After paper copy Submittals have been approved, submit copies thereof for final distribution. Previously approved Submittals transmitted for final distribution will not be further reviewed and are not to be revised. If errors are discovered during manufacture or fabrication, correct the Submittal and resubmit for review.
 - c. Following completion of the Work and prior to final payment, furnish record documents and approved Samples and Shop Drawings necessary to indicate "as constructed" conditions, including field modifications, in the number of copies specified. Furnish additional copies for insertion in Equipment instruction books and operating manuals as required. All such copies shall be clearly marked "PROJECT RECORD."
 - d. Keep a copy or sample of each Submittal in good order at the Site.
 5. Quantity Requirements:
 - a. Except as otherwise specified, transmit all Shop Drawings in the following quantities:
 - 1) Initial Submittal: Paper – 6 copies to Engineer. 3 copies will be returned to Contractor.
 - 2) Resubmittals: Paper – 6 copies to Engineer. 3 copies will be returned to Contractor.
 - 3) Submittal for final distribution: Paper – 3 copies plus the number required by Contractor, to Engineer.
 - 4) As-constructed documents: Paper – 3 copies to Engineer.
 - b. Transmit Submittals of product data as follows:
 - 1) Initial Submittal: Paper – 6 copies to Engineer. 3 copies will be returned to Contractor.
 - 2) Resubmittals: Paper – 6 copies to Engineer. 3 copies will be returned to Contractor.
 - 3) Submittal for final distribution: Paper – 3 copies plus the number of copies required by Contractor, to Engineer.
 - c. Transmit Submittals of Material Samples, color charts, and similar items as follows:
 - 1) Initial Submittal – 5 to Engineer.
 - 2) Resubmittal – 5 to Engineer.
 - 3) Upon approval, – 2 Samples will be returned to Contractor.
 - d. Transmit Submittals of Equipment instruction books and operating manuals as follows:

- 1) Initial Submittal: Paper – 5 copies to Engineer. One copy will be returned to Contractor.
 - 2) Resubmittals: Paper – 5 copies to Engineer. One copy will be returned to Contractor.
 - 3) Submittal for Final Distribution – 4 paper copies to Engineer. Digital – 2 copies to Engineer.
- e. Transmit Submittals for reference only: Paper – 4 copies to Engineer.
 - f. Owner may copy and use for internal operations and staff training purposes any and all document Submittals required by this Contract and approved for final distribution, whether or not such documents are copyrighted, at no additional cost to Owner. If permission to copy any such Submittal for the purposes stated is unreasonably withheld from Owner by Contractor or any Subcontractor, manufacturer, or Supplier, Contractor shall provide to Engineer 30 copies plus the number of copies required by Contractor at each final distribution issue.
6. Equipment erection drawings and other Submittals required for the installation of Equipment furnished by others under separate contract for installation under this Contract will be transmitted to Contractor by Engineer in the final distribution of such Submittals.
 7. Information to Manufacturer's District Office: Contractor shall arrange for manufacturers and Suppliers of Equipment and Materials to furnish copies of all agreements, drawings, specifications, operating instructions, correspondence, and other matters associated with this Contract to the manufacturer's district office servicing the Owner. Insofar as practicable, all business matters relative to Equipment and Materials included in this Contract shall be conducted through such local district offices.
- F. Engineer's Review:
1. Engineer will review and return Submittals to Contractor with appropriate notations. Instruction books and similar Submittals will be reviewed by Engineer for general content but not for basic details.
 2. Work requiring a Submittal shall not be commenced or shipped until the Submittal has been marked "No Exceptions Taken" or "Make Corrections Noted" by Engineer.
 3. Engineer's acceptance of Submittals will not relieve Contractor from Contractor's responsibility as stated in the GENERAL CONDITIONS.
- G. Submittal Action Stamp: Engineer's review action will appear on all submittals of Contractor when returned by Engineer to Contractor. Review status designations listed on Submittal Action Stamp are defined as follows:
1. No Exceptions Taken: Signifies equipment or material represented by the submittal conforms with the design concept and complies with the intent of the Contract Documents and is accepted for incorporation in the Work. Contractor is to proceed with fabrication or procurement of the items and with related work.
 2. Make Corrections Noted: Signifies equipment or material represented by the submittal conforms with the design concept and complies with the intent of the Contract Documents and is accepted for incorporation in the Work. Contractor is to proceed with fabrication or procurement of the items and with related work in accordance with Engineer's notations.
 3. Amend and Resubmit: Signifies equipment or material represented by the submittal appears to conform with the design concept and complies with the intent of the Contract Documents, but information is either insufficient in detail or contains discrepancies which prevent Engineer from completing his review. Contractor is to resubmit revised information responsive to Engineer's annotations on the returned submittal or written in

the letter of transmittal. Fabrication or procurement of items represented by submittal and related work shall not proceed until the submittal is accepted.

4. Rejected – See Remarks: Signifies equipment or material represented by the submittal does not conform with the design concept or comply with the intent of the Contract Documents and is not accepted for incorporation in the Work. Contractor is to provide submittal responsive to the Contract Documents and to Engineer's notations. Fabrication or procurement of items represented by submittal and related work shall not proceed.

1.4 INFORMATION SUBMITTALS

A. Informational Submittals are comprised of technical reports, administrative Submittals, and guarantees which relate to the Work, but do not require Engineer approval prior to proceeding with the Work. Informational Submittals include:

1. Welder qualification tests.
2. Welding procedure qualification tests.
3. X-ray and radiographic reports.
4. Hydrostatic testing of pipes.
5. Field test reports.
6. Concrete cylinder test reports.
7. ASME pressure vessel test reports.
8. Certification on Materials:
 - a. Steel mill tests.
 - b. Roofing lab tests.
 - c. Brick and concrete masonry unit lab tests.
 - d. Paint lab tests.
 - e. Metal paneling lab tests.
 - f. Cement tests.
9. Soil test reports.
10. Air handling balancing reports.
11. Temperature records.
12. Piping stress analysis.
13. Shipping or packing lists.
14. Job progress schedules.
15. Equipment and Material delivery schedules.
16. Progress photographs.
17. Warranties and guarantees.
18. Fire protection and hydraulic calculations.

B. Transmittal of Informational Submittals:

1. All informational Submittals furnished by Subcontractors, manufacturers, and Suppliers shall be submitted to Engineer by Contractor unless otherwise specified.
 - a. Identify each informational Submittal by Project name and number, Contract title and number, and the Specification Section and Article number marked thereon or in the letter of transmittal. Unidentifiable Submittals will be returned for proper identification.
 - b. At the time of each submission, call to the attention of Engineer in the letter of transmittal any deviations from the requirements of the Contract Documents.
2. Quantity Requirements:
 - a. Technical reports and administrative Submittals except as otherwise specified:
 - 1) Engineer: Three copies.

- b. Written Certificates and Guarantees:
 - 1) Engineer: 6 copies.
- 3. Test Reports:
 - a. Responsibilities of Contractor, Owner, and Engineer regarding tests and inspections of Equipment and Materials and completed Work are set forth elsewhere in these Contract Documents.
 - b. The party specified responsible for testing or inspection shall in each case, unless otherwise specified, arrange for the testing laboratory or reporting agency to distribute test reports as follows:
 - 1) Engineer: Two copies.
 - 2) Resident Project Representative: One copy.
 - 3) Contractor: Two copies.
 - 4) Manufacturer or Supplier: One copy.
- C. Engineer's Review:
 - 1. Engineer will review informational Submittals for indications of Work or Material deficiencies.
 - 2. Engineer will respond to Contractor on those informational Submittals which indicate Work or Material deficiency.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01330

SECTION 02110 - CLEARING AND PROTECTION OF RIGHT-OF-WAY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section sets forth the materials and procedural requirements for clearing right-of-way. The Contractor shall confine construction activities to the right-of-way(s) obtained. All waste material and debris shall be disposed of in accordance with applicable federal, state, and local regulations includes construction dewatering.
- B. The majority of the work to be performed is on privately owned land and where the Utility has obtained easements.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

- A. The Contractor shall clear the right-of-way of brush and other debris and conduct such right-of-way construction as necessary to provide an adequate working area within the easement limits.
- B. In clearing the right-of-way, the Contractor shall remove only that vegetation, including trees, necessary for the progress of construction. If construction shall be in close proximity to such vegetation, particularly shade trees or other trees of significant value, the Contractor shall be expected to work without removing or damaging such vegetation. All shrubbery, small trees (less than four (4) inches in diameter measured 12 inches above the ground), and other landscaping items shall either be protected or replaced.
- C. All brush, timber, and other debris required to be removed shall be hauled from the site and disposed of by the Contractor in accordance with all federal, state, and local regulations. Burning of brush shall be permissible, provided that burning procedures shall be in full compliance with the provisions of all federal, state, and local agencies controlling and supervising these activities. Burning shall be conducted only when it does not jeopardize surrounding vegetation, right-of-way, and adjacent property.
- D. If any portion of the Work crosses off-site or private property where livestock are present, it shall the responsibility of the Contractor to protect the livestock by means of temporary fencing and/or other provisions and measures as necessary.

- E. At the completion of grading work, all right-of-way shall be left in a neat and presentable condition that can be mowed where terrain permits.

3.2 UTILITIES

- A. The Contractor shall be responsible for the location of all existing utilities within the construction area and shall verify that these existing utilities have been disconnected and capped before commencing with right-of-way clearing. Procedures for uncovering existing utilities, utility crossings, proximity, and notification of intent to excavate near existing utilities as specified in these Specifications.

3.3 MISCELLANEOUS ITEMS

- A. Signs, mailboxes, posts, fences, and other obstructions may require removal and replacement within the right-of-way. Such items shall be removed and protected. Temporary replacements shall be provided as necessary until permanent installations are provided. After construction in the immediate vicinity is completed, any items damaged by the Contractor shall be restored to an equal or better condition than before the damage or otherwise replaced to the original condition as acceptable to the owner of the damaged item.
- B. Historic items, relics, and other similar items, including but not limited to cornerstones, commemorative plaques or tablets, antiques, and other items of interest or value that may be encountered during right-of-way clearing shall be carefully removed and salvaged in order to prevent damage.
- C. Fences: If the Drawings indicate it shall be necessary to cross a fence during the course of construction, the cutting and rebuilding or repairing of the fence shall be as set forth in these Specifications.

END OF SECTION 02110

SECTION 02113 – SURFACE REMOVAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This section forth requirements for surface removal within lawns; gardens; mowed, cultivated, or other well-kept areas; fields, meadows, and other graded areas; wooded and rocky areas; or within the limits of paved or unpaved driving surfaces.
- B. This Specification shall not apply to state or interstate highways or driving surfaces within railroad right-of-ways unless otherwise directed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 ALLOWABLE SURFACE REMOVAL

- A. In all areas that water lines, sewer lines, force mains, manholes, and other appurtenances shall be constructed, any paved or unpaved surfaces shall be removed prior to excavation. The allowable limits of surface removal shall be dependent upon the type of area through which construction proceeds as set forth below.
 - 1. Lawns, Gardens, and Other Well-Kept Areas: In these areas, the Contractor shall excavate the top six (6) inches of topsoil from the ditch line, or as otherwise necessary to provide adequate topsoil for the establishment of vegetation as set forth in the Cleanup, Seeding, and Sod section of these Specifications, and store such material along the ditch line to prevent mixing with the remaining excavation.
 - a. The width of allowable surface removal shall be the standard trench width, as defined in the appropriate section of these Specifications for water or sewer lines.
 - b. The length of ground cover removed for the installation of pipe, fittings, manholes, or other appurtenances shall be the linear dimension of such installation plus 12 inches on each side of the trench.
 - 2. Fields, Meadows, and Other Graded Areas: Surface removal in these areas shall be as set forth in the Lawns, Gardens, and Other Well-Kept Areas paragraph in this Section.
 - 3. Wooded and Rocky Areas: In wooded or rocky areas, the ground cover shall be removed as set forth in the Lawns, Gardens, and Other Well-Kept Areas paragraph above, with the exception that the Contractor shall generally not be required to separate and store the top six (6) inches of topsoil along the ditch line. However, the Contractor shall be required to

store and replace topsoil as required to establish adequate vegetation in disturbed areas as set forth in the Cleanup, Seeding, and Sod section of these Specifications.

4. Driving Surfaces: Excavation within the limits of any driving surface, including paved and gravel streets, roads, driveways, and parking areas, shall be in accordance with the following Specifications.
 - a. The Contractor shall remove any required pavement or road surface as a part of the trench excavation. The amount to be removed shall depend upon the width of trench specified and the type of pavement area to be removed for the installation of pipe, fittings, manholes, and other appurtenances. Driving surfaces shall be removed to the dimensions set forth on the Drawings, and in accordance with these Specifications.
 - b. The Contractor shall use such methods as drilling, chipping, and sawing, to assure the pavement shall break along straight lines. The face of the remaining pavement shall be approximately vertical.

END OF SECTION 02113

SECTION 02211 – CLASSIFICATION OF EXCAVATION FOR CONSTRUCTION OF SEWER LINE INTERCEPTORS, FORCE MAINS, AND WATER LINES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Unless specifically provided for in the Bid and in the Methods of Measurement and Payment for rock excavation, all excavation shall be unclassified and considered subsidiary to related bid items.

1.3 DEFINITION OF ROCK EXCAVATION

- A. The work is underlain by broken chert, and/or solid chert, sandstone or limestone. The excavation required for construction of the pipeline may necessitate the excavation of solid chert, sandstone or limestone. The pay item for rock excavation in this project in the Bid and in the Methods of Measurement and Payment for rock excavation will include:
 - 1. solid chert, sandstone or limestone which requires blasting for removal;
 - 2. solid or consolidated chert, sandstone or limestone which cannot be normally ripped and removed with the power-operated excavator without hammering with the bucket which causes undue damage to the equipment; or
 - 3. boulders and pieces of masonry or concrete which exceed 1,000 pounds in weight.
- B. Layers of rock less than 12 inches in depth will not be considered for payment. Layers greater than 12 inches will be considered for payment only when the length exceeds 5 feet.
- C. Broken or weathered chert, sandstone or limestone which can be normally excavated with the power-operated excavator will not be classified as rock excavation.
- D. Rock and/or broken chert excavated in clearing of right of way and surface removal will not be classified nor will it be paid for as rock excavation.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 MEASUREMENT

- A. Measurement for rock excavation will be made on the basis of depth measured from 4 inches

below the bottom of the pipe to the top of the rock by a minimum width of either the pipe outside diameter plus 16 inches or the pipe outside diameter times 1.25 plus 12 inches, whichever is greater. No payment for rock excavation outside these limits will be made.

- B. Rock excavation shall be measured in place by the Resident Project Representative (RPR) before the trench is backfilled. At the end of each day's pipe laying operations, when the quantity of rock excavation has been determined, the RPR shall record the quantity of rock excavation to be paid for in his daily field report. The RPR will deliver a copy of the daily field report to the Contractor's representative. The Contractor's representative shall initial the RPR's copy of the daily field report indicating his agreement with the measured rock excavation for that day.

END OF SECTION 02211

SECTION 02230 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Protecting existing trees to remain, where indicated.
 - 2. Removing existing trees, shrubs, groundcovers, plants and grass.
 - 3. Clearing and grubbing.
 - 4. Stripping and stockpiling topsoil.
 - 5. Removing above- and below-grade site improvements.
 - 6. Disconnecting, capping or sealing, and abandoning site utilities in place or removing site utilities, as indicated.
 - 7. Temporary erosion and sedimentation control measures.
- B. Related Sections include the following:
 - 1. Division 2 Section "Environmental Specifications."

1.3 DEFINITIONS

- A. Topsoil: Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches (50 mm) in diameter; and free of subsoil and weeds, roots, toxic materials, or other nonsoil materials.
- B. Tree Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

1.4 MATERIAL OWNERSHIP

- A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be either burned or removed from Project site. Before burning, obtain approval from authorities having jurisdiction.

1.5 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of trees and plantings, adjoining construction, and site improvements that might be misconstrued as damage caused by site clearing.
- B. Record drawings identifying and accurately locating capped utilities and other subsurface structural, and electrical conditions.
- C. Copies of all applicable Federal, State and Local permits.

1.6 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner, authorities having jurisdiction, and Engineer.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
- C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.
- D. Do not commence site clearing operations until tree protection and temporary erosion and sedimentation control measures are in place.
- E. Do not commence site clearing operations until all applicable Federal, State and Local permits have been acquired.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Locate and clearly flag trees and vegetation to remain or to be relocated.
- C. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to Division 2 Section 02270 "Environmental Specifications" and all applicable Federal, State and Local requirements.
- B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.
- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

- A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

3.4 UTILITIES

- A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.
 - 1. Arrange with utility companies to shut off indicated utilities.
- B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Engineer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Engineer's written permission.
- C. Excavate for and remove underground utilities indicated to be removed.

3.5 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 3. Grub stumps and remove roots, obstructions, and debris extending to a depth of 18 inches (450 mm) below exposed subgrade.
 - 4. Use only hand methods for grubbing within tree protection zone.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material unless further excavation or earthwork is indicated.
 - 1. Place fill material in horizontal layers not exceeding a loose depth of 8 inches (200 mm), and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

- A. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.
- B. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust. Comply with Division 1 requirements and as follows:
 1. Limit height of topsoil stockpiles if required by any permit.
 2. Do not stockpile topsoil within tree protection zones.
 3. Dispose of excess topsoil as specified for waste material disposal.

3.7 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.
 2. Paint cut ends of steel reinforcement in concrete to remain to prevent corrosion.

3.8 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials including trash and debris, and either burn or legally dispose of them off Owner's property. Before burning, obtain approval from authorities having jurisdiction.
- B. Disposal shall comply with all applicable Federal, State and local requirements.

END OF SECTION 02230

SECTION 02240 - DEWATERING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes construction dewatering.

1.3 PERFORMANCE REQUIREMENTS

- A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations and permit construction to proceed on dry, stable subgrades.
 1. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
 2. Prevent surface water from entering excavations by grading, dikes, or other means.
 3. Accomplish dewatering without damaging existing buildings adjacent to excavation.
 4. Remove dewatering system if no longer needed.

1.4 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.
- B. Preinstallation Conference: Conduct conference at Project site.

1.5 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
- B. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.
 1. During dewatering, regularly re-survey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify Engineer if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
 - 1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
 - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

3.2 INSTALLATION

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
- B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed, or until dewatering is no longer required.
- C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.
 - 1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.
- E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
 - 1. Comply with Division 2 Section "Environmental Specifications."

- F. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.
 - 1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches (900 mm) below overlying construction.

- G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

END OF SECTION 02240

SECTION 02270 – ENVIRONMENTAL SPECIFICATIONS

PART 1 – GENERAL

1.1 Introduction

A. The purpose of Section 02270 Environmental Specifications is:

- 1) To identify the environmental regulatory requirements with which the Project OWNER must comply,
- 2) To identify the CONTRACTOR'S responsibilities related to compliance with OWNER'S environmental regulatory permits,
- 3) To provide specifications for CONTRACTOR'S implementation of Best Management Practices (BMPs) during construction activities, (including, but not limited to, sediment and erosion control structures) and achievement of final stabilization upon completion of construction activities,
- 4) To provide specifications for minimizing adverse impacts to the environment during CONTRACTOR'S construction activities, as a part of the terms and conditions of the Agreement between OWNER and CONTRACTOR.

B. Definitions:

- 1) ENVIRONMENTAL CONSULTANT is a subconsultant of ENGINEER. In all instances where notifications, submittals, or consultations with ENVIRONMENTAL CONSULTANT are required per these Specifications, the ENGINEER shall also be notified.

C. The following resources and regulatory references are available for the CONTRACTOR to use, to understand, and to implement for compliance with environmental regulatory requirements. The Section 02270 Environmental Specifications refer to each of these documents, which are, therefore, part of the Contract Specifications by reference. The CONTRACTOR shall be familiar with the content of each document and shall implement applicable requirements in all Work that CONTRACTOR performs for OWNER:

- 1) Arkansas Department of Environmental Quality (ADEQ) General Stormwater Permit for Construction Activity (ARR150000);
- 2) Stormwater Pollution Prevention Plan (SWPPP) – As required by ADEQ NPDES General Stormwater Permit for Construction Activity (ARR150000);
- 3) U.S. Army Corps of Engineers (COE) Section 404 Permit;
- 4) ADEQ 401 Water Quality Certification;
- 5) Short Term Activity Authorization for unavoidable impacts to “waters of the State” issued by ADEQ;
- 6) Cave System Contingency Plan – U.S. Fish and Wildlife Service (USFWS)

Recommendations for Cave Protection;

- 7) Title 40 of the Code of Federal Regulations, Part 112 requirements for implementation of a Spill Prevention Control and Countermeasures Plan (SPCCP), as required by USEPA;
 - 8) EPA's list of Reportable Quantities of Hazardous Substances, found at 40 CFR 302.4, and the reporting requirements for releases at, or in excess of, the reportable quantities;
 - 9) Project Comprehensive Best Management Practices Plan (CBMPP);
 - 10) This Section 02270 Environmental Specifications;
 - 11) Any other state or local sediment and erosion control plans that have been developed are enforceable by the general stormwater permit and are required to be implemented by CONTRACTOR. This applies only to site-specific state or local permits or plans;
 - 12) Copies of, and/or applicable references to, these documents are contained within the CBMPP.
 - 13) In reference to the above-listed documents, the ADEQ permit, COE permit, EPA regulatory requirements, and USFWS recommendations take precedence. Section 02270 takes precedence over the CBMPP. However, where the CBMPP contains more detail on a subject than Section 02270, the additional details prevail, as appropriate. If specifications in the documents conflict, the most restrictive requirement shall prevail.
- D. The ADEQ has adopted the EPA stormwater regulations at 40 CFR 122.26 that require National Pollutant Discharge Elimination System (NPDES) permits for stormwater discharges from construction activities, and developed the Arkansas General Permit ARR150000 pertaining to stormwater discharges associated with construction activities. The permitting requirement applies to sites where construction activities began after October 1, 1992, and result in a surface disturbance that exceeds one acre. As a requirement of the general permit, controls to reduce pollutant loading in stormwater shall be developed and implemented for regulated construction activities. The anticipated area of disturbance for the facility is approximately three and one half (3.5) acres. Therefore, the project meets the definition of a "small" construction site and submittal of a Notice of Intent (NOI) for authorization under the ADEQ general stormwater permit for construction activities is not required.
- E. CONTRACTOR shall be responsible for compliance with the Arkansas general stormwater permit ARR150000 that became effective on November 1, 2011 which has the addition of narrative Effluent Limitation Guidelines (ELG) based on Federal requirements identified in 40 CFR Part 450 Subpart B, that include new requirements for the following:
- 1) Erosion and Sediment Controls.
 - 2) Soil Stabilization.
 - 3) Dewatering.
 - 4) Pollution Prevention Measures.

- 5) Prohibited Discharges.
 - 6) Surface Outlets.
- F. CONTRACTOR shall be responsible for compliance with all applicable terms and conditions of Arkansas General Permit ARR150000 as it relates to their activities on the construction site, including protection of endangered species and implementation of BMPs and other controls required by the permit.
- G. Best Management Practices: By definition, Best Management Practices (BMPs) are schedules of activities, prohibition of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the State. BMPs also include treatment requirements, operating procedures, and practices to control site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. BMPs can be structural (such as a temporary retention pond) or non-structural (such as materials handling practices). All of the Regulatory References listed above, discuss various BMPs that are applicable to the OWNER. CONTRACTOR shall implement specified and required BMPs and strictly adhere to environmental regulatory requirements in all Work that CONTRACTOR performs for OWNER.
- H. For areas where construction will cross the streams and/or involve a discharge of fill material into "waters of the United States", authorization under the COE Section 404 Permit Program, as described in 33 CFR Appendix A to Part 330, has been issued to the OWNER.
- I. Water Quality Certification Conditions – As required by Section 401 of the Clean Water Act. Section 401 Water Quality Certification issued by the ADEQ requires the implementation of BMPs and all other reasonable measures during construction to minimize impacts to water quality via implementation of a BMP Plan.

PART 2 – PRODUCTS (NOT USED)

PART 3 -- EXECUTION

PART 4 - CONTRACTOR REQUIREMENTS

4.1 General Requirements

- A. The CONTRACTOR shall be responsible for implementing all applicable requirements of the ADEQ General Stormwater Permit for Construction Activity (ARR150000), 401 Water Quality Certification, the COE Section 404 Permit, the ADEQ Short-Term Activity Authorization, the SPCCP, the USFWS recommendations for cave protection, local Municipal Separate Storm Sewer requirements, and all other environmental regulatory requirements that are associated with the construction activities that they are contracted to perform. The CONTRACTOR shall comply with all provisions set forth in the Environmental Specifications contained herein. Section 02270 Environmental Specifications refers to each of these documents, which are therefore, part of these

specifications. CONTRACTOR is responsible for managing all materials, equipment, and activities at the work site in a manner that is in compliance with local, State, and Federal environmental regulations.

- B. In the event of an environmental regulatory non-compliance incident(s) that results in a fine or penalty assessed against the OWNER, the CONTRACTOR shall be liable for payment of said fine(s) or penalties.
- C. Although these specifications provide environmental regulatory guidance, CONTRACTOR shall be responsible for selection, installation, implementation, and maintenance of structural and nonstructural BMPs at the construction site that minimize pollutants in stormwater discharges, as necessary to meet applicable water quality standards, and follow all other environmental regulatory requirements. Detailed specifications are provided for BMPs most commonly used. However, CONTRACTOR may use BMPs described in other guidance documents, as long as they are effective, compliant with environmental regulatory permits, and approved by ENVIRONMENTAL CONSULTANT.
- D. CONTRACTOR shall be aware of, and responsible for, compliance with the ADEQ General Stormwater Permit for Construction Activity (ARR150000), as applicable, that became effective on November 1, 2011. CONTRACTOR shall be responsible for becoming aware of requirements detailed in the general permit that are made available to the public on the ADEQ website at:

http://www.adeq.state.ar.us/water/branch_permits/general_permits/stormwater/construction/construction.htm
- E. CONTRACTOR shall supervise, inspect, and direct the work necessary in a competent and efficient manner, devoting such attention thereto, and applying such skills and expertise as may be necessary to perform work to maintain compliance with environmental regulatory requirements. CONTRACTOR shall be solely responsible for the means, methods, techniques, sequence, and procedures of sediment and erosion control measures.
- F. CONTRACTOR shall keep on the Work at all times during its progress, competent and suitably qualified personnel to perform the Work associated with environmental regulatory compliance, as required by the Contract Documents.
- G. Bid shall be lump sum price for sediment and erosion control and site restoration. Payment will be made upon completion of the work, all remedial measures and restorations have been accomplished, and the OWNER has determined that CONTRACTOR has met all environmental regulatory requirements, including achievement of final stabilization.

4.2 Certifications

- A. CONTRACTOR shall be responsible for implementing the project Stormwater Pollution Prevention Plan (SWPPP) as a part of the CBMPP. CONTRACTOR shall retain a copy of the CBMPP on-site from the time of project commencement to the date of final stabilization.
- B. For each measure identified in the plan, the SWPPP must clearly identify the contractor(s) that will implement the measure. If additional contractors are added to the project, then the list of contractors should be updated accordingly in the SWPPP.
- C. CONTRACTOR shall post the Notice of Coverage (NOC) at the construction site in a prominent place for public viewing (such as alongside a building permit) prior to commencing construction and the SWPPP must be available at the construction site prior to commencing construction.
- D. CONTRACTOR'S representative who will be responsible for site evaluations required by ADEQ general stormwater permit shall execute the following certification prior to conducting any site evaluation activities at the site:

"I certify under penalty of law that documents and all attachments such as Inspection Forms were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

4.3 Construction Practices (Sediment and Erosion Controls)

4.3.1 General Sediment and Erosion Controls

- A. The SWPPP contains detailed specifications for BMPs most commonly used. However, BMPs described in any of the other EPA-approved documents are available for CONTRACTOR'S use upon approval by ENVIRONMENTAL CONSULTANT. The structural sediment and erosion controls designated on Sediment and Erosion Control Plan (SECP) Sheets and/or Typical Drawings indicate the minimum sediment and erosion control structures that shall be initially implemented by CONTRACTOR. CONTRACTOR shall be aware of the dynamics of a construction project and shall implement additional sediment controls, erosion controls, and pollution prevention measures not indicated on SECP Sheets as necessary to maintain compliance with environmental regulatory requirements. CONTRACTOR shall be responsible for continually updating SECP Sheets to indicate current representation of controls implemented at the site.

B. CONTRACTOR shall be aware of the dynamics of sequencing a construction project and shall include the specific intended sequence of major construction activities, including staging and material laydown areas, construction entrances, etc., within the SWPPP. Each sequence or specified activity shall include any additional, or relocation of, BMPs, if applicable. CONTRACTOR shall maintain compliance with the ADEQ General Stormwater Permit for Construction Activities (ARR150000), which reads in part as follows:

- 1) *"For drainage locations serving less than 10 acres, sediment traps, silt fences, or equivalent sediment controls are required for all side slope and down slope boundaries of the construction area unless a sediment basin providing storage based on either the smaller of 3,600 cubic feet per acre, or a size based on the runoff volume of a 10-year, 24-hour storm is provided. (A rule of thumb is one square foot per acre for a spillway.) However, in order to protect the waters of the state, the Director, at his/her discretion, may require a sediment basin for any drainage areas draining to a common point."*
- 2) *"Velocity Dissipation Devices. Velocity dissipation devices must be placed at discharge locations, within concentrated flow areas serving two or more acres, and along the length of any outfall channel to provide a non-erosive flow velocity from the structure to a water course so that the natural physical and biological characteristics and functions are maintained and protected (i.e., no significant changes in the hydrological regime of the receiving water). Please note that the use of hay-bales is not recommended in areas of concentrated flow."*

C. CONTRACTOR shall have day-to-day control over construction activities and shall be responsible for implementing, adding, relocating, and/or maintaining erosion control structures and BMPs, as necessary, to maintain compliance with the ADEQ Stormwater Permit for Construction Activities (ARR150000), the CBMPP, the Section 404 permit, and the SPCCP applicable to the CONTRACTOR's work. This includes activities that are contracted by the CONTRACTOR to subcontractors.

D. Regarding the sequencing of sediment and erosion controls, CONTRACTOR shall install perimeter silt fences (and other necessary sediment and erosion control structures) after the clearing and grubbing necessary for installation of the measure, but before the clearing and grubbing for the remaining portions of the site. As various phases of construction take place, CONTRACTOR shall be responsible for maintaining necessary structural sediment and erosion controls from the time of initial surface disturbance until final stabilization has been achieved, and as specified in the ADEQ General Stormwater Permit for Construction Activities (ARR150000), which reads in part as follows:

- 1) *"Perimeter controls must be actively maintained until final stabilization of those portions of the site upward of the perimeter control. Temporary perimeter controls must be removed after final stabilization and properly disposed."*

- E. The CONTRACTOR shall follow all applicable State and/or local sanitary sewer, septic system, and waste disposal regulations. Open burning of refuse, trash, garbage, or other waste material is prohibited by Section 18.602 of the Arkansas Air Pollution Control Code (Regulation 18).
- F. The CONTRACTOR shall be responsible for ensuring that the following temporary and permanent measures for sediment and erosion control are used where practicable, and/or required:
- 1) At a minimum, silt fences or equivalent sediment controls shall be installed for all side slope and down slope boundaries of the construction area.
 - 2) Natural vegetation shall be preserved at vegetation buffer zones that may exist adjacent to areas of active construction, wherever possible.
 - 3) Check dams and/or silt fencing shall be anchored below ground surface at the foot of slopes.
 - 4) Earthen interceptor dikes on the upgradient side of all areas of construction shall be used to divert runoff flow away from the area of excavation/surface disturbance and into an area of natural vegetation, or have sediment control structures installed at the down slope end such as rock check dams, straw bales or silt fencing, wherever practicable.
 - 5) Periodic removal of trapped sediment shall be conducted to maintain the operating condition of structural controls. Structural controls shall be promptly repaired or restored as needed. Sediment collected in the various sediment control devices shall be removed when needed or as directed by ENVIRONMENTAL CONSULTANT. Sediment removed shall be deposited and stabilized and will normally be incorporated back into the final grade construction, or disposed offsite, as directed by ENVIRONMENTAL CONSULTANT.
 - 6) Vegetative buffer strips shall be maintained at the top and bottom of slopes outlining the area of construction or adjacent to streams. These zones may consist of planted vegetation or preserved existing vegetation. CONTRACTOR shall protect and maintain a minimum of twenty-five (25) feet of vegetative buffer zone, as measured from the top of the bank to the disturbed area, from any stream, with the exception of areas designated for construction activities.
 - 7) CONTRACTOR shall not clear, grub, or excavate more than 1,000 feet of linear path or more than 5 days of projected trenching/installation activity, unless otherwise approved by the OWNER. CONTRACTOR shall complete final surface restoration within two weeks of the installation or repair of the facilities or as directed. In no case shall the length between non-restored areas and the pipe laying operations exceed 2,000 feet unless otherwise approved by the OWNER.

- 8) The CONTRACTOR shall be responsible for achieving temporary soil stabilization and pollution prevention during the period of active construction and achieving final stabilization where construction activities have ceased.
- 9) Immediately upon completion of work in local areas, CONTRACTOR shall restore the project site to conditions equivalent to or better than those existing prior to starting construction unless otherwise required by these specifications, environmental regulatory permits and/or as shown on the Plans. Temporary and/or permanent stabilization at construction locations shall be done in a progressive manner. The CONTRACTOR shall comply with the requirement of the general stormwater permit that soil stabilization shall be initiated on disturbed areas as soon as practicable, but no more than 14 days after construction activity on a portion of the site has temporarily or permanently ceased, unless construction activity will resume within 21 days.
- 10) If CONTRACTOR violates any environmental regulatory requirement, or any other requirement of these specifications, and fails to properly maintain, install and/or construct erosion and sediment control measures, the OWNER may take, but is not limited to, one or more of the following actions:
 - a. Cessation of other project related work,
 - b. Withholding of CONTRACTOR payments,
 - c. Suspension of the Project,
 - d. Default of the Contract.
- 11) All work required due to a violation of environmental regulatory requirements, or other requirements of these specifications, which result from CONTRACTOR negligence, carelessness, or failure to perform work as scheduled, shall be performed by the CONTRACTOR at no cost to the OWNER.
- 12) If CONTRACTOR fails to restore the area within specified time periods, the OWNER shall reserve the right to secure a landscaping service to perform the work. The total cost of the restoration work shall be the responsibility of CONTRACTOR. OWNER reserves the right to require CONTRACTOR to cease construction activities should CONTRACTOR fail to follow progressive sequential stabilization activities, or fail to be in compliance with any environmental regulatory requirement.
- 13) CONTRACTOR shall be responsible for "final stabilization", as defined in the ADEQ General Stormwater Permit (ARR150000), meaning that all soil disturbing activities at the site have been completed and a uniform (e.g., evenly distributed, without large bare areas) *perennial* vegetative cover with a density of 80% of the native background vegetation cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or equivalent permanent stabilization measures, have been employed. For example, if vegetative cover is 60% prior to construction, then 80% of the original 60% vegetation must be established to

achieve final stabilization; therefore, in this hypothetical scenario there must be 48% vegetative ground cover established for final stabilization to be deemed achieved.

- 14) Discharges to waters for which there is a total maximum daily load (TMDL) allocation are not eligible for coverage under the Arkansas General Stormwater Permit unless a SWPPP has been developed and certified that is consistent with the assumptions and requirements in the approved TMDL. Consequently, if at any time during the course of the project, a TMDL is developed and approved for the receiving stream(s) the CONTRACTOR shall be responsible for implementation of additional BMPs, as determined necessary by the ADEQ, to meet the requirements of the TMDL.
- 15) As a protective measure, 401 Water Quality Certification has been issued by the ADEQ for the COE Section 404 Permit, as required by the Clean Water Act. If it is determined by the ADEQ at any time during the course of the project that the stormwater discharge from the site has caused or may cause an excursion above an applicable water quality standard, the CONTRACTOR shall be responsible for implementing additional BMPs determined necessary to maintain water quality standards within the streams where practicable.

4.3.2 Silt Fences

- A. This item consists of placing and securing a geotextile fabric to an existing support system or constructing a self-supporting geotextile fence where shown on the plans or as directed by ENVIRONMENTAL CONSULTANT for the purposes of impeding the flow of water carrying silt toward existing streams and/or across adjacent property redirecting the flow of silt-laden water to a sediment basin; and/or routing clean water through the construction area.
- B. In areas where silt fencing is required, CONTRACTOR shall use the following installation specifications:
 - 1) CONTRACTOR shall use silt fence geotextile fabric in accordance with Section 625 of the Arkansas 2003 Standard Specifications for Highway Construction: Type 3 or Type 4. Only those fabric types specified for use as silt fence by the manufacturer shall be used. Supports for the fabric shall be of any material of sufficient strength and durability to support the fabric when loaded with silt for the entire time the barrier is needed for service. This may include, but not be restricted to, 2-inch diameter pine, 2-inch diameter oak, steel T-posts, or 1.33-lb/linear ft. steel as long as they have a minimum length of 4 feet.
 - 2) The fabric toe shall be buried to secure the base. Re-anchoring of the toe of the installed silt fence and re-securing the geotextile fabric to the supports shall be considered normal maintenance and will be considered included in the unit price bid for silt fence.

- 3) Fabric shall be stretched and securely fastened to the fence with wire fasteners, staples, or preformed clips.
- 4) Fabric shall be attached to "upgradient" side of posts to prevent stormwater flow from tearing fabric from posts.
- 5) All silt fences shall be installed at level grade following contours. Both ends of each fence section shall be extended at least 8 feet upslope at 45 degrees to the main fence alignment to allow for pooling of water and prevent stormwater runoff from flowing around end of silt fence.
- 6) Ends of a silt fence shall be tied into the landscape to prevent flow around the end of the fence before the pool reaches design level. CONTRACTOR shall provide stabilized outlets to protect the fence system and release storm flows that exceed the design storm. Splices shall be securely fastened. At fabric ends, both ends shall be overlapped a minimum of 6 inches, folded, and secured to the fence. The fabric toe should be placed in the bottom of the trench, backfilled, and compacted.
- 7) CONTRACTOR shall be responsible for maintenance of silt fences. Silt accumulations shall be removed before they reach 1/3 of the silt fence height. Silt fences shall be replaced, as necessary, should they fail to achieve adequate sedimentation control.
- 8) CONTRACTOR shall ensure that the depth of impounded water does not exceed 1.5 feet at any point along the silt fence.
- 9) The design life of a synthetic silt fence should be approximately 6 months.
- 10) The slope length is the distance from the fence to the drainage divide or the nearest upslope channel. The maximum slope length above silt fence shall not exceed the following dimensions:

Slope - Percent	Maximum Slope Length (ft) Above Fence	
	18-Inch High Fence	30-Inch High Fence
2 (or Less)	150	500
5	100	250
10	50	150
15	35	100
20	25	70
25	20	55
30	15	45
35	15	40
40	15	35
45	10	30
50	10	25

- 11) "Super" silt fence with chain-link fencing or 2-inch by 4-inch wire backing shall be used to control runoff from small disturbed areas where the maximum slope lengths for standard 18-inch or 30-inch silt fence cannot be met and sufficient room for construction of sediment traps or basins does not exist.
- 12) The maximum slope length above any "super" silt fence should not exceed the following dimensions:

Slope Percent	Maximum Slope Length (ft)
2 (or less)	1,000
5	500
10	300
20	200
30	100
40	75
50	50

- 13) "Super" silt fence shall not be used in areas where rock or rocky soils prevent the full and uniform anchoring of the fence or proper installation of the fence posts. It shall be used only where access exists or can be made for the construction equipment required to install and remove the fencing.
- 14) Wire reinforcement for "super" silt fence shall be a minimum 14 gauge and a maximum mesh spacing of 4 inches.
- 15) Poles for "super" silt fence shall be 2.5-inch diameter galvanized or aluminum posts, or 4 feet long steel "T-posts", set at 6-foot maximum spacing. Poles shall be driven a minimum 18-inches below the ground surface and extend a minimum of 30 inches above the ground surface.
- 16) The "super" silt fence shall be entrenched into an 8-inch deep trench and the disturbance on the downslope side shall be minimized. The bottom of the trench should be at level grade. Maximum deviation from level grade should be 5 percent, and not extend for more than 50 feet, where practicable.
- 17) "Super" silt fence shall be installed at level grade. Both ends of each fence section shall be extended at least 8 feet upslope at 45 degrees to the main fence alignment to allow for pooling of water.
- 18) Silt fence shall be installed so as to serve a 10-year peak storm event. A 10-year, 24-hour peak storm event equates to approximately 5 inches of rainfall, resulting in 2.3 inches to 4.9 inches of runoff.
- 19) Should silt fences fail from excessive stormwater flow, CONTRACTOR shall be responsible for installing additional rows of silt fence that follow the contours of slopes, and/or other structural controls necessary to prevent future silt fence failure.

4.3.3 Straw Bale Check Dams

- A. According to the EPA BMP Manual, the use of hay bales in concentrated flow areas is not recommended as a best management practice.
- B. CONTRACTOR shall use straw bale check dams only where the following conditions apply:
 - 1) Where contributing area is approximately 1/2 acre, or less.
 - 2) Where there is not concentration of water in a channel above the barrier.
 - 3) Where length of slope above the barrier is less than 100 feet.
 - 4) Where straw bales are used in conjunction with silt fence.
- C. Straw bales shall not be used on high silt producing areas, above high-risk areas, where water concentrates, or where there would be a possibility of a washout.
- D. Straw bales shall not be used in excess of a three-month time period. If construction continues beyond this time period, the existing straw bales shall be replaced with new bales.
- E. CONTRACTOR shall install straw bales to the following specifications:
 - 1) Anchors shall be No. 5 reinforcing bars, 2-inch x 2-inch oak stakes, or steel pickets.
 - 2) A trench shall be excavated along the areas where straw bales will be used to a depth of 4 inches and to the width of one straw bale. The straw bales then shall be placed in the trench with excavated material placed on upgradient side of the check dam and compacted.
 - 3) Straw bales shall be anchored with a minimum of two (2) stakes or rebars per bale, driven into the underlying soil, making sure that the binding wire or twine is facing the sides and not touching the soil. The first stake into each bale shall be driven toward the previously laid bale to force them together.
 - 4) Spacing between the bales shall be tightly chinked with loose straw and overlapped with an additional straw bale.
 - 5) Ends of a check dam shall be angled outward and upgradient to prevent flow around the end of the check dam before the pool reaches design level.
 - 6) After straw bales are in place the excavated soil shall be backfilled against the upslope side of the straw bales to a height of 4 inches after compacting.

- 7) Straw bales shall be routinely inspected to determine if any repairs or replacements to the straw bales are needed. If it is determined that the straw bales need to be repaired or replaced, the work will occur immediately. Silt accumulations shall be removed before they reach 1/3 the barrier height.

4.3.4 Sand Bag Ditch Check

- A. CONTRACTOR shall use sand bag ditch checks where shown on the plans or as directed by the ENVIRONMENTAL CONSULTANT.
- B. This item shall consist of preparing and placing sand bags in ditches, or as a perimeter barrier to sheet flow to impede run-off velocity of water and to prevent scouring and eroding of soil until permanent erosion control items can be placed.
- C. Sand for sand bags shall consist of a sandy type soil or clean sand that meets the approval of ENVIRONMENTAL CONSULTANT. Bags for sand shall be of a tightly woven burlap or other material that is sufficiently durable to remain intact for the time intended. The sacks shall be filled approximately 3/4 full, shall weigh a minimum of 55 pounds and shall be securely closed.
- D. Sand bags shall be placed in the ditches at locations shown on the plans or as directed by ENVIRONMENTAL CONSULTANT. They shall be laid in horizontal courses and successive courses shall break joints with preceding ones. The sacks shall be rammed and packed against each other and tamped on the surface to secure a uniform surface. The number of bags required and the arrangement at each installation will vary with on-site conditions. The overflow area in the center of the ditch check shall be constructed lower than the sides.
- E. Ends of a ditch check shall be angled outward and upgradient to prevent flow around the end of the check dam before the pool reaches design level.

4.3.5 Gravel Bag Barrier

- A. CONTRACTOR shall use gravel bag barriers where shown on the plans or as directed by the ENVIRONMENTAL CONSULTANT.
- B. A gravel bag barrier consists of a single row of gravel bags that are installed end-to-end to form a barrier across a slope to intercept runoff, reduce its flow velocity, release the runoff as sheet flow, and provide some sediment removal. Gravel bag barriers can also be used where flows are moderately concentrated, such as ditches, swales, and storm drain inlets to divert and/or detain flows.
- C. Bags shall be woven polypropylene, polyethylene, or polyamide fabric; minimum unit weight 4 ounces per square yard; mullen burst strength exceeding 300 psi in conformance with the requirements in ASTM designation D3786; and ultraviolet stability exceeding 70 percent in conformance with the requirements in ASTM designation D4355.

- D. Gravel fill material shall be between 0.4 and 0.8 inches in diameter and shall be clean and free from clay balls, organic matter, and other deleterious materials. Bags shall be filled approximately 2/3 full with gravel and shall be securely closed.
- E. When used as a linear control for sediment removal, bags shall be installed along a level contour with ends of gravel bag row turned up slope (j-hook style) to prevent flow around the ends. When used for concentrated flows bags shall be stacked to required height using a pyramid approach, the upper rows of gravel bags should overlap joints in lower rows. Gravel bag barriers shall be installed with a set-back of at least 3 feet from the toe of a slope to allow for cleaning out of accumulated sediment.
- F. Ends of barrier shall be angled outward and upgradient to prevent flow around the end of the check dam before the pool reaches design level.

4.3.6 Diversion Ditch

- A. Where shown on the plans or as directed by the ENVIRONMENTAL CONSULTANT this item shall consist of excavating or grading for diversion ditches to control soil erosion at selected locations. Diversion ditches will generally be excavated above the back slopes of cuts, along the top of embankments, or across fore slopes and back slopes to divert the run-off to natural drainage channels, downslope protection locations, or sediment basins. Sediment laden water shall not be discharged directly into natural drainage channels.

4.3.7 Rock Ditch Checks

- A. Where shown on the plans or as directed by the ENVIRONMENTAL CONSULTANT this item shall consist of constructing small dams across swales or ditches to slow concentrated storm water runoff to a non-erosive velocity. The overflow area in the center of the ditch check shall be constructed lower than the sides.

4.3.8 Wattles

- A. Wattles are sediment and stormwater velocity control devices that are composed of tubes of straw, rice straw, or coconut husk encased in ultraviolet (UV) degradable plastic netting or 100% biodegradable burlap material. Wattles help stabilize slopes by breaking up the length, and by slowing and spreading overland water flow.
- B. Wattles may be suitable along the toe, top, face, and at grade breaks of exposed and erodible slopes to shorten slope length and spread runoff as sheet flow; at the end of a downward slope where it transitions to a steeper slope; along sidewalks and curbs to prevent sediment from washing into gutters; around storm drains and drop inlets; down-slope of exposed soil areas; and around temporary material spoil and stockpiles, such as topsoil and for streambank (sensitive area) protection.
- C. CONTRACTOR shall install wattles to the following specifications:

- 1) Installation of wattles begins by constructing a shallow trench, 2 to 4 inches deep, and shaped to accept the wattle, along the contour of the slope. All debris (rocks and clods) that would prevent close contact between the wattle and soil should be removed. The wattle is placed in the trench, and excavated material from the trench is packed tightly along the base of the wattle, on the uphill side. The wattle should be secured with 1-inch by 1-inch wooden stakes or No. 5 rebar. The stakes should be placed at a 4-foot spacing and driven in perpendicular to the slope through the center of the wattle leaving less than 2 inches of stake exposed above the wattle. The terminating ends of each wattle installation should be turned uphill a minimum of 6 inches to prevent runoff from flowing around the ends of the wattle.
- 2) Flat ground application. Install along sidewalks and behind curbs, fitting tightly against the concrete before backfilling, then backfill the wattle to create a trench.
- 3) Storm drain inlet protection. Wattles placed along the back of curb should be offset, as required to go around structures such as curb intakes that project behind the back of curb. At these locations, the wattle should be placed behind the structure (not over it) and shaped to direct water around either side of the structure to prevent ponding. At area intake locations, a shallow trench should be constructed 1 to 2 feet away from the edge of the intake. The wattle should be placed in the trench and firmly staked in place.
- 4) For slope applications, wattles shall be installed on the contour from the bottom of the slope upward.
- 5) Wattles can be made from straw, rice straw, coconut husk, or other approved material. The netting consists of biodegradable burlap or high-density polyethylene and ethyl vinyl acetate containing ultraviolet inhibitors. Straw shall be Certified Weed Free Forage, by a manufacturer whose principle business is wattle manufacturing. Coir (coconut fiber) can be in bristle and mattress form, and should be obtained from freshwater cured coconut husk.
- 6) Wattles are available in a variety of diameters ranging from 9 inches to 20 inches. The most common sizes are 9 and 12-inch wattles. The allowable spacing for these diameters shall be, as follows:

Slope	Spacing Intervals (ft.)	
	9" Diameter	12" Diameter
<4:1	20	40
2:1 to 4:1	15	30
2:1 or greater	10	20

- 7) For soft, loamy soils, the spacing interval should be decreased. For hard, rocky soils, the spacing interval may be increased.
- 8) For highly erosive soils, and for slopes 2:1 or greater, an additional row of wooden

stakes should be provided on the downhill side of the wattle.

- 9) CONTRACTOR shall maintain, repair, and/or replace split, torn, unraveling or slumping wattles. If the wattle is used as a sediment capture device, or as an erosion control device to maintain sheet flows, sediment that accumulates in the wattle must be periodically removed when accumulation reaches one-half the designated sediment storage depth (usually one-half the distance between the top of the fiber roll and the adjacent ground) in order to maintain effectiveness. If wattles are used for reduction of slope length, sediment removal should not be required as long as the system continues to control the grade. Additional sediment control practices are required to be used in conjunction with this type of application.

4.3.9 Pit/Trench Dewatering

- A. The ADEQ General Permit strictly prohibits turbid discharges to surface waters of the state resulting from dewatering activities. Ground water dewatering which does not contain sediment or other pollutants is not required to be treated prior to discharge. However, care must be taken when discharging ground water to ensure that it does not become pollutant-laden by traversing over disturbed soils or other pollutant sources.
- B. Water removed from open pits and/or trenches shall have silt removed prior to leaving the immediate site of construction. Silt shall be removed by natural vegetation, a straw bale trench dewatering inlet device, settling pond, filter bag, a rock/geotextile fabric sediment trap/basin, or other appropriate sediment control measure. Water filtered through a basin shall not violate any water quality standard and shall have efficient sediment/silt removal prior to discharging to a waterbody.
- C. CONTRACTOR shall be responsible for providing adequate number of pumps for prompt and efficient dewatering. Ends of discharge hoses shall be provided with a flow dispersion device to prevent scouring of surface soils, and/or washout of stream banks. Discharges from dewatering activities shall not be conveyed into or upon any roadside ditch, curb and gutter, street or publicly used thoroughfare.
- D. The direct discharge of silty/muddy water to a stream is strictly prohibited.
- E. The direct discharge of silty/muddy water off of the project site is strictly prohibited.
- F. The direct discharge across areas of equipment access points and/or construction haul roads is strictly prohibited.
- G. CONTRACTOR is solely responsible for adequate maintenance of dewatering filtration and sedimentation structures to assure they are working in an efficient manner.
- H. CONTRACTOR shall install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

- I. CONTRACTOR shall provide standby equipment on-site that is available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, CONTRACTOR, shall at CONTRACTOR'S expense, restore damaged structures and surface soils at no additional expense to OWNER.
- J. CONTRACTOR shall remove dewatering system from Project site on completion of dewatering and promptly repair damages to adjacent areas caused by dewatering operations within 3 business days of completion of dewatering activity.

4.3.10 Sediment Basins

- A. Sediment basins shall consist of excavating and grading a storage area to detain sediment-laden runoff from disturbed areas long enough to allow sediment to settle out. Sediment basins shall be placed at locations shown on the plans or as directed by the ENVIRONMENTAL CONSULTANT.
- B. Discharges from basins and impoundments shall utilize outlet structures that withdraw water from the surface, unless infeasible.
- C. The soil used in basin construction shall be compacted and stabilized. Dumped riprap and geotextile for a sediment basin with a spillway outlet shall be placed on the spillway as shown on the plans. For sediment basins with a pipe outlet, the rock filter material shall be placed around a perforated riser pipe that is connected with an elbow to a non-perforated corrugated metal pipe. Sufficient rock filter shall be used to cover the perforations and stabilize the riser. An anti-seep collar shall be installed.
- D. Sediment basins shall not be obliterated until final stabilization has been achieved. The soil used to create the basin, the sediment trapped in the basin, and the dumped riprap and rock filter for the outlet may be used to fill the basin; however, all fill material used shall be compacted and stabilized. The area shall be graded to conform to the adjacent contours, unless otherwise directed by the ENGINEER.

4.4 Narrative Effluent Limitations Guidelines (ELG)

CONTRACTOR shall comply with the following narrative effluent limitations:

- A. Erosion and Sediment Controls. Install and maintain effective erosion controls and sediment controls to minimize the discharge of pollutants. At a minimum, such controls must be designed, installed and maintained to:
 - 1) Control stormwater volume and velocity within the site to minimize soil erosion;
 - 2) Control stormwater discharges, including both peak flow rates and total stormwater volume, to minimize erosion at outlets and to minimize downstream channel and streambank erosion;

- 3) Minimize the amount of soil exposed during construction activity;
 - 4) Minimize the disturbance of steep slopes;
 - 5) Minimize sediment discharges from the site. The design, installation and maintenance of erosion and sediment controls must address factors such as the amount, frequency, intensity and duration of precipitation, the nature of resulting stormwater runoff, and soil characteristics, including the range of soil particle sizes expected to be present on the site;
 - 6) Provide and maintain natural buffers around surface waters, direct stormwater to vegetated areas to increase sediment removal and maximize stormwater infiltration, unless infeasible; and
 - 7) Minimize soil compaction and, unless infeasible, preserve topsoil.
- B. Soil Stabilization. Stabilization of disturbed areas must, at a minimum, be initiated immediately whenever any clearing, grading, excavating or other earth disturbing activities have permanently ceased on any portion of the site, or temporarily ceased on any portion of the site and will not resume for a period exceeding 14 calendar days. Stabilization must be completed within a period of time determined by the permitting authority. In arid, semiarid, and drought stricken areas where initiating vegetative stabilization measures immediately is infeasible, alternative stabilization measures must be employed as specified by the permitting authority.
- C. Dewatering. Discharges from dewatering activities, including discharges from dewatering of trenches and excavations, are prohibited unless managed by appropriate controls.
- D. Pollution Prevention Measures. Design, install, implement, and maintain effective pollution prevention measures to minimize the discharge of pollutants. At a minimum, such measures must be designed, installed, implemented and maintained to:
- 1) Minimize the discharge of pollutants from equipment and vehicle washing, wheel wash water, and other wash waters. Wash waters must be treated in a sediment basin or alternative control that provides equivalent or better treatment prior to discharge;
 - 2) Minimize the exposure of building materials, building products, construction wastes, trash, landscape materials, fertilizers, pesticides, herbicides, detergents, sanitary waste and other materials present on the site to precipitation and to stormwater; and
 - 3) Minimize the discharge of pollutants from spills and leaks and implement chemical spill and leak prevention and response procedures.
- E. Prohibited discharges. The following discharges are prohibited:
- 1) Wastewater from washout of concrete, unless managed by an appropriate control;

- 2) Wastewater from washout and cleanout of stucco, paint, form release oils, curing compounds, and other construction materials;
 - 3) Fuels, oils, or other pollutants used in vehicle and equipment operation and maintenance; and
 - 4) Soaps or solvents used in vehicle and equipment washing.
- F. Surface Outlets. When discharging from basins and impoundments, utilize outlet structures that withdraw water from the surface, unless infeasible.

4.5 Other Controls

- A. A dedicated concrete truck wash out area shall be maintained to include adequate containment to prevent runoff of concrete truck wash water. Concrete truck drivers shall be notified to use wash out area.
- B. CONTRACTOR shall follow the appropriate waste storage and disposal practices, as per applicable environmental regulatory requirements. Solid waste dumpsters/roll-offs, or other appropriate waste receptacles will be maintained and used at the site. Good housekeeping practices will preclude trash, construction wastes, and debris to be dumped or scattered on the construction site. There shall be no open burning of any waste material. No solid materials, including building materials, shall be discharged to waters of the State.
- C. No liquid waste chemicals, fuels, and/or oils are to be leaked or spilled on ground surfaces. Bulk storage of liquid chemical wastes will be provided with secondary containment with a capacity sufficient to contain the volume of the largest container within the secondary containment. All waste materials shall be stored in a manner to prevent releases and should be disposed of by a qualified waste disposal firm at an acceptable waste disposal facility. Records of the disposal of all solid, hazardous, non-hazardous, and liquid wastes are to be maintained within the SWPPP Volume II Recordkeeping Binder. CONTRACTOR shall notify the RESIDENT PROJECT OBSERVER of any spills or leaks that occur in spite of the preventive measures taken. CONTRACTOR will prepare a report of any spills or leaks in accordance with the reporting and recordkeeping measures described in the CBMPP. No contaminants from fuel storage areas, hazardous waste storage and truck wash areas shall be discharged to waters of the State. These areas should not be located near a water body, if there is a water body on or near the project.
- D. CONTRACTOR shall maintain compliance with applicable State and/or local sanitary sewer, septic system, and waste disposal regulations.
- E. CONTRACTOR shall be responsible for preventing or minimizing the discharge of hazardous substances or oil in the stormwater discharge(s) from the construction site. Where a release containing a hazardous substance or oil in an amount equal to or in

excess of a reporting quantity established under either 40 CFR 110, 40 CFR 117, or 40 CFR 302, occurs during a 24-hour period, that requires notification to the National Response Center, CONTRACTOR shall be responsible for, at CONTRACTOR's expense, OWNER's submittal of specific information regarding the spill, date such release occurred, circumstances leading to the release, and any required modification of CBMPP.

- F. Used and/or waste oil generated from equipment maintenance is exempt from the hazardous waste rules, as long as it is transported offsite to be recycled/reused. CONTRACTOR shall be responsible for disposal of waste oils, fuels, and fluids at a recycling/reuse facility and shall provide written documentation of the final waste disposal method and facility location, including EPA identification number of transporter and disposal facility, to ENVIRONMENTAL CONSULTANT.
- G. Off-site vehicle tracking of sediments and the generation of dust must be minimized. Measures such as stone at construction access points, parking areas, and unpaved roads that carry significant amounts of traffic (e.g. more than 25 vehicles per day), providing entrance wash racks or stations for trucks, and/or street sweeping shall be implemented where appropriate. Application of water to construction haul roads should be done, as appropriate, to control dust generation. Application of excessive levels of water that create mud should be avoided.

4.6 Final Stabilization Requirements

4.6.1 General Requirements

- A. CONTRACTOR shall be responsible for achieving temporary stabilization and final stabilization, as required by ADEQ General Stormwater Permit. Stabilization of disturbed areas must, at a minimum, be initiated immediately whenever any clearing, grading, excavating or other earth disturbing activities have permanently ceased on any portion of the site, or temporarily ceased on any portion of the site and will not resume for a period exceeding 14 calendar days.
- B. The ADEQ General Stormwater Permit for Construction Activities (ARR150000) requires the achievement of "final stabilization" for all regulated construction sites. The permit defines "final stabilization" as:

All soil-disturbing activities at the site have been completed and either of the two following criteria is met:

- 1) *A uniform (e.g., evenly distributed, without large bare areas) **perennial** vegetative cover with a density of 80% of the native background vegetative cover for the area has been established on all unpaved areas and areas not covered by permanent structures, or*
- 2) *Equivalent permanent stabilization measures (such as the use of riprap, gabions, or*

geotextiles) have been employed.

- C. The OWNER will determine when final stabilization has been achieved. The contract shall not be terminated until final stabilization is achieved.
- D. Upon final stabilization, all temporary structural controls shall be removed from the site. Trapped sediment and other disturbed areas resulting from the disposition of the structural controls shall be stabilized to prevent further erosion and sedimentation.
- E. After temporary structural controls have been removed, the affected areas shall be graded to conform to the adjacent contours, unless otherwise directed by the ENGINEER. Following this removal and grading, permanent stabilization shall be established in these areas.
- F. CONTRACTOR shall be responsible for all methods and means necessary to establish **perennial** vegetation required to achieve temporary stabilization and/or final stabilization. This shall include, but not be limited to:
 - 1) Provision of competent and knowledgeable personnel capable of preparing an adequate seedbed and applying fertilizer, soil amendments, and seed, as necessary, to establish temporary stabilization, and to establish perennial vegetative cover to achieve final stabilization;
 - 2) Preservation and/or importing of adequate topsoil capable of supporting perennial vegetation necessary to achieve permanent stabilization;
 - 3) CONTRACTOR shall apply seed mixture appropriate for the season and disturbed area.
 - 4) CONTRACTOR shall be responsible for labor, materials, tools and equipment, and related items required for preparing ground, providing for sowing of seeds and fertilizing, lime, mulching/top dressing, and other management practices required for sediment and erosion control, to achieve final stabilization required by the ADEQ General Stormwater Permit. CONTRACTOR shall be responsible for establishing **perennial** vegetation on all areas that will not be covered with impermeable surfaces (such as concrete, asphalt, rock).

4.6.2 Seedbed Preparation

- A. CONTRACTOR shall maintain finish grades on areas to be seeded in true and even condition without ruts or tracks. Seedbed cultivation shall be done to a state of good tilth so that soil particulates on the surface are small enough, and lie close enough together, to prevent seed from being covered too deep for optimum germination. Prior to seeding, area shall be cleared of surface stone, stumps, or other objects larger than 3 inches in thickness or diameter, and roots, brush, wire, grade stakes, and other objects that might be a hindrance to maintenance operations.

- B. To enhance achievement of final stabilization, CONTRACTOR shall remove and stockpile existing 6-12 inches of topsoil in areas designated for construction of project for reapplication after site grading. If existing topsoil is not suitable, the CONTRACTOR shall be responsible for placement of imported topsoil. Imported topsoil shall be from naturally drained areas and be fertile, friable loam that is free of subsoil, stiff or lumpy clay, hard clods, hardpan, rocks, disintegrated debris, plants, roots and other materials that would be toxic to, or impair, plant growth.
- C. Topsoil stripped from within the project shall be moved to a designated area, or other approved locations, and stockpiled. Stockpiles shall be located so that they will not interfere with any proposed construction nor constitute drainage, traffic, or other hazards, either to the project, the general public, or adjacent property. Storage should be in such locations that will afford easy access for loading, hauling, and replacement. The stored topsoil shall be protected from contamination, and shall have sediment control measures installed to prevent silt runoff. The storage sites for topsoil shall be dressed to conform to the adjacent area after the storage piles have been removed.
- D. Finish grade topsoil shall be at a level that matches the conditions of the original undisturbed soil or finished grade and has the following characteristics:
1. Minimum depth of 4 inches
 2. pH from 6.0 to 7.0
 3. Minimum organic content of 4% dry weight
 4. Soluble salts < 500 ppm
- E. Fertilizers and/or lime shall be applied at appropriate agronomic rate. Representative soil test(s) shall be conducted in accordance with industry standards to determine pH, nitrogen (N), phosphorous (P), potassium (K) content prior to seeding application. CONTRACTOR shall submit soil test results to ENVIRONMENTAL CONSULTANT and recommended fertilizer and lime application rates at least one week prior to commencement of seeding.
- F. Fertilizer bags shall state the source or category from which the nitrogen is derived. Nitrogen fertilizers have two categories: Water Soluble Nitrogen (i.e., all nitrogen is immediately available); and Slowly Available Nitrogen (i.e., nitrogen is available over an extended period of time). The nitrogen source impacts how the grass is fertilized and the rate and timing of application of fertilizer. CONTRACTOR shall use a fertilizer that has no less than 50% Slowly Available Nitrogen (SAN) that has a delayed release of available nitrogen, thereby reducing both the potential of excess nutrients in runoff and the leaching potential of excess nutrients into groundwater.
- G. Lime shall be agricultural grade ground limestone or equivalent as approved by ENVIRONMENTAL CONSULTANT. Lime, at the rate determined by the lime requirement test, shall be uniformly spread on areas to be seeded prior to their being roughened or scarified. The seedbed shall be thoroughly pulverized by means of disk harrows or other approved methods, thoroughly mixing lime and soil to a depth of not less than 4" (100 mm) (2" [50 mm] for slopes 4:1 or steeper) below finish slope

elevation. Regardless of the pulverizing method used, the soil shall be broken with the contour of the slope. Objectionable foreign matter shall be removed and the soil left in a suitable horticultural condition to receive the fertilizer and seed. Water may be applied before, during, and after seedbed preparation in order to maintain the desired moisture content in the soil.

- H. Fertilizer shall be uniformly incorporated into the soil alone or in conjunction with the required lime. If the CONTRACTOR so elects, the fertilizer may be drilled into the soil or combined with the seed in the hydro-seeding operation.
- I. CONTRACTOR shall schedule applications of fertilizer/lime at a time that considers season, following the general guidelines below:
 - 1) The earliest spring application of nitrogen for **cool season** grasses is six weeks prior to the last average frost date (i.e. Springdale 90% last frost date = April 25; six weeks prior = March 13).
 - 2) The latest fall application of nitrogen for **cool season** grasses is six weeks after the first average frost date (i.e. Springdale 90% first frost date = October 24; six weeks after = December 6).
 - 3) The earliest spring application of nitrogen for **warm season** grasses is the last average frost date for the region (i.e., Springdale 90% last frost date = April 25).
 - 4) The latest fall application of nitrogen for **warm season** grasses is 30 days prior to the average first frost date for the region (i.e. Springdale 90% first frost date = October 24; 30 days prior = September 24).
 - 5) If possible, lime should be applied three to six months before seeding perennial vegetation and incorporated within the top four inches of topsoil.
- J. SEEDBED REPAIRS: CONTRACTOR shall be responsible for ensuring that the soil seedbed is not blown, washed, or otherwise removed from the site. CONTRACTOR shall make repairs (including replacement of lost topsoil and/or mulch) to the seedbed preparation site in the event of heavy rain, wind, or other natural events that cause damage and prevent achievement of final stabilization. Should adequate vegetation growth not be achieved, the CONTRACTOR shall be responsible for additional reseeding, remulching, and/or seedbed preparation, as necessary. If unplanted skips are noted after germination, and/or adequate seeding is not achieved, CONTRACTOR shall be responsible for additional reseeding and/or seedbed preparation, as necessary. Before final acceptance, the CONTRACTOR shall repair or replace any seeding or mulching that is defective or damaged at no additional cost to OWNER.

4.6.3 Mulching

- A. Mulch cover shall consist of the application of mulch to surface soils as a deterrent to soil erosion. Mulching shall be used in conjunction with both temporary and permanent seeding practices to enhance stabilization success by providing erosion protection prior to

the onset of vegetative growth. Straw mulching shall be of oat, wheat, barley, or rice straw mulch. Hay mulch shall be free of Johnson grass or other noxious weeds and foreign materials. Mulch shall be stored in dry conditions prior to application and shall not be molded or rotted.

- B. In addition to mulching for temporary and permanent seeding, the application of mulch cover, without seeding, shall be done on areas that require erosion control for a short period of time; when erosion control is necessary during the midwinter season when seed will not germinate; or because of the nature of material used for surface grading.
- C. Mulching shall be spread in a uniform continuous blanket, at a rate of 1 to 3 tons per acre (air dried weight) or to a uniform 2-inch depth. Mulch shall be spread by hand or by an approved blower type mulch spreader. Care shall be taken to remove all wire and/or twine from baled hay/straw when the mulch is applied.
- D. When mulching is done in conjunction with seeding, the mulch shall be applied immediately after seeding and shall be spread uniformly over the entire area by approved power mulching equipment. CONTRACTOR may use hand methods to apply mulch cover to small or inaccessible areas.
- E. Immediately following or during the application of the mulch cover on seeded areas, the mulch shall be anchored by one of the following methods:
 - 1) Tracking or Roller Method. The mulch shall be effectively pressed into the soil using steel cleated track or cleated roller equipment. The anchoring shall be performed so that the grooves formed are perpendicular to the flow of water down back slopes and fore slopes. The equipment and method used shall produce acceptable results.
 - 2) Asphalt Tackifier. Asphalt shall be applied at the rate of approximately 0.05 gallon per square yard. Application shall be made using a pressure distributor to ensure constant and uniform distribution.
 - 3) Other Tackifiers. Other tackifiers may be applied according manufacturer's recommended rates, upon approval of ENGINEER. Tackifiers used in mulch anchoring shall be of such quality that the mulch cover will be bound together to form a cover mat that will stay intact under normal climatic conditions.
 - 4) If 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. Removal of any objectionable discoloration shall be at no cost to OWNER.

- F. Where mulch is applied to unseeded areas, mulching shall be crimped into the soil to a depth of two to three inches to form a soil-binding mulch to prevent loss or bunching, as necessary, to hold mulch in place.
- G. Mulch Control Netting shall consist of furnishing and installing mulch control netting to be used over mulch cover in areas shown on the plans or designated by ENVIRONMENTAL CONSULTANT. This is not a substitute for mulch anchoring or mulch cover. It is to be used where additional or long-term control is needed for the mulch cover, and/or on slopes.
 - 1) Mulch control netting shall be installed over the mulch with the longitudinal length parallel to the slope. Adjacent netting widths shall be overlapped by not less than 4 inches. Remaining fabric areas shall be stretched, then secured by pinning to the ground with approximately 1 staple per square yard of area. Upslope ends, edges, bottom, and overlaps shall be stapled at 2-foot intervals.
 - 2) Mulch control netting shall be a uniformly extruded, rectangular, photodegradable plastic mesh with a minimum weight of 0.23 ounce per square yard and a maximum mesh opening of 2 inches x 2 inches.

4.6.4 Turf Reinforcement Mats and Erosion Control Blankets

- A. Turf Reinforcement Mats (TRM) are typically a machine-produced mat of 100% UV-stabilized polypropylene fiber matrix incorporated into a permanent three-dimensional netting structure. TRMs do not readily biodegrade and are a permanent solution to erosion control challenges within channels and on steep slopes.
- B. Erosion Control Blankets (ECBs) are temporary solutions to erosion control challenges and are primarily made from straw, coconut (coir) fiber or an open weave polypropylene geotextile, and most are reinforced on one or both sides by a polypropylene netting. They are designed to hold seed and soil in place, protect emerging seedlings and accelerate vegetation growth in low to moderate erosion applications. ECBs are engineered to degrade over a period of one to three years as vegetation becomes robust enough to maintain long-term erosion protection by itself.
- C. CONTRACTOR shall select, install, and maintain TRM and ECB shown on Sediment Control Drawing in CBMPP or as directed by ENVIRONMENTAL CONSULTANT, as follows:
 - 1) TRM shall be Propex or North American Green, or equivalent quality and specifications.
 - 2) Erosion control blanket material shall be at a minimum of 1.50-lb. photodegradable polypropylene top net with straw and/or coconut fiber matrix with a 12-month longevity, or equivalent.

- 3) CONTRACTOR shall select TRM and/or ECB appropriate for site grade and slope.
- 4) CONTRACTOR shall grade and compact area of TRM/ECB installation. Subgrade shall be uniform and smooth. All rocks, clods, vegetation or other objects shall be removed so the installed mat will have direct contact with soil surface.
- 5) Finish grade topsoil shall be at a level that matches the conditions of the original undisturbed soil or finished grade and has the following characteristics:
 - a. Minimum depth of 4 inches
 - b. pH from 6.0 to 7.0
 - c. Minimum organic content of 4% dry weight
 - d. Soluble salts < 500 ppm
- 6) CONTRACTOR shall prepare seedbed, install by loosening the top 2-3 inches minimum of topsoil and incorporate amendments such as lime and fertilizer and/or wet the soil, if needed.
- 7) CONTRACTOR shall install TRM/ECB following manufacturers specifications and installation procedures, including spacing, overlapping, anchoring, stapling, key/check slots, seeding, and soil filling criteria.
- 8) Upon selection of TRM/ECB, CONTRACTOR shall notify ENVIRONMENTAL CONSULTANT and provide product information, product application, and product installation guidance prior to procurement of product.
- 9) CONTRACTOR shall maintain TRM/ECB areas until all work on the entire project has been completed and accepted. Additional work and materials required due to the CONTRACTOR'S negligence in maintaining the completed work shall be accomplished by CONTRACTOR at no cost to OWNER.

4.6.5 Seeding Requirements

- A. CONTRACTOR shall be responsible for ensuring that permanent seeding takes place to establish a sustainable ground cover at areas that are initially cleared or graded and will have no additional construction activities throughout the course of the project and/or where specific phases of construction have been completed that have resulted in exposed soils.
- B. Except as modified herein, the seed shall comply with the current rules and regulations of the Arkansas State Plant Board and the germination test shall be valid on the date the seed is used. It shall have a minimum of 98% pure seed and 85% germination by weight, and shall contain no more than 1% weed seeds. A combined total of 50 noxious weed seeds shall be the maximum amount allowed per pound of seed with the following exceptions: Johnson grass seed, wild onion seed, wild garlic seed, field bindweed seed, nut grass seed, sickle pod seed, sesbania seed, indigo seed, morning-glory seed, cocklebur seed, balloon vine, crotalaria spp., serrated tussock, and tropical soda apple

will not be allowed in any amount. Seed shall be furnished in sealed, standard containers. Seed that has become wet, moldy, or otherwise damaged in transit or in storage will not be acceptable.

- C. Seeding shall be done via broadcast, seed drill, or hydraulic method (hydromulching/seeding). More than one type of seeding method may be necessary. Seeding equipment shall be calibrated and operated to ensure uniform distribution and coverage at specified rates. Seeding rate shall account for seeding method used to achieve desired vegetation density. After the seed has been distributed, it shall be incorporated into the soil by rolling/compacting, or other approved method. CONTRACTOR shall notify ENGINEER and ENVIRONMENTAL CONSULTANT about seeding method, seed mixture, and seeding rate at least 14 days prior to seeding activities.
- D. Seeding done by hydraulic method shall have slurry with proper consistency to adhere to earthen slopes without lumping or running. Mixing time of materials shall not exceed 45 minutes from the time the seeds come into contact with water in the mixer to complete discharge of the slurry onto the slopes; otherwise the batch shall be recharged with seed. Slurry mixture of water, seed, fertilizer, and mulch shall be applied using equipment containing a tank having a built-in continuous agitation and a discharge system that will allow application of the slurry to the slopes at a continuous and uniform rate. If recirculation agitation is present, the recirculation shall be limited to no more than fifty (50) gallons per minute. The nozzle shall produce a spray that does not concentrate the slurry nor erode the soil. Slurry shall be applied at appropriate rate specific to the product specifications and slope (Example: 3,000 lbs/acre for 4:1 to 3:1 slopes and 4,000 lbs/acre for 2:1 to 1:1 slopes.). Mulch used within hydroseeding slurry shall consist of a Bonded Fiber Matrix (BFR) material. CONTRACTOR shall use caution to avoid over spraying hydroseeding slurry onto any hardscape areas, including fences, walls, concrete, or asphalt surfaces. Removal of slurry from such non-target surfaces shall be done at CONTRACTOR'S expense.
- E. Broadcast sowing may be accomplished by hand seeders or by approved power equipment. Either method shall result in uniform distribution and no work shall be performed during high winds. The area seeded shall be lightly firmed with a cultipacker immediately after broadcasting.
- F. When seed is drilled in rows, the rows shall be horizontal (parallel to contour lines). Fertilizer and seed shall not be drilled together and shall not be mixed.
- G. CONTRACTOR shall apply a mixture of various annuals and perennials to provide overlapping times of seasonal peak vegetative cover. Seed mixtures shall be appropriate for the season of construction and the area. Seeding shall be done when there is sufficient time in the season to ensure adequate vegetation establishment and erosion control. Seeding shall only be done just prior to the peak season for the selected seed mix. If seeding is applied during excessively dry conditions, CONTRACTOR shall be responsible for watering seeded areas to provide sufficient moisture for survival of germinating plants.

- H. To optimize soil stabilization, CONTRACTOR shall utilize a seasonal nurse crop of fast growing annuals within a mix of perennials appropriate for the season. The nurse crop is intended to germinate and grow rapidly, holding the soil until the slower-growing perennial seedlings become established. Permanent vegetation shall not be considered established until a ground cover of perennial vegetation is achieved that is uniform and mature enough to survive and be of sufficient density to preclude erosion.
- I. CONTRACTOR shall conduct seeding activities to achieve stabilization that are generally congruent with the following schedule:

- 1) **Dormant Cold Season Temporary Stabilization (November 1 – February 28)**
 Seeding at this time of the year with perennial vegetation to achieve final stabilization typically does not produce successful results, as cold temperatures inhibit seed germination. CONTRACTOR shall be responsible for achieving temporary stabilization via mulching, erosion control blankets, matting, compost, and/or other appropriate structural/nonstructural methods for temporary stabilization until seasonal weather conditions become more conducive to establishment of permanent perennial vegetative cover. Fertilizers/lime shall be added, at appropriate rates, at this time in preparation for seeding. CONTRACTOR shall be responsible for achieving temporary stabilization at all areas that are unstable and subject to erosion. CONTRACTOR shall apply temporary seeding, as follows:

Dormant Cool Season Temporary Seed Mix (November 1 – February 28)

Plant Species	Growth Season/ Life Cycle	Seeding Rate
Winter Rye (<i>Secale cereale</i>)	cool season annual	100 lb/ac
Annual Ryegrass (<i>Lolium multiflorum</i>)	cool season annual	25 lb/ac
Winter Wheat (<i>Triticum aestivum</i>)	cool season annual	50 lb/ac

- 2) **Pre Warm Season Seeding (March 1 – May 31)**
 As the growing season approaches, CONTRACTOR shall apply a mix of quick germinating cool season species combined with warm season species listed below. The cool season species will serve to hold the soil until warmer weather arrives stimulating the warm season species to germinate.

Pre Warm Season Seed Mix (March 1 – May 31)

Plant Species	Growth Season/ Life Cycle	Seeding Rate
Spring Rye (<i>Secale cereale</i>)	cool season annual	15 lb/ac
Annual Ryegrass (<i>Lolium multiflorum</i>)	cool season annual	15 lb/ac
Crimson Clover (<i>Trifolium incarnatum</i>)*	cool season annual	15 lb/ac
White Clover (<i>Trifolium repens</i>)*	cool season perennial	10 lb/ac
Korean (Kobe) lespedeza (<i>Kummerowia stipulacea</i>)**	warm season annual	10 lb/ac
Bahiagrass (<i>Paspalum notatum</i>)	warm season perennial	50 lbs/ac
Bermuda (<i>Cynodon dactylon</i>)	warm season perennial	75 lbs/ac

*All legume seed must be properly inoculated with appropriate inoculant.

**DO NOT apply sericea lespedeza.

3) Warm Season Seeding (June 1 – August 31)

In the midst of the growing season, CONTRACTOR shall apply a mix of warm season annuals and perennials, as follows:

Warm Season Seed Mix (June 1 – August 31)

Plant Species	Growth Season/ Life Cycle	Seeding Rate
Brown-Top Millet (<i>Panicum ramosum</i>)	warm season annual	20 lb/ac
Korean (Kobe) lespedeza (<i>Kummerowia stipulacea</i>)**	warm season annual	10 lb/ac
Bahiagrass (<i>Paspalum notatum</i>)	warm season perennial	5.0 lbs/ac
Bermuda (<i>Cynodon dactylon</i>)	warm season perennial	7.5 lbs/ac

**DO NOT apply sericea lespedeza.

4) Late Season Seeding (September 1 – October 31)

During late summer to early fall, CONTRACTOR shall apply the following mix:

Late Season Seed Mix (September 1 – October 31)

Plant Species	Growth Season/ Life Cycle	Seeding Rate
Winter Rye (<i>Secale cereale</i>)	cool season annual	25 lb/ac
Winter Wheat (<i>Triticum aestivum</i>)	cool season annual	25 lb/ac
Crimson Clover	cool season annual	15 lb/ac
White clover (<i>Trifolium repens</i>)*	cool season perennial	10 lb/ac
Perennial Ryegrass (<i>Lolium perenne</i>)	cool season perennial	35 lb/ac

*All legume seed must be properly inoculated with appropriate inoculant.

- J. CONTRACTOR shall maintain all seeded areas until final stabilization has been achieved and shall restore or replace any portion of the seeding work that is found defective or which becomes damaged prior to final acceptance. Restoration or replacement work shall include the re-establishment of the grade or profile of the area, replacement of topsoil, re-fertilization, reseeding and remulching as necessary. When the damage consists only of the displacement of mulch, the mulch shall be replaced within 3 business days. Additional work and materials required due to Contractor's negligence shall be at no cost to OWNER.
- K. For areas seeded in the September 1 – October 31 and November 1 – February 28 seasons, final acceptance will be delayed until an acceptable stand of vegetation of uniform color and density is established to meet the ADEQ requirements of final stabilization with perennial vegetation.
- L. Areas designated or directed to be temporarily seeded do not have to be brought to typical section or a garden-like condition, but shall be lightly tilled. Rye or the cereal grasses shall be planted at the rate of 100 pounds per acre between August 15 and January 20. Brown Top Millet shall be planted at a rate of 50 pounds per acre between January 21 and August 14.

M. The ENVIRONMENTAL CONSULTANT may adjust the seasonal limitations specified above when immediate erosion control measures are required and other methods are not considered practicable. The decision to adjust seasonal limitations will be based on the practicality of planting seed at that particular time, with consideration being given to the period of time remaining before permanent erosion items can be applied and requirements of the ADEQ general stormwater permit to stabilize locations where construction will cease for more than 14 days. Fertilizer shall be applied at the rate of 500 pounds per acre on areas to be temporarily seeded.

4.6.6 Watering Requirements

- A. After application of the mulch cover, a minimum of 27,000 gallons per acre of water will be applied to thoroughly moisten the soil to the depth of pulverization and then as necessary to germinate the seed. This quantity may be reduced by the ENVIRONMENTAL CONSULTANT dependent on the soil moisture conditions immediately prior to the application of the seeding. Water used for hydro-seeding or tackifier application will not be measured or paid for, and will not be included in the quantity of water required for the initial water application.
- B. Unless otherwise directed by ENVIRONMENTAL CONSULTANT, CONTRACTOR shall apply water in an amount such that, in conjunction with any rainfall, the seeded and mulched areas will receive an amount equivalent to a minimum of 1 inch of water each week beginning the week after seeding and continuing for a minimum of four (4) weeks. One inch of water is equivalent to 27,000 gallons per acre. The CONTRACTOR will adjust the amount of water required each week to deduct any rainfall received during the 7-calendar day period prior to the weekly watering.
- C. Failure to meet the requirements of A. and B. above will result in a permanent deduction in payment and/or permanent recovery of payments equal to the minimum bid price established for each M.G. not applied as directed in accordance with these specifications. Additional work and materials required due to the CONTRACTOR'S negligence in maintaining completed work or failure to water vegetation as directed shall be accomplished at no cost to OWNER.
- D. The CONTRACTOR shall have on the project such equipment of adequate capacity and a suitable water supply to achieve the desired moisture level in the soil. The equipment and methods used will be such that the application of water will not cause erosion or excessive movement of the previously placed seed and mulch cover. Any slope that is eroded or any seed or mulch cover that is washed down the slope due to failure to follow the above requirement will be repaired and/or reseeded at no cost to OWNER. Water shall be of irrigation quality and free of impurities that would be detrimental to plant growth.

4.7 Construction Practices At Stream Crossings

- A. CONTRACTOR shall submit a written plan of action for sediment control measures at each stream crossing to the ENVIRONMENTAL CONSULTANT for review, a

minimum of one week prior to the construction of each stream crossing. The plan of action submitted by CONTRACTOR shall include a specific construction sequencing plan, including station number, stream crossing methodology, anticipated commencement/completion dates, locations of sedimentation/filtration basins, quantity and size of pumps, estimated width of crossing, and estimated quantity of stone and/or riprap. Prior to the first stream crossing, CONTRACTOR shall schedule a meeting at the site to be attended by representatives of the CONTRACTOR, ENGINEER, OWNER, and ENVIRONMENTAL CONSULTANT to discuss the plan of action.

B. The ADEQ general permit does not allow any violation of Arkansas Water Quality Standards. Due to the fact that it is virtually impossible to conduct construction activities within a stream without violating the water quality standard for turbidity, the OWNER has filed for, and received, a Short-Term Activity Authorization for "unavoidable" impacts to water quality. The authorization grants a "one-time" exceedance of the turbidity standard, pursuant to certain conditions. CONTRACTOR shall be responsible for meeting the following requirements of the short-term activity authorization:

- 1) CONTRACTOR shall take all reasonable measures to limit equipment and machine usage in the wetted area of any stream.
- 2) CONTRACTOR shall divert any pumped water to a sediment basin or other containment device, and at no time, shall pumped water be discharged directly into a stream.
- 3) CONTRACTOR shall implement all reasonable sediment control measures to prevent siltation of any stream.
- 4) CONTRACTOR shall implement all reasonable measures to prevent any spill or leakage of fuel, oil, or any other lubricating and/or hydraulic fluid into stream.
- 5) Prior to each stream crossing, the OWNER is required to notify the ADEQ District Water Inspector, to inform them about the specific date and location of each stream crossing. CONTRACTOR shall notify ENVIRONMENTAL CONSULTANT at least 24-hours prior to commencement of each stream crossing, and ENVIRONMENTAL CONSULTANT will notify ADEQ District Water Inspector. Should CONTRACTOR foresee that stream crossing would not be completed within the specified time limitation, CONTRACTOR shall notify ENVIRONMENTAL CONSULTANT before the specified period expires, and ENVIRONMENTAL CONSULTANT will request an extension from ADEQ.

C. For areas where the construction will cross streams, the following specifications as required by COE Section 404 Permit apply:

- 1) The CONTRACTOR shall implement the Little Rock District Corps of Engineers Sedimentation and Erosion Control Guidelines for Pipeline Projects. This document

is contained within the Appendices of the CBMPP. Some of the guidelines are summarized herein.

- 2) The CONTRACTOR shall use and maintain appropriate soil erosion and sedimentation controls during construction, and all exposed soil and other fills, as well as work below the ordinary high water mark of any stream, must be permanently stabilized at the earliest practicable date.
 - 3) The CONTRACTOR shall limit areas of "waters of the United States" that are disturbed, to the minimum necessary to construct the utility line.
 - 4) The CONTRACTOR shall implement appropriate measures to maintain near normal downstream flows and to minimize flooding.
 - 5) The CONTRACTOR shall use materials for backfill that will not be eroded by expected high flows.
 - 6) Plan #1, specified in the COE Guidelines shall be implemented for conventional open-cut trenching techniques across small streams with solid rock and silt or mud present. It shall be noted that general conditions and restrictions within the Section 404 Permit take precedence over these recommended guidelines where applicable.
 - 7) The CONTRACTOR shall conduct excavation activities in a manner as to not result in the relocation of an existing stream channel or a restriction of stream flow.
 - 8) The CONTRACTOR shall keep dredged or excavated material at a minimum. Excess excavated materials from a stream shall be removed and disposed of in an area identified by the CONTRACTOR and approved by the ENGINEER.
 - 9) The CONTRACTOR shall remove any temporary fills in their entirety and the affected areas shall be returned to their pre-existing elevation, as much as practicable.
 - 10) In the event that the CONTRACTOR constructs a haul road for construction access across stream crossings, culverts shall be placed in the stream channel to maintain low flow conditions, and not restrict movement of aquatic life.
 - 11) Once CONTRACTOR commences with construction activities within "waters of the U.S." CONTRACTOR shall complete work within stream as promptly as practicable and not cease work within stream until work is completed.
- D. The CONTRACTOR shall initiate permanent restoration measures for the area where the pipeline crosses any stream as soon as possible following construction. CONTRACTOR shall complete the final restoration within 2 days of commencement of pipeline installation across any stream, as described below:

- 1) Subsequent to completion of the pipeline stream crossing, ground contours shall be restored to their original condition as practicable.
- 2) Revegetation methods shall be initiated as rapidly as possible after pipeline crossings at streams are completed.
- 3) CONTRACTOR shall construct interceptor dikes, where needed, to prevent stormwater flow onto areas of active construction or toward a stream channel.
- 4) CONTRACTOR shall employ matting with stapling on extremely steep slopes where vegetative stabilization alone is insufficient.
- 5) CONTRACTOR shall place additional straw bales/silt fences where drains and ditches allow sediment to enter the waterway.
- 6) Stream banks shall be stabilized with the appropriate material, such as turf reinforcement matting, riprap, or other material, as approved by the OWNER.
- 7) Temporary sediment control structures, which are no longer necessary and not biodegradable, shall be removed after stabilization has been achieved.
- 8) CONTRACTOR shall monitor and maintain erosion control measures until final stabilization has been achieved.

4.8 Special Conditions (Cave System Contingency Plan)

- A. Due to the presence of karst geology in the project area and ecologically sensitive species, the CONTRACTOR shall exercise caution during construction to avoid any breakthrough into any cave system, subterranean conduit, or tunnel, as follows:
 - 1) Where surface fractures or cave opening are encountered during construction, the CONTRACTOR shall immediately halt all excavation activities within the immediate vicinity and notify the ENVIRONMENTAL CONSULTANT. The ENVIRONMENTAL CONSULTANT shall immediately notify the OWNER and discuss the need to contact USFWS, or other regulatory authority as appropriate, to conduct a survey to determine if the cave is inhabited by any listed species. Construction activities within the immediate vicinity of the cave or tunnel shall not resume until a determination of the necessary action is reached after conferral with the OWNER, and/or USFWS. All practical and reasonable efforts shall be made to protect the site from further damage or the introduction of pollutants into the cave system. These efforts shall be, but are not limited to, the construction of a ring levee with silt fence and staked straw bales as soon as possible around the opening to reduce silt-laden runoff from entering the opening.
 - 2) The CONTRACTOR shall not perform equipment fueling or transfer of liquid chemicals within 100 yards of any open excavation, streambed, or any observable

surface fracture, where practicable. Should site limitations not allow this practice, equipment fueling and/or the transfer of liquid chemicals shall be done as far as possible from any open excavation, streambed, or any observable surface fracture. If, in spite of the preventive measures, a spill or leak of fuel or liquid chemicals occurs within 100 yards of any open excavation, streambed, or any observable surface fracture, the CONTRACTOR shall immediately notify the ENVIRONMENTAL CONSULTANT, who will immediately notify the OWNER and discuss whether to notify the USFWS or other regulatory agency. The CONTRACTOR shall prepare a report of any such spill or leak in accordance with the reporting/recordkeeping requirements of the CBMPP.

- 3) The CONTRACTOR shall not store fuels and/or chemicals within 100 yards of any open excavation, streambed, or any observable surface fracture, where practicable.
- 4) CONTRACTOR shall immediately discontinue use of heavy equipment that exhibits excessive fluid leakage and make necessary repairs prior to reuse of equipment. In the event of an excessive fluid leakage within 100 yards of an open excavation, streambed, or any observable surface fracture, CONTRACTOR shall immediately notify the ENVIRONMENTAL CONSULTANT, who will immediately notify the OWNER and discuss whether to notify the USFWS or other regulatory agency. The CONTRACTOR shall prepare a report of any such spill or leak in accordance with the reporting/recordkeeping requirements of the CBMPP.
- 5) CONTRACTOR shall not conduct equipment repairs or maintenance involving the draining of fluids within 100 yards of any open excavation, streambed, or any observable surface fracture, where practicable. In the event that equipment repairs or maintenance results in the spill of fluids within 100 yards of any open excavation, streambed, or any observable surface fracture, the CONTRACTOR shall immediately notify the ENVIRONMENTAL CONSULTANT, who will immediately notify the OWNER and discuss whether to notify the USFWS or other regulatory agency. The CONTRACTOR shall prepare a report of any such spill or leak in accordance with the reporting/recordkeeping requirements of the CBMPP.

4.9 Spill Prevention Control And Countermeasures Plan Certification And Implementation

- A. CONTRACTOR shall be responsible for implementation of the SPCCP, as required by Part 112 of Title 40 of the Code of Federal Regulations, and shall maintain the necessary resources, equipment, and personnel to prevent chemical spills, and to promptly respond to chemical spills should they occur. CONTRACTOR shall also be responsible for implementation of chemical spill prevention and response requirements contained within the ADEQ general permit, as specified within the CBMPP.
 - 1) Should CONTRACTOR maintain onsite, an aggregate storage capacity of oil or oil products exceeding 1,320 gallons, but less than 10,000 gallons, CONTRACTOR shall be responsible for Self-Certification of SPCCP contained within CBMPP.

- 2) Should CONTRACTOR maintain onsite, an aggregate storage capacity of oil or oil products exceeding 10,000 gallons, CONTRACTOR shall be responsible for Professional Engineer Certification of SPCCP contained within CBMPP.
- 3) Should CONTRACTOR'S aggregate storage capacity of oil or oil products not exceed 1,320 gallons, CONTRACTOR shall be responsible for implementation of SPCCP contained within the CBMPP, without Professional Engineer Certification or Self-Certification of the Plan.
- 4) Containers, such as drums and above-ground storage tanks (ASTs) having a storage capacity of 55 gallons or more for oil or oil products shall be counted toward determining oil storage threshold. Equipment fuel tanks do not count toward the aggregate storage capacity.
- 5) CONTRACTOR shall designate a named individual who is knowledgeable about chemical handling, storage, and spill response, as the CONTRACTOR'S designated spill coordinator.
- 6) The CONTRACTOR shall maintain all Material Safety Data Sheets (MSDS) for all chemicals that CONTRACTOR stores and/or uses on-site. The MSDS shall be reviewed to determine if hazardous and/or toxic constituents are present, which may be within wastes that may be generated from the chemical. This includes, but is not restricted to, any lubricating fluids, oils, cement additives, paints, epoxies, solvents, adhesives, and fuels. CONTRACTOR'S personnel shall be trained for the proper storage, handling, use, and disposal of such chemicals.
- 7) CONTRACTOR shall provide a dedicated chemical storage area that does not allow runoff of contaminated stormwater. Containers shall be properly labeled as to their contents. Chemicals shall be stored in containers constructed of materials compatible with the contents.
- 8) CONTRACTOR shall ensure that all hazardous materials at the construction site are stored, handled, applied, and disposed of per manufacturer's printed instructions and per all applicable Federal, State, and local codes.
- 9) CONTRACTOR shall submit written verification from a used oil handling facility that used oil is disposed at a recycling/reuse facility.
- 10) The CONTRACTOR shall maintain an inventory list of the type and amount of all fuels, oil, hydraulic oils and hazardous and/or toxic chemicals that will be used at the site.
- 11) The CONTRACTOR shall ensure that onsite work crews and subcontractors are trained and knowledgeable in the proper handling of hazardous materials and disposal of wastes. The CONTRACTOR shall be responsible for disposing of all waste

materials by a waste management firm licensed to dispose of the specific type of waste generated.

- 12) In the event of a chemical or fuel spill, the CONTRACTOR shall immediately halt construction activities in the immediate vicinity. The CONTRACTOR shall immediately notify the ENVIRONMENTAL CONSULTANT and initiate immediate efforts to contain the spill to prevent runoff or migration of the spilled material. The CONTRACTOR shall review the applicable MSDS to determine appropriate spill response measures. The CONTRACTOR shall be required to follow the appropriate regulatory requirements for disposal of contaminated soil. The CONTRACTOR will prepare a report of any chemical or fuel spill in accordance with the reporting/recordkeeping requirements of the CBMPP.
 - 13) CONTRACTOR shall not store, or temporarily stage, fuel, chemicals, equipment, or materials in, or near, environmentally sensitive areas.
 - 14) In the event that pollutant spills occur which are the result of the CONTRACTOR'S actions or negligence, the clean up shall be performed by the CONTRACTOR at no cost to OWNER.
 - 15) The CONTRACTOR will provide the OWNER and the ENVIRONMENTAL CONSULTANT the information necessary for the OWNER to determine whether any spill, leak, or release of oil, fuel, chemicals, or other substances requires reporting to the National Response Center or other regulatory agency.
- B. The quantity of materials stored on the project should be limited, as much as practical, to that quantity required to perform the work in an orderly sequence and should be stored in a neat, orderly manner in their original containers with the original manufacturer's label.
- C. Manufacturer's recommendations for proper use and disposal of materials shall be followed. All disposal shall be according to all local, State and Federal regulations in a permitted landfill or permitted disposal facility. The CONTRACTOR should inspect daily to ensure proper use and disposal of materials.
- D. Product Specific Practices. The CONTRACTOR shall limit the amount of petroleum products and other chemicals in work areas adjacent to wetlands, water bodies, and other sensitive areas. The following product specific practices shall be followed on-site:
- 1) Petroleum Products. All on-site vehicles shall be monitored for leaks and receive regular preventive maintenance to reduce the chance of leakage. Petroleum products shall be stored in tightly sealed containers that are clearly labeled. All asphalt substances used on-site shall be applied according to manufacturer's recommendations and/or OWNER specifications. Construction of berms, or other similar measures, may be required for storage/refueling areas as a best management practice to restrict spill areas. No contaminants from fuel storage areas, hazardous waste storage and truck wash areas shall be discharged to waters of the State.

Methods for protecting these areas shall be identified and implemented. These areas should not be located near a water body, if there is a water body on or near the project

- 2) Fertilizers. Fertilizers shall be applied only in the manner and amounts required by the specifications. Material shall be stored in a covered area and shall not be exposed to precipitation. Partially used bags shall not be discarded, but removed and disposed of properly. No storage of these materials shall be allowed within a wetland or floodplain.
- 3) Paints and Solvents. All containers shall be tightly sealed and stored when not required for use. Excess material and waste shall not be discharged, but shall be properly disposed of according to manufacturers' instructions and/or State and Federal regulations. No storage of these materials shall be allowed within a wetland or floodplain.
- 4) Concrete Trucks. Concrete trucks shall be allowed to discharge surplus concrete or drum wash water on site only in areas designated in the SWPPP. Discharge areas shall not be in or where the discharge can be washed into wetlands or waterbodies. No liquid concrete waste shall be discharged to Waters of the State. Appropriate controls to prevent the discharge of concrete washout waters must be implemented if concrete washout will occur on-site.
- 5) Concrete Curing Agents. Concrete curing agents shall be applied only in the manner and amount required by the specifications. Excess material shall not be allowed to run off the area being treated.

E. In addition, the practices below shall be followed:

- 1) All spills shall be cleaned up immediately after discovery or contained until appropriate cleanup methods can be employed.
- 2) The spill area shall be contained and personnel shall wear appropriate protective clothing to prevent injury from contact with a hazardous substance.
- 3) Manufacturer's recommended methods for spill cleanup shall be followed along with proper disposal methods in accordance with local, State, and Federal regulations.

4.10 Slurry/Fluid Handling And Disposal Specifications For Drilling/Boring/Tunneling

- A. Portions of the proposed line work may involve drilling, boring, and/or tunneling under streams, wetlands, miscellaneous structures, and/or roadways. Should CONTRACTOR subcontract drilling/boring/tunneling activities, CONTRACTOR is responsible for ensuring that subcontractor is made aware of, and implements, necessary pollution prevent measures for compliance with environmental regulatory requirements. CONTRACTOR shall be responsible for complying with the following specifications during drilling/boring/tunneling activities:

- 1) All drilling/boring/tunneling activities shall be in accordance with laws, permits, and the requirements of governing authorities and OWNER.
- 2) CONTRACTOR shall provide OWNER with any and all information pertaining to the use of any drilling slurry or fluid. OWNER shall approve slurries/fluids prior to use.
- 3) No toxic or hazardous additives shall be co-mingled with drilling slurries/fluids, such as diesel fuel and/or oil.
- 4) CONTRACTOR shall provide OWNER with all MSDS for any drilling slurries/fluids to be used, including, but not restricted to, bentonite, Con-Det, Polybore, and/or Diamond-Seal.
- 5) There shall not be discharges or releases of any slurry/fluid into waterways. CONTRACTOR shall be responsible for seeing that slurry/fluid tank capacities are of the appropriate size to hold excess slurry material without spillage. The drilling/boring/tunneling entry point shall be appropriately enclosed and/or contained within earthen berms, and equipped with a sump pump to reclaim or discharge excess mud to a reuse or disposal tank. Earth spoiled or contaminated by drilling slurry shall be removed and disposed of properly by CONTRACTOR, and the site shall be restored with clean material to a condition equal to, or better than, its original condition.
- 6) During an active drilling/boring/tunneling operation, containment structures shall be constructed with a design developed on a site-specific basis. Structural controls include earthen berms, silt fencing, and/or straw bale check dams, either individually or in combination. Where possible, upgradient diversion dikes shall be constructed to divert storm water runoff away from the area of the active bore.
- 7) Drilling fluids/slurries shall be disposed of in an acceptable manner and be adequately contained to prevent the migration of bentonite to waterbodies. Appropriate locations shall be identified by the CONTRACTOR and approved by the OWNER.
- 8) CONTRACTOR shall be responsible for maintaining sufficient personnel, equipment, and materials to contain drilling/boring/tunneling slurry/fluid that upwells to the surface as a "frac out" and/or is discharged into a body of water onsite during all drilling/boring/tunneling operations.
- 9) In areas where drilling/boring/tunneling slurries/fluids have been released, either due to recirculation pit overflows or fugitive escape through subterranean fractures, drilling/boring/tunneling operations shall immediately cease and CONTRACTOR shall notify OWNER immediately.
- 10) Should CONTRACTOR use any drilling/boring/tunneling fluid/slurry, CONTRACTOR shall maintain a record of the drilling/boring/tunneling pressures

and the quantities of drilling/boring/tunneling fluid/slurry used during the entire operation. The record shall correlate to both time of day and the station of the bore head. These records shall be available to the OWNER at all times during the drilling/boring/tunneling operations and submitted as record at the conclusion of the operation. When a reduction in drilling/boring/tunneling slurry/fluid recirculation pressure is observed, drilling/boring/tunneling operators shall be instructed by CONTRACTOR to perform a site reconnaissance of the immediate area in order to determine if the fugitive escape of slurry/fluid through bedrock fractures to the surface (or to waterbodies) is occurring.

- 11) CONTRACTOR shall maintain continuous visual inspection of the drilling/boring/tunneling alignment at all times when the operation is proceeding without return of drilling slurry/fluid to the entry site. When the alignment is beneath a body of water, a visual inspection shall be made at the most accessible point immediately downstream of the bore alignment for changes in turbidity or color, which may indicate a slurry/fluid discharge into the waterway. Unusual conditions, including excessive loss of slurry/fluid, shall be reported promptly to the OWNER by the CONTRACTOR.
- 12) Following completion of drilling/boring/tunneling activities all drilling/boring/tunneling pits/shafts shall be backfilled with native materials and compacted in 6-inch lifts, or in accordance with OWNER, or to achieve a similar compaction of native surrounding soil. Surfaces shall be restored to original, or better, condition and to the satisfaction of the OWNER. All excess/spilled slurry/fluid shall be removed from the site, and the contours shall be restored as close to the original condition as practicable. Seeding, mulching, and/or matting shall be promptly initiated.
- 13) Should any drilling/boring/tunneling slurry/fluid be released to a stream or waterway, CONTRACTOR shall be responsible for all cleanup activities and associated costs. Removal of slurry/fluid from streams is accomplished on a site-specific basis, and shall be determined by OWNER. CONTRACTOR shall conduct cleanup activities in a manner to prevent damage to the riparian/streamside vegetation as much as practicable. CONTRACTOR shall be responsible for any slurry/fluid off site disposal and associated costs.
- 14) Spoils and/r excavated materials generated from drilling/boring/tunneling activities shall not be staged, or stored near ecologically sensitive areas, such as wetlands or streams, and shall be provided with the appropriate sediment control structures to prevent silt runoff from the site, and/or into any waterbody.
- 15) Any dewatering activities is done during drilling/boring/tunneling activities shall have appropriate sediment controls in place to prevent silt runoff into any stream or wetland.

4.11 Site Evaluations/Recordkeeping

- A. CONTRACTOR shall provide competent "qualified" personnel to conduct site evaluations at a minimum of once every seven-calendar days, or once every fourteen-calendar days and within 24 hours after any storm event of greater than 0.5 inches. The ADEQ stormwater permit defines "qualified" personnel as:

"a person knowledgeable in the principles and practice of erosion and sediment controls who possesses the skills to assess conditions at the construction site that could impact stormwater quality and to assess the effectiveness of any sediment and erosion control measures selected to control the quality of stormwater discharges from the construction activity."

- B. CONTRACTOR'S inspections must include all areas of the site disturbed by construction activity and areas used for storage of materials that are exposed to precipitation. CONTRACTOR'S inspectors must look for evidence of, or the potential for, pollutants entering the stormwater conveyance system. Erosion and sedimentation control measures must be observed to ensure proper operation. Discharge locations must be inspected to determine whether erosion control measures are effective in preventing significant impacts to waters of the State, where accessible. Where discharge locations are inaccessible, nearby downstream locations must be inspected to the extent that such inspections are practicable. Locations where vehicles enter or exit the site must be inspected for evidence of off-site sediment tracking.
- C. CONTRACTOR shall maintain copies of the written site evaluation reports onsite. Any inadequacies on the part of the CONTRACTOR shall be corrected as soon as practicable, but no later than three (3) calendar days following the evaluations.
- D. The OWNER is required to retain records of all reports and documents required by the General Stormwater Permit, including the SWPPP and site evaluation reports, for a period of at least three years from the date of final stabilization. The CONTRACTOR shall maintain the following written records, and copies shall be submitted to OWNER at project termination:
- 1) Site evaluation/stormwater inspection reports
 - 2) Updated sediment and erosion control plans
 - 3) Chemical use inventory
 - 4) Waste disposal records
 - 5) Documentation of pollution prevention meetings/training
 - 6) Records of all spills, leaks, and releases
 - 7) Records of major construction activities and stabilization
 - 8) List of the sources of non-stormwater
 - 9) Oil/fuel inventory

- 10) Written documentation of used oil disposal, including disposal method and facility location, facility name, and EPA identification number of transporter and disposal facility
- 11) Storm event records
- 12) Records of subcontractors involved in surface disturbance activities.

4.12 Contractor Submittals

- A. Prior to commencement of construction activities, the CONTRACTOR shall provide the following submittals to ENGINEER within 10 days of issuance of the Notice to Proceed:
 - 1) The specific intended sequence of major construction activities. Sequence shall include items such as staging/laydown areas, construction entrances, etc. Submittal shall include proposed BMPs required for each sequence.
 - 2) Contact information for CONTRACTOR's designated spill coordinator.
 - 3) Projected oil/fuel inventory and volume of containers having a capacity of 55 gallons or more. This shall include projected oil/fuel inventory of all subcontractors.
 - 4) CONTRACTOR local or on-site contact information.
 - 5) Subsequent to commencement of construction, CONTRACTOR shall submit copies of all remaining records specified in 4.9, Item A.2.

4.13 Environmental Training

- A. The ADEQ general permit requires employee training to inform personnel responsible for implementing activities identified in the stormwater pollution prevention plan or otherwise responsible for stormwater management at all levels of responsibility of the components and goals of the SWPPP and the requirements of the general permit, including contractors and subcontractors.
- B. A regulatory training session will be given by ENVIRONMENTAL CONSULTANT. CONTRACTOR shall ensure that CONTRACTOR'S, and any subcontractor's, site personnel who will be responsible for management of day-to-day surface disturbance activities shall attend environmental regulatory training session. An on-site visit may be required as part of the training session. Should onsite construction personnel change, CONTRACTOR shall be responsible for the cost of conducting any additional environmental training. CONTRACTOR shall be responsible for maintaining records of training in SWPPP.

END OF SECTION 02270

SECTION 02273 - STONE RIPRAP AND FILTER FABRIC

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This section sets forth the materials and procedures required in placing riprap and filter fabric for bank stabilization where required.

PART 2 - PRODUCTS

2.1 RIPRAP

- A. Material for stone riprap shall be from an approved quarry source. Riprap shall be reasonably free from overburden spoil and well-graded between the maximum and minimum rock sizes specified. Based on any one (1) hauling unit shipment or delivery, the maximum size shall not be greater than 18 inches in any dimension and at least 50% of the material by weight shall consist of pieces weighing 35 pounds or more. Particles from quarrying or loading operations passing a 1/2 inch sieve shall not exceed 5% of the total weight.

2.2 FILTER FABRIC

- A. Filter fabric shall be woven or unwoven, synthetic fiber, geotextile fabric meeting the requirements of AASHTO M288 (Geotextiles). Filter fabric shall be Geotextile 801, as manufactured by Propex Geosynthetics, or approved equal.
- B. Fabric shall be furnished with an appropriate protective cover to provide protection from adverse radiation effects and abrasion during shipping and handling.

PART 3 - EXECUTION

3.1 FILTER FABRIC

- A. The filter fabric shall be placed directly on the prepared surface. Fabric sections may be placed vertically or horizontally on the slope. The filter fabric shall be installed in such a manner that all overlapping sections are provided with a minimum lap in accordance with the manufacturer's recommendations. Fabric shall be overlapped in the direction of water flow. The fabric shall be turned down and buried approximately 12 inches at the exterior limits.

- B. Adjacent overlapping fabric sections shall be joined with U-shaped wire pins, single shaped steel pins with metal disc heads, or similar fasteners. The fasteners shall be six (6) inches or more in length and shall hold the fabric firmly in place. Fasteners shall be inserted through both strips of overlapped fabric at intervals of approximately four (4) feet along the overlap. Additional pins shall be installed as necessary to prevent displacement of the fabric.
- C. 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 damaged area and lapping and pinning the new fabric beyond the damaged area by a minimum of two (2) feet.
- D. Placement of riprap shall be in accordance with details set out in Erosion Control Methods in Section 02270 of these Specifications.

3.2 STONE RIPRAP

- A. The stone riprap shall be placed in such a manner to produce a reasonably well-graded, smooth surfaced mass of rock with the minimum practicable percentage of voids to the lines and grades indicated on the Drawings. The area shall be well-covered but not to an excessive thickness. Material shall be placed in one operation and in such a manner to avoid displacing the underlying material. Placing riprap in layers shall not be permitted. The larger riprap stones shall be well-distributed, and the entire mass of stones shall be roughly graded to conform to the gradation specified. The finished riprap shall be free from objectionable pockets of small stones and clusters of larger stones. Hand-placing may be required as necessary to meet the requirements of this Section. Placing riprap by dumping into chutes or by other methods likely to cause segregation shall not be permitted.
- B. Riprap stone shall not be deposited in a manner that shall cause damage to the filter blanket. Any damage to fabric during placement of riprap shall be corrected by the Contractor prior to proceeding with the Work. Damaged fabric shall be repaired as set forth in this Section.
- C. Particular care shall be exercised by the Contractor to restore the area where riprap rock is stockpiled to pre-construction conditions. The riprap stockpiling area shall be cleaned and seeded as specified in 02920 – Cleanup, Seeding, and Sod of these Specifications.

END OF SECTION 02273

SECTION 02320 – BLASTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. The Contractor shall conduct all blasting operations in conformance with the Arkansas Department of Labor Safety Code number 13, Blasting Regulations, promulgated by Arkansas Department of Labor, and all other applicable local ordinances, and state and federal laws. The blasting contractor shall be registered and licensed with the Arkansas Contractor's Licensing Board.

1.3 DEFINITIONS

- A. Blasting Agents: Any material or mixture consisting of fuel and oxidizer, intended for blasting, not otherwise defined as an explosive (non-cap sensitive).
- B. Construction: The fabrication, erection, or building of pipelines, sewer lines, water lines, utilities, roads or buildings, including preparatory work and demolition work, which involves blasting.
- C. Explosives: Any chemical compound, mixture or device, the primary or common purpose of which is to function by explosion (the almost instantaneous release of heat and gas).
- D. Handling: The use of explosives and/or detonators.
- E. Production Blasting: The systematic drilling, loading, and firing of blast holes so as to break the rock mass into pieces small enough to be removed by standard excavating equipment.
- F. Pre-Split Blasting: Drilling, loading, and firing of blast holes, distributed along the full hole depth, and detonated so as to produce an open shear plane between closely spaced blast holes prior to adjacent production blasting.
- G. Pre-Blast Survey: The photographic documentation of pre-existing structural and cosmetic conditions of any structure within a predefined distance from a blasting project.
- H. Storage: Any facility, such as a magazine, used for storing blasting agents.
- I. Transportation: The carrying of explosives from one location to another.

1.4 INSURANCE REQUIREMENTS

- A. The Contractor shall meet the additional insurance requirements contained in the Supplementary Conditions.

1.5 QUALITY ASSURANCE

- A. Certified Blaster Qualifications:
 - 1. Any person performing blasting activities must have a valid, current blasters certificate issued by the Arkansas Department of Labor.
 - 2. The blaster certification shall be carried by the blaster or shall be on file at the blasting area during the blasting operation.
 - 3. A blaster shall be qualified, by reason of training, knowledge, or experience, in the field of transporting, storing, handling, or use of explosives, and have a working knowledge of State and local laws and regulations which pertain to explosives.
 - 4. Blasters shall be required to furnish satisfactory evidence of 10 years experience in the construction-blasting field.
 - 5. The blaster shall have verifiable training in the safe handling of explosives.
 - 6. Provide to the Engineer a list of successfully completed close in precision controlled blasting projects that were performed in close proximity to existing structures.
 - 7. The blaster shall be knowledgeable and competent in the use of each type of blasting method used.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 BLASTING PLAN

- A. Before beginning any drilling and blasting, the blasting contractor shall submit a proposed blasting plan for such operations to the Project Engineer for his records. Proper notifications shall be given to all regulating authorities. The blasting contractor shall address all points as outlined in the Arkansas Department of Labor Safety Code number 13, Blasting Regulations.
- B. The blasting contractor shall provide copies of State permit(s), permit(s) notification(s), individual blaster license(s), and proof of liability insurance to the Owner prior to beginning blasting.

3.2 PRE-BLAST SURVEYS

- A. Prior to commencing drilling, the blasting contractor shall complete a pre-blast survey, which shall include at a minimum the following:
 - 1. Any structure with a concrete slab, poured concrete footings, or block foundation within 500 feet of any blast on the project.
 - 2. The pre-blast survey should include the condition, type, construction, and condition of the exterior and interior of each structure. Still color, fine-grained, photographs only shall be used for visual documentation.

3.3 STORAGE AND USE OF EXPLOSIVES

- A. Explosives shall not be stored on the project site overnight. The Contractor shall transport explosives to the site daily as needed. Explosives shall be stored, handled, and used in accordance with all Federal, State, and local laws and regulations. The Contractor shall comply with all special rules and regulations that may be made by the authorities having jurisdiction, regarding construction of and storage in magazines, precautions in blasting, and other aspects of the storage and usage of explosives. The contractor shall store explosives at an offsite location and transport explosives to the site on an as needed basis.

3.4 BLASTING

- A. Method: The Contractor shall take such precautions as are necessary to prevent cracking or damaging the rock or concrete outside the prescribed limits of excavation. The use of bulk explosives will not be permitted unless positive measures are taken to prevent its mixing with water and the uncontrolled spread of the blasting agent into subsurface cracks, caverns, or cavities. When sufficient natural cover is not available to contain flyrock, or if excessive flyrock occurs outside the blasting area, the Contractor shall cover all shots. Shots shall be covered in conformance with Section 3.4, D below.
- B. Clearing of Misfires: In the event of a misfire, all work in the area shall be stopped. The blast area should then be cleared in accordance with the explosive manufacturer's recommendations. The blaster in charge or the blaster designing and detonating the blast shall clear the misfire. Only the individuals necessary for clearing the misfire shall be present until the misfire is cleared. The misfire shall be documented with the blast record including the manner in which the misfire was cleared and any corrective actions.
- C. Stemming: All blast holes shall be stemmed from the top of the explosive charge to the collar of the blast hole. Holes shall be stemmed with angular crushed stone chips having a maximum size of 1/2 inch. Drill cuttings, clay, or dirt shall not be used as stemming.
- D. Shot Cover:
 - 1. Blasting mats shall be placed over all shots to control air overpressure and stemming ejection from the bore holes during detonation. The shots will be entirely covered, leaving no exposed bore hole collars at the surface of the ground.
 - 2. The blasting mats will be either of woven cable or rubber tire design and must be of sufficient size and quantity to completely suppress all flyrock from leaving the shot area. Flyrock thrown from the project site due to blasting will not be tolerated at any time throughout the course of this project.

3.5 BLAST VIBRATION AND MONITORING

- A. Vibration monitoring and air blast monitoring of all blasts is required of the blasting contractor. The blasts shall be monitored to ensure that the peak particle velocity measured at any nearest inhabited structure does not exceed 1.0 inch per second (ips), peak particle velocity. No blasting shall occur without at least three (3) recording seismographs capable of producing a printed record of each blast.
- B. Seismograph Equipment:
 - 1. The Contractor shall provide sufficient seismographs to measure and record ground movements caused by each blast. The instrumentation shall record three orthogonal

components (vertical, radial, and transverse with respect to the location of the blast) of particle velocity direction. The peak particle velocity of the highest component of vibration shall be used as the peak particle velocity, (ppv). Instruments that provide only peak readings from an analog view-meter type display will not be acceptable. On a yearly basis, and more often if necessary, the equipment, including peak readout, shall be certified by the manufacturer to be within acceptable calibration limits. The record for each blast shall consist of seismograph records identified by instrument number, the location of instruments positively identified, the date, time and location of the blast, the amount of explosives used, the peak particle velocity and all other data to adequately control blasting operations. The particle velocity data shall be included in the Shot Record Addendum.

2. The seismograph operator shall be a qualified person capable of setting the instrument up at designated locations and effectively recording the blast.
3. The results of vibration monitoring in the form of peak readings for each blast shall be provided to the Blaster prior to any further blasting. No blast shall be made before the results from the previous blasting have been furnished to the Blaster. The Blasting Contractor shall take all necessary precautions to assure that the peak readings available from the blast record are accurate to the maximum extent possible, as defined by the manufacturer of the equipment.

3.6 RECORD OF BLASTING OPERATIONS

- A. A record of each blast, including seismograph reports shall be completed and retained for at least three (3) years. A copy of these records shall be submitted to the Engineer for his records. The record shall contain as a minimum the following data:
1. Name of the blasting company or contractor.
 2. Exact location of the blast, date, and time of the detonation.
 3. Name, signature, and license number of the blaster in charge.
 4. Type of material blasted.
 5. Number of holes, burden, and spacing.
 6. Diameter and depth of holes.
 7. Types of explosives used.
 8. Total amount of explosives used.
 9. Maximum amount of explosives per delay period of eight (8) milliseconds or greater.
 10. Method of firing and type of circuit.
 11. Direction, distance in feet, and identification of nearest dwelling house, public building, school, church, commercial or institutional building neither owned nor leased by the person conducting the blast.
 12. Weather conditions including temperature, wind velocity, and direction.
 13. Type and height or length of stemming.
 14. A statement as to whether mats or other protection against flyrock were used.
 15. Type of delay electric blasting caps used and delay periods used.
 16. The person taking the seismograph reading shall accurately indicate exact location of seismograph if used and shall also show the distance of seismograph from blast and the distance from the nearest seismograph and the nearest structure.
 17. Seismograph reading.
 18. Maximum number of holes per delay period of eight (8) milliseconds or greater.
 19. Sketch of blast pattern including number of holes, burden and spacing distance delay pattern, and if decking is used, a hole profile.

END OF SECTION 02320

SECTION 02446 – HORIZONTAL DIRECTIONAL DRILLING (HDD)

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes furnishing all labor, materials, tools and equipment as necessary to install pipeline by the horizontal directional drilling method and provide a complete finished crossing. The finished work includes proper installation testing, restoration of underground utilities and environmental protection and restoration.

1.3 DEFINITIONS

- A. Within this section of the Specifications, the “subcontractor” shall mean the entity supplying and performing the horizontal directional drilling and installation of pipe and appurtenances by the method described in this section of the Specifications.

1.4 QUALITY ASSURANCE

- A. The horizontal directional drilling (HDD) equipment operator(s) shall be trained to operate the specific HDD equipment and have at least three (3) years experience in directional drilling obtained within the last five (5) years. All pipe and appurtenances of similar type and material shall be furnished by a single manufacturer.
- B. Perform HDD operations under the constant direction of a drilling supervisor who shall remain on site and be in responsible charge throughout the drilling operation. The subcontractor’s supervisor shall have supervised directional drilling of a minimum of 5,000 linear feet of pipe of a similar or greater diameter, of similar material, over similar lengths, and with similar subsurface conditions.
- C. The requirements set forth in this Specification specify a wide range of procedural precautions necessary to ensure that the basic, essential aspects of a proper directional bore installation are adequately controlled. Strict adherence shall be required under specifically covered conditions outlined in this Specification.
- D. Perform the work in general conformance with ASTM F 1962 standard, current revision, “Standard Guide for Use of Maxi-Horizontal Directional Drilling for Placement of Polyethylene Pipe of Conduit under Obstacles, Including River Crossings.”
- E. Adhere to the Specifications; any changes must be expressly approved by the Engineer. Approval of any aspect of any directional bore operation covered by this Specification shall in

no way relieve the subcontractor of its ultimate responsibility for the satisfactory completion of the work authorized under the contract.

1.5 PROFILES AND TOPOGRAPHY

- A. Contours, topography and profiles of the ground as may be shown on the Drawings are believed to be reasonably correct, but are not guaranteed to be absolutely so and are presented only as an approximation. It is the subcontractor's responsibility to verify all elevations required to successfully complete the crossing.

1.6 SUBMITTALS

- A. Working drawings and written procedure describing in detail proposed method and entire operation for information only including, but not limited to:
 - 1. Size, capacity and arrangement of equipment.
 - 2. Location and size of drilling and receiving pits.
 - 3. Dewatering and methods of removing spoils material.
 - 4. Method of installing detection wire and pipe.
 - 5. Type, location and method of installing locator station.
 - 6. Method of fusion pipe segment and type of equipment.
 - 7. Type of cutting head.
 - 8. Method of monitoring and controlling line and grade.
 - 9. Detection of surface movement.
 - 10. Bentonite drilling mud for information only:
 - a. Products information, material specifications, and handling procedures.
 - b. Material Safety Data Sheet and special precautions required.
 - c. Method of mixing and application.

1.7 JOB CONDITIONS

- A. Any nighttime work is strictly regulated and will be allowed only with prior approval granted by Engineer subject to regulatory agencies having jurisdiction. All crossing operations shall be accomplished during daylight hours, unless approved by Engineer. The subcontractor shall provide a Work Plan submittal indicating its proposed hours of operation and length of work week. All work plans shall be subject in compliance with all applicable regulatory requirements for construction activities and any off-site impacts.
- B. When hazards of nighttime work are carefully considered and determined to be insignificant, nighttime work may be allowed only to complete a properly planned crossing, and only if in the opinion of Engineer, the delay was caused by reasonably unavoidable circumstances, and that such nighttime work is necessary to avoid placing an undue economic hardship on the subcontractor. The subcontractor shall be responsible for any additional cost associated with nighttime work.
- C. In emergency situations, or where delay would increase the likelihood of a failure, nighttime work may be allowed to complete a delayed crossing. All operations shall continue on a 24-hour per day basis during pipe pullback.

1.8 COORDINATION OF WORK

- A. Coordinate connections to existing pipelines that require shutdown of Owner's facilities. Owner will designate the time for these connections that could involve work during evenings, nights, Saturdays, Sundays, or holidays. Method of connection and designated times are to cause the least amount of disruption to Owner's sewer service to its customers. The cost for connections is to be included in the contract price. No contract price adjustment will be allowed for overtime, premium time, or other related costs.

1.9 USE OF EXISTING WATER SYSTEMS

- A. All use of existing water systems during construction by the subcontractor shall be allowed with the approval and direction of Owner and its representatives. The subcontractor shall be responsible for all permits, fees, temporary piping, temporary meter rental/provisions, temporary backflow preventer rental/provision, and other water utility requirements for supplying water during construction. The subcontractor shall use the existing water system only at locations, times, and conditions as set forth by Owner or its representatives.
- B. If water is not readily available at the site or Owner cannot provide the volume of flow required by the subcontractor, provide potable water as needed from an off-site location at no additional cost to Owner.

PART 2 - PRODUCTS

2.1 EQUIPMENT

- A. General: All equipment for the directional bore shall have the capacity, stability, and necessary safety features required to fully comply with the Specifications and requirements of this section without showing evidence of undue stress or failure. It shall be the responsibility of the subcontractor to assure that the equipment to be used in the directional bore is in sound operating condition. Backup equipment shall be required in the event of an equipment breakdown and where the condition of the equipment to be used indicates that routine component replacement or repair will likely be necessary during the directional bore.
- B. Directional Drilling System: The directional drilling system shall consist of over-the-road transportable field power unit, mud-mixing and recycling unit, a trailer or carriage-mounted drill unit, and all other support accessory vehicles and equipment. All system components shall be in sound operating condition with no broken welds, excessively-worn parts, badly bent, or otherwise misaligned components. All drill pipe, reamers, pullback heads, swivels, drill heads and collars, pipe cradles, pipe rollers, ropes, cables, clamps, and other non-mechanical but essential items shall be in sound condition and replaced immediately when need is apparent. The equipment must be capable of drilling the specified length in a single bore.
 - 1. Mud-Mixing and Recycle Units: The mud-mixing and recycle unit shall be a self-contained system designed to provide a supply of high-pressure Bentonite-based cutting fluid to the drill unit. It shall contain a fluid storage tank and a complete Bentonite and drilling fluid additive(s) mixing system. The cutting fluid is to be mixed on-site. The cutting fluid shall be formulated for this specific project and anticipated conditions. It shall permit changes to be made to the Bentonite and drilling fluid additive(s)

concentrations during drilling in response to changing soil conditions. The field power unit shall contain the power-taken, off-driven high-pressure cutting fluid pumping system. The recycle units shall be of a capacity to minimize the production of new cutting fluid and maximize the reuse and recirculation of original cutting fluid produced.

2. Directional Drill System: A carriage-mounted version of the drill system shall include a thrust frame. Both the trailer-mounted and carriage-mounted drill system shall be designed to rotate and push 10-foot (3-meter) minimum hollow drill sections into the tunnel being created by the boring head. The drill sections shall be made of high strength S-grade steel that permits them to bend to a 30-foot (9-meter) radius without yielding. Drill end fittings shall permit rapid makeup of the drill sections while meeting the torque, pressure and lineal load requirements of the system. The boring head itself shall be capable of housing a probe used by the Magnetic Guidance System (MGS) to determine tool depth and location from surface and to orient the head for steering. The MGS shall have a minimum accuracy of plus or minus (\pm) 2 percent of the vertical depth.
 - a. The drilling equipment must be fitted with a permanent alarm system capable of detecting an electric current. The system will have an audible alarm to warn the operator when the drill head nears electrified cables. The drilling equipment shall be grounded, protected, and operated in accordance with manufacturer's requirements for electric strike safety.
 - b. The control console shall contain a calibrated display of inclination, azimuth, tool face location, mud pump rates, and torque pressures. The downhole steering system accuracy shall be ± 1.0 percent of the horizontal bore length, such that the difference between actual depth and machine calculated depth is not more than 1 foot per 100 feet.
 3. Restrictions: Other devices or utility placement systems for providing horizontal thrust other than those previously defined in the preceding sections shall not be used unless approved by Engineer prior to commencement of the work. The proposed device or system will be evaluated prior to approval or rejection on its potential ability to complete the pipe placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular condition of the project. Water sluicing methods, jetting with compressed air, or boring or tunneling devices with vibrating type heads that do not provide positive control of the line and grade shall not be allowed.
- C. Spoils Equipment: the cutting fluid removal system shall include a self-contained vacuum truck which has sufficient vacuum and tank capacity to remove excess cutting fluid mixture and cuttings from the project site as required or as directed by Engineer. Spoils are not to be discharged into sewers or storm drains.
1. The subcontractor shall contain all drilling and pipe lubricating mud by taking special measures to prevent runoff onto adjacent properties and/or waterways.
 2. All surplus drilling and pipe lubricating mud shall be removed from the site and properly disposed of by the subcontractor at no cost to the Owner. The subcontractor will also be responsible for all required erosion control measures at no cost to the Owner.
- D. Magnetic Guidance System: A Magnetic Guidance System (MGS) shall consist of a probe and a tracker that is capable of monitoring the location of the drill head during the drilling operation. The tracker shall be capable of tracking at all depths up to 100 feet and in any soil condition, including hard rock. It shall enable the driller to guide the drill head by providing immediate information on the tool face, azimuth (horizontal direction), and inclination (vertical direction). The tracker shall be accurate to ± 2 percent of the vertical depth of the borehole at sensing position at depths up to 100 feet. Ferrous materials shall not influence or affect the MGS readings or accuracy.

1. Components: The subcontractor shall supply all components and materials to install, operate, and maintain the MGS. This shall include but is not limited to the following:
 - a. MGS probe and interface.
 - b. Computer, printer and software.
 - c. DC power source, current control box, and coil/tracking wire.
 2. The Magnetic Guidance System shall be a Tensor Tru-Tracker MGS, or other licensed and industry-approved wire guidance system. The subcontractor is required to obtain an approval from Engineer for the equipment to be used. The subcontractor is responsible for supplying all required information regarding the equipment and method to be used on the project. Work shall not commence until approval is obtained from Engineer. The subcontractor is responsible for setting up and operating the MGS using personnel experienced with this system. "AWalk-Over" tracking systems shall not be used, except as approved by Engineer. Subcontractor shall provide Engineer with current calibration certification of MGS in accordance with manufacturer's specifications.
- E. If equipment breakdown or other unforeseen stoppages occur and forward motion of the directional cutting head is halted at any time other than for reasons planned in advance (addition of drill stems, etc.), the boring path shall be filled with a proper Bentonite solution immediately, or as directed by Engineer.
- F. The boring tool shall have steering capability and have an electronic tool detection system. The position of the tool during operation shall be capable of being determined accurately, horizontally within 1 percent of the horizontal distance of the borehole and vertically within 2 percent of the vertical depths of the borehole. The boring tool shall have a nominal steering radius of 30 feet.

2.2 DRILLING FLUIDS

- A. A mixture of Bentonite drilling clay, project specific cutting fluid additives, and potable water is to be used as the cutting fluid (MUD) and over-ream hole filler for the directional bore. The drilling fluid mixture used shall have the following minimum viscosities as measured by a March Funnel:
- | | | |
|----|-------------|----------|
| 1. | Rock Clay | 60 sec. |
| 2. | Hard Clay | 40 sec. |
| 3. | Soft Clay | 45 sec. |
| 4. | Sandy Clay | 90 sec. |
| 5. | Stable Sand | 120 sec. |
| 6. | Loose Sand | 150 sec. |
| 7. | Wet Sand | 150 sec. |
- These viscosities may be varied to best fit the soil conditions encountered as recommended by the drilling mud and fluid additive manufacturer, and as approved by Engineer.
- B. Where sandy or granular materials are encountered, a cement slurry or polymer supplement shall be considered for added strength and stability of the bore and over-ream hole.
- C. No chemicals or polymer surfactant shall be used in the drilling fluid without written consent of Engineer, and after a determination is made that the chemicals to be added are not harmful or corrosive to the facility and are environmentally safe. Clay must be totally inert and contain no risk to the environment.

- D. Provide Engineer and have on-site at all times the Material Safety Data Sheets (MSDS) for all drilling compounds and chemicals.

2.3 TRACER WIRE

- A. Tracer wire shall be installed simultaneously with pullback of the HDPE pipe. Wire shall either be wrapped around the pipe or taped to the pipe at 10-foot minimum intervals before installation. The tracer wire shall terminate at ground surface inside of tracer wire riser pipe.

PART 3 - EXECUTION

3.1 SITE DISTURBANCE AND SOIL EROSION

- A. Sediment barriers shall be constructed as shown on the Drawings or as set out in Section 02270 of these Specifications. All soil erosion and sediment control work shall be done in accordance with said Section 02270 for the location where the work is performed. Subcontractor shall maintain Best Management Practices until the project is deemed complete.
- B. The subcontractor shall be responsible for the preservation of all existing trees, plants, and other vegetation that are to remain within or adjacent to the construction site and shall also be responsible for protecting existing concrete curb, fence, utilities, and other structures that are located within or adjacent to the construction site.
- C. The subcontractor assumes all liability for environmental damage and cleanup due to inadvertent discharges of slurry or other causes. Slurry materials shall be selected based on the soil conditions encountered to minimize the risk of mud returns.

3.2 PERSONNEL REQUIREMENTS

- A. Provide a competent and experienced supervisor representing the drilling subcontractor who must be present at all times during actual operations. A responsible representative, who is thoroughly familiar with the equipment and type work to be performed, must be in direct charge and control of the operation at all times. In all cases, the supervisor must be continually present at the jobsite during the actual directional pilot hole, over-reaming and pullback operations.
- B. Subcontractor must have a sufficient number of competent workers on the job at all times to ensure the directional bore is made in a timely and satisfactory manner. Adequate personnel for carrying out all phases of the actual directional bore operation must be on the jobsite at the beginning of work.
- C. If HDPE is specified for the carrier pipe, HDPE pipe thermal butt-fusion welding shall be completed by a welder certified by the manufacturer of the pipe or pipe welding equipment, in accordance with the Plastic Pipe Institute "Handbook of Polyethylene Pipe," Polyethylene Joining Procedures, and 49 CFR 192, Subpart F, latest edition.
- D. Engineer must be notified 48 hours in advance of starting each phase of the work. Engineer's concurrence for beginning the installation shall in no way relieve the subcontractor of the ultimate responsibility for the satisfactory completion of the work as authorized under the

contract. It shall be the responsibility of Engineer to provide resident observation personnel at such times as appropriate without causing undue hardship by reason of delay to the subcontractor.

3.3 ALIGNMENT AND GRADE

- A. Subcontractor shall determine and physically locate the depth, location, and size of all existing underground facilities in the vicinity of the proposed crossings and provide Engineer with a comprehensive report of these facilities before starting any construction. The subcontractor shall be held completely and solely responsible for any damages incurred. The kinds, locations and sizes of the existing underground utilities which may be shown on the Drawings are intended only as a guide to the subcontractor and are not guaranteed to be even approximately correct. Notify Engineer of all existing utilities along the route and in the vicinity of the crossing prior to the construction to include all test borings and excavations.
- B. If utilities of unknown depth or other obstructions require grade or alignment deviations from the Drawings, the grade and/or alignment may be adjusted with Engineer's approval. All adjustments shall permit gradual bends of the pipe to the original alignment beyond the directional bore section. At unusual site conditions, the subcontractor may request a review of site conditions by Engineer for additional adjustment, and such determination shall be final. An adjustment in alignment, position, or elevation approved by Engineer shall not be cause for an adjustment of costs.
- C. Pipe entry and exit points are to be allowed no more than 5 feet of deviation from the staked centerline. The entry point may be moved up to 25 feet further from the original entry point only with Engineer's approval. Exit point lengths greater than 25 feet from the original point require Engineer's approval. Entry and exit points normally will not be allowed closer to the banks of a waterway being crossed. Any installation that deviates from the plan may be rejected and any rejected installation shall be reconstructed at the subcontractor's expense.
- D. The vertical profile as shown on the Drawings is the minimum depth to which the pipeline shall be installed. Subcontractor may, at his option and with the permission of Engineer, elect to install the pipe at a greater depth than shown on the Drawings, at no additional cost to the Owner.

3.4 INSTALLATION

- A. The subcontractor shall be responsible for providing a Maintenance of Traffic Plan to Engineer and local traffic law enforcement agency for review. The Maintenance of Traffic Plan shall show the location of all barricades, signs, devices and alternate routes for local traffic and pedestrian safety. Erection of the appropriate safety and warning devices in accordance with the USDOT "Manual of Uniform Traffic Control Devices" (MUTCD) shall be completed prior to beginning of work and maintained until all construction is completed and the site restored.
- B. Specifically note in the Maintenance of Traffic Plan street intersections that are to remain open as required during the pipe pullback operation, or traffic detours implemented. Install a temporary sleeve across the street intersections through which the pipe can be pulled or to construct a temporary bridge for the pipe over the intersections as required. No additional

payment will be made for temporary structures required in order to permit access through street intersections or the implementation of traffic detours.

- C. The cost of restoring pavement, curb, sidewalk, driveways, lawns, storm drains, etc., and other landscaped facilities shall be borne by the subcontractor unless otherwise noted.
- D. The following is a general outline of steps for the directional bore operation:
1. Clear the right-of-way and temporary work space as shown on the Drawings. Subcontractor is responsible to install and maintain all soil erosion and sediment control devices, until project is completed and the approved permanent site stabilization is in place.
 2. Lay out the pipe crossing alignment using a qualified professional land survey team to confirm accurate horizontal distances, either physically measured or shot by electric distance measurement. Entry and exit points shall be located and marked with survey hubs or markers. Payment for survey mark-out shall be included in the price bid under horizontal directional drilling.
 3. Haul, string, and assemble restrained pipe. Joint air test the section prior to installation and hydrostatically test the assembled pipeline section, unless otherwise approved by Engineer. If sufficient linear footage of lay-down area for the pipe string is not available, the finished pipeline may be assembled in no more than two sections, with each section joint air tested separately and hydrostatically tested when fully assembled as one piece. The subcontractor is responsible for ensuring that the drill rig has adequate pullback capacity to overcome the increased frictional resistance resulting from the stoppage of pipe pullback to perform the final weld or fusion of pipe sections. The subcontractor is required to provide adequate site security. The subcontractor shall be responsible for maintaining the integrity of the pipe until after the pullback, final test of the pipeline, and acceptance of the work by the Owner.
 4. All assembled pipe sections shall be securely plugged at the end of each workday. The pipe interior is to be protected at all times against dirt, dust, drilling mud, pipe cuttings, debris, animal access, and other sources of contamination.
 5. Provide adequate support rollers for the pipeline during pullback of the pipe string into the pre-drilled hole. The rollers and cradles shall be of a type that will prevent damage to the pipe and will be of sufficient number, as recommended by pipe manufacturer, to prevent overstressing due to sag bends during the pullback procedure. The pipe shall be supported at all times, including pullback, to maintain a free stress arc which limits pipe bending and internal hoop stresses to within manufacturer's limits.
 6. Pipe which is not properly protected and supported and show indications of excessive stressing, gouges, cuts, abrasions, or other damage which may affect the operational performance intended for the pipe, as recommended by the pipe manufacturer, shall be removed from the site and replaced at no additional cost as directed by the Engineer.
 7. Mobilize the drilling equipment, erect the rig, drill a pilot hole, enlarge the hole as necessary to a minimum diameter of 1.5 times the nominal diameter of the pipe, and pull back the prefabricated pipe string under the crossing.
 8. Prior to beginning the pilot hole over-reaming, furnish to the Engineer a record plan and profile of the actual crossing to confirm the installation is in compliance with the required grade. Pilot hole alignment shall be accepted by the Engineer in writing prior to reaming and pipe installation.
 9. The subcontractor shall be responsible for selecting the reaming process to be utilized, whether forward- and/or back-reaming will be undertaken, and the number of reaming passes to be made.

10. Supply portable mud tanks or construct temporary mud pits to contain excessive drill fluids during construction and slurry material displacement by the pipe during installation. Mud pits are to be protected at all times against unauthorized access and be stabilized at all times against surface water runoff and containment berm failure. Pump, haul, and dispose of any drill cuttings and excess drill fluids to a receiving site permitted to accept the spoils, all in a manner consistent with the local and state regulations at no additional cost to Owner.
11. Pull back the bore pipe in one continuous section. The subcontractor shall use a swivel to minimize the rotation of the product pipe during pullback. Swivel shall utilize lubricated internal bearings which are fully protected from external contamination and over-lubrication. Demonstrate the swivel operation prior to pullback to Engineer prior to the operation.
12. Use potable water and disinfect all piping and hoses used for water addition to the carrier pipe to counter the pipe flotation during pullback.
13. During pullback, maintain records for submission to Engineer indicating job, date, time, constant pipe footage progress, mud flow rates, pulling forces required and torque readings. Document the pull head location for each length of drill stem pipe for record drawings.
14. Owner and Engineer shall have access at all times to any measuring or gauging devices used for the horizontal drill as well as any drilling logs maintained by the subcontractor.
15. In the event that subcontractor must abandon the drill hole before completion of the crossing, the subcontractor shall seal the bore hole with neat cement grout starting at the low point or end of the drill hole and re-drill the crossing at no extra cost to the Owner.
16. Install flange connections from the directionally-drilled pipe to adjacent pipe installed by open-cut with support by backfill material. Flange bolts shall be carefully tightened in increments, with a final torque value not exceeding the manufacturer's recommendations. Tightening torque increments shall not exceed 15 foot-pounds.

3.5 PLANS OF RECORD

- A. The MGS pullback data shall be recorded for every pilot hold drill stem length during the actual crossing operation. The subcontractor shall furnish record plan and profile drawings, on the same horizontal and vertical control datum shown in the Specifications and Drawings, based on these recordings showing the actual location horizontally and vertically of the installation, and all utility facilities found during the installation.

END OF SECTION 02446

SECTION 02512 - ARKANSAS STATE HIGHWAY CROSSINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. The work included under this section of the Specifications shall consist of providing all materials, labor, equipment, tools, supplies, and incidentals necessary to bore and insert a casing pipe, or to open cut as required, existing Arkansas State Highway(s).

PART 2 - PRODUCTS

2.1 CARRIER PIPE

- A. The carrier pipe shall be in conformance to that section of the Specifications governing sewer lines.

2.2 CASING PIPE

- A. Unless otherwise shown on the Drawings, all casing pipe shall be welded or seamless new steel pipe having a wall thickness as shown on the Drawings and a minimum yield strength of 35,000 pounds per square inch.

2.3 CASING SPACERS AND END SEALS

- A. Casing spacers for use in the casing pipe shall be Model SSI (12 inch band, runners 2 inches wide and 8 inches long), as manufactured by Advance Products and Systems, Inc., or approved equal. The end seals shall be watertight and shall be Model AW wrap-around end seal as manufactured by Advance Products and Systems, Inc., or approved equal.

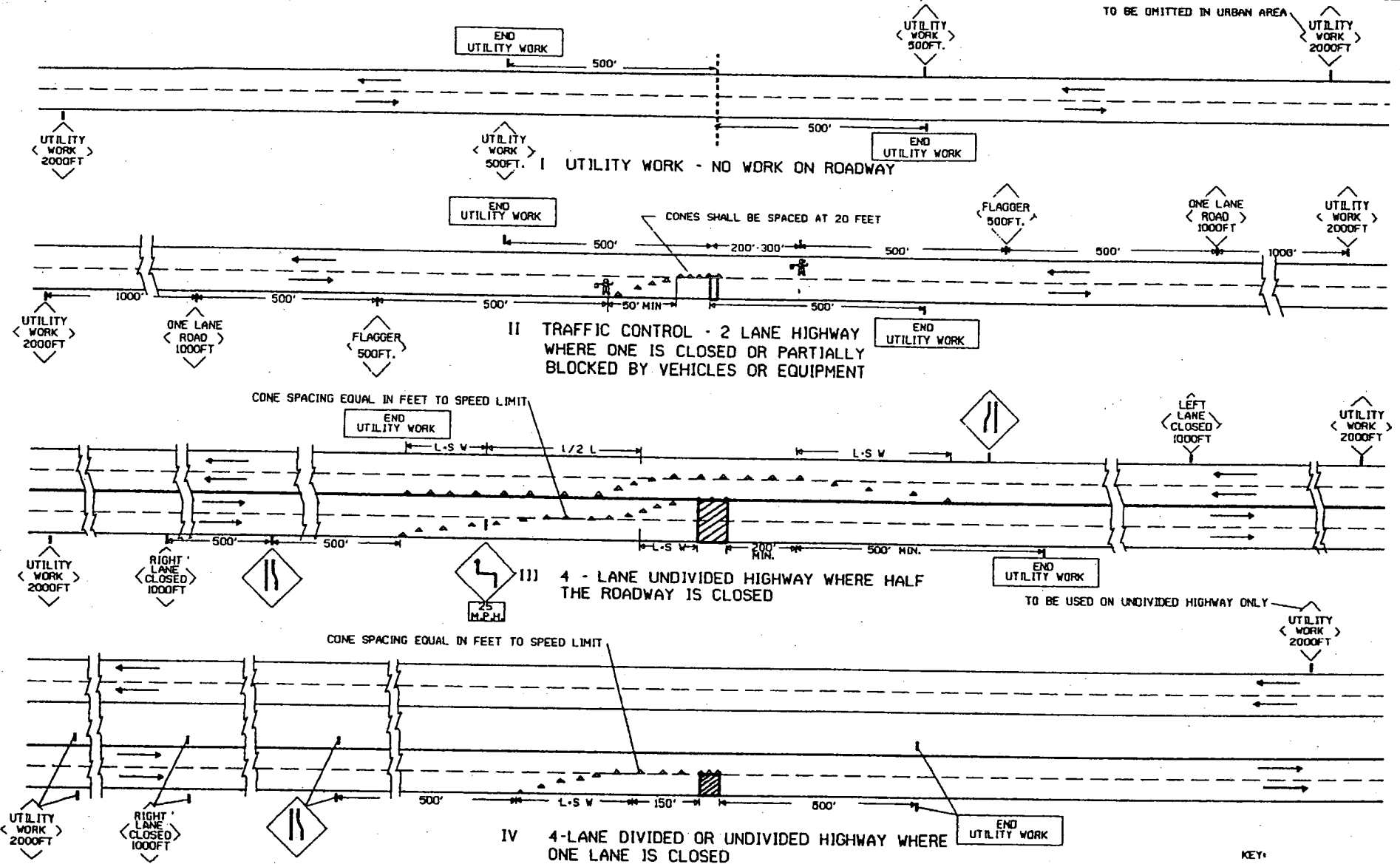
PART 3 - EXECUTION

3.1 CONSTRUCTION

- A. The Drawings show the location of highway crossings to be made. The crossings shall be accomplished by boring and inserting a casing pipe of the type, thickness, diameter and length as specified or shown on the Drawings.

1. **Permit Application:** The Owner has made application with the Arkansas State Highway and Transportation Department for permits which include all crossings and construction on AHTD right of way as shown on the Drawings. A copy of the permit issued by the AHTD will be furnished to the Contractor by the Owner. A copy of the license or permit issued by the AHTD shall be kept on the job site at all times.
2. **Bond Posted:** The Owner will be required to post a deposit or acceptable bond with the Arkansas State Highway and Transportation Department prior to the issuance of the permit. Upon completion of all highway crossings, including repair and cleanup in accordance with these Drawings and Specifications, and upon receiving final approval from the Arkansas State Highway and Transportation Department, the bond or deposit will be returned to the Owner. A percentage equal to the amount of the bond will be held from the Contractor's pay until the bond has been released.
3. **Location of Utilities:** The Contractor shall be responsible for the location of all utility lines located within the area of construction.
4. **Traffic Control:** It shall be the responsibility of the Contractor to provide sufficient flagmen, signs, barricades, lights and other items required to ensure complete safety of the public and the workmen at all times.
 - a. Traffic control on state or federal highways shall be conducted and maintained as set forth in the Manual on Uniform Traffic Control Devices as published by the U. S. Department of Transportation, Federal Highway Administration. The following data sheets are intended as guidelines for typical sign dimensions and application for various types of installation.
5. **Borings:** The crossing shall be made by boring or tunneling and inserting a casing pipe. The top of the casing pipe shall be a minimum of 3.0 feet below the low points of the roadbed cross section (including ditches) or 4.0 feet below the top of the pavement at any location along the casing pipe, whichever gives the greater depth. If rock is encountered and all available means of making the crossings by boring or tunneling have been exhausted, the Engineer will make application to the Arkansas State Highway and Transportation Department to make the installation by the open cut method.
6. **Open Cut:** If approval to open cut is received, the Contractor shall proceed with the installation in full accordance with all provisions and special conditions set forth by the Arkansas State Highway and Transportation Department. Any additional cost of deposits or bonds for open cutting shall be borne by the Contractor. Since the return of the deposit required by the AHTD depends upon returning the roadbed to its original or better condition, the Contractor will be required to complete this item of construction to the satisfaction of the Highway Department.
7. **Restoration of Property:** Any highway property disturbed by the installation of the facility shall be restored to its original or equivalent condition including establishing a sod as required by the District Engineer.
8. **Casing Spacers and End Seals:** Carrier pipes to be installed inside casings shall be installed with self-restraining casing spacers. Casing spacers shall provide axial thrust restraint to prevent pipe joint separation during and after installation. They shall also provide dielectric insulation between the carrier pipe and the casing, and shall facilitate installation of the carrier pipe into the casing.

END OF SECTION 02512



NOTES:

1. PLAN I IS APPROPRIATE WHEN NO PART OF THE ROADWAY IS BLOCKED BY VEHICLES OR EQUIPMENT AND WOULD SUFFICE FOR UTILITY WORK PARALLEL TO ROADWAY.
2. IF THE UTILITY WORK REMAINS IN OPERATION DURING HOURS OF DARKNESS, TYPE II BARRICADES OR DRUMS SHOULD BE USED IN LIEU OF CONES. LIGHTS SHOULD BE PROVIDED TO MARK FLAGGER STATIONS AND BARRICADES AT NIGHT.
3. L - LENGTH OF TAPER
 S - SPEED LIMIT OR 95 PERCENTILE SPEED
 W - WIDTH OF OFFSET IN FEET
4. WARNING SIGNS FOR UTILITY WORK SHALL BE DIAMOND SHAPED, HAVING A BLACK SYMBOL OR MESSAGE ON AN ORANGE BACKGROUND.
5. SIGN SUPPORTS MAY BE FIXED OR PORTABLE DEPENDING UPON TIME DURATION OF PROJECT.
6. ALL SIGNING SHALL BE IN COMPLIANCE WITH THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES.
7. THIS PLAN IS SUBJECT TO MODIFICATIONS BY THE DISTRICT ENGINEER IN URBAN AREAS.
8. ALL SIGNS INTENDED TO BE USED DURING HOURS OF DARKNESS SHALL BE REFLECTORIZED WITH TYPE II REFLECTIVE SHEETING MINIMUM.
9. THE DESIRABLE SIZE OF WARNING SIGNS (DIAMOND - SHAPED SIGNS) IS 48' X 48'; THE MINIMUM SIZE IS 36' X 36'. FOR UTILITY WORK ON FREEWAYS, 48' X 48' SIGNS SHALL BE USED.
10. FOR FLAGGING OPERATIONS, A SINGLE FLAGGER MAY BE USED IF THE ENTIRE WORK AREA IS VISIBLE FROM ONE STATION.

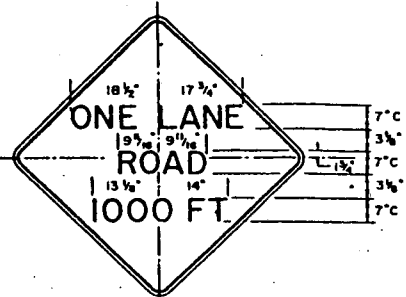
NOTICE:

THESE ARE EXAMPLES OF TRAFFIC CONTROL DEVICES AND THEIR LOCATION FOR YOUR INFORMATION ONLY. PLEASE REFER TO THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR PROPER SIGNING FOR YOUR OPERATION.

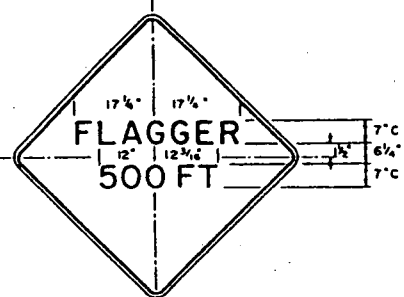
- KEY:
- FLAGGER
 - CONES
 - WORK AREA

**TRAFFIC CONTROLS
 FOR
 UTILITY WORK**

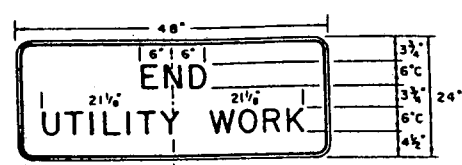
FIGURE 16



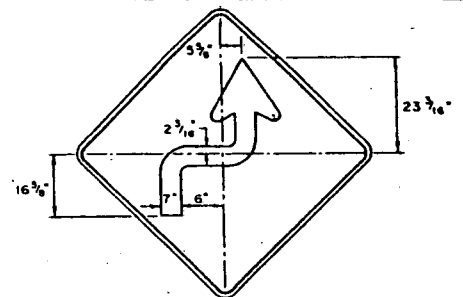
W 20-4



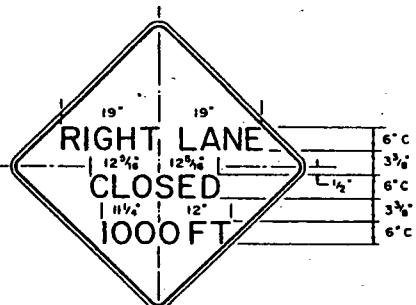
W 20-7



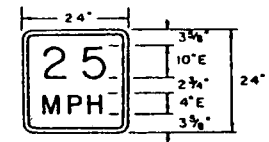
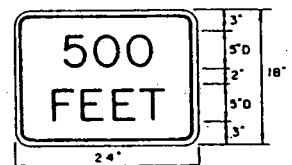
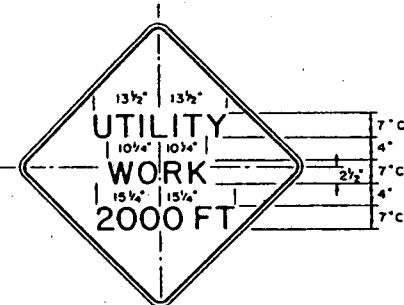
W 20-7a



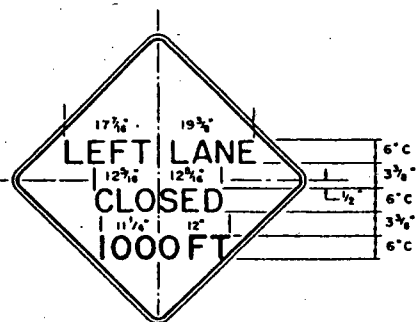
W 1-3



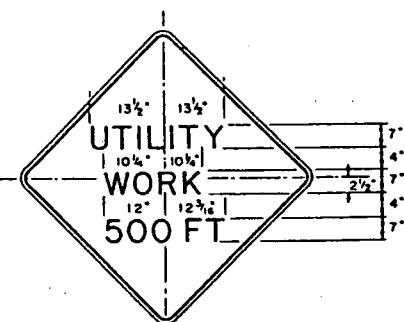
W 20-5



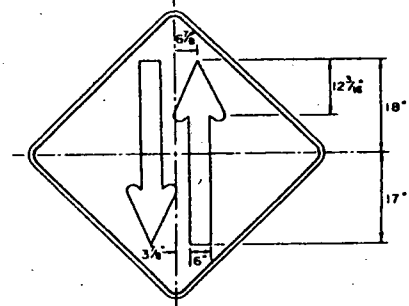
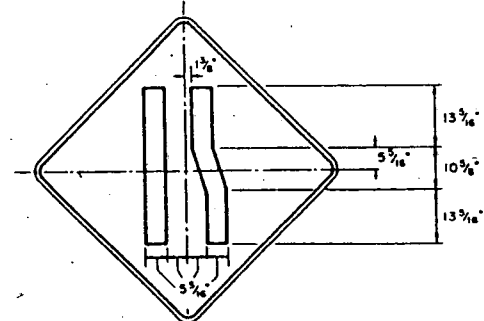
W 13-1



W 20-5



W 4-2



W 6-3

NOTICE: THESE ARE EXAMPLES OF TRAFFIC CONTROL DEVICES AND THEIR LOCATION FOR YOUR INFORMATION ONLY. PLEASE REFER TO THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES" FOR PROPER SIGNING FOR YOUR OPERATION.

NOTE: THE DESIRABLE SIZE FOR WARNING SIGNS IS 48" X 48" AS SHOWN. THE MINIMUM SIZE IS 36" X 36". WHEN THE MINIMUM SIZE IS USED, AN 18" X 18" W13-1 WILL BE ALLOWED.

67

SECTION 02533 – HIGH DENSITY POLYETHYLENE (HDPE) PIPE AND FITTINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplemental Conditions and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

- A. This Specification includes but is not limited to high-density polyethylene (PE 3408) (ductile iron pipe size O.D.) pressure pipe primarily intended for the transportation of water and sewage, either buried or above grade.

1.3 REFERENCES

- A. AWWA C 901 – Polyethylene (PE) Pressure Pipe and Tubing, 1/2 Inch through 3 Inch for Water.
- B. AWWA C 906 – Polyethylene (PE) Pressure Pipe and Fittings, 4 Inch through 63 Inch for Water.
- C. ASTM D 3035 – Standard Spec for PE Pipe (DR-PR) Based on Controlled Outside Diameter.
- D. ASTM D 3261 – Butt Head Fusion PE Fittings for PE Pipe and Tubing.
- E. ASTM D 3350 – Standard Specification for PE Pipe and Fittings Materials.
- F. ASTM D 1238 – Melt Flow Index.
- G. ASTM D 1505 – Density of Plastics.
- H. ASTM D 2837 – Hydrostatic Design Basis.
- I. NSF Standard #14 – Plastic Pipe Components and Related Materials.
- J. TR-33 / 2005 – Generic Butt Fusion Joining Procedure for Field Joining of PE Pipe.

1.4 GENERAL

- A. Use: High density polyethylene (HDPE) pipe/fittings shall be allowed for use as water, wastewater and reclaimed water pressure pipe where compatible with the specific conditions of the project. All material used in the production of water main piping shall be approved by the National Sanitation Foundation (NSF).

- B. Documentation
1. Documentation from the resin manufacturer showing results of the following tests for resin identification:
 - a. Melt Flow Index ASTM D 1238.
 2. Density ASTM D 1505.
- C. Manufacturer: All HDPE pipe and fittings shall be from a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the HDPE pipe to be furnished. The pipe shall be designed, constructed and installed in accordance with the best practices and methods, and shall comply with these Specifications. Qualified manufacturers shall be:
1. PLEXCO Division of Chevron Chemical Company.
 2. DRISCOPIPE as manufactured by Phillips Products Co., Inc.
 3. SCLAIRPIPE as manufactured by DuPont of Canada.
 4. Or equal, as approved by Owner.
- D. Finished Product Evaluation: Production staff shall check each length of pipe produced for the items listed below. The results of all measurements shall be recorded on production sheets, which become part of the manufacturer's permanent records.
1. Pipe in process shall be checked visually, inside and out, for cosmetic defects (grooves, pits, hollows, etc.).
 2. Pipe outside diameter shall be measured using a suitable periphery tape to ensure conformance with ASTM F 714 or ASTM D 3035, whichever is applicable.
 3. Pipe wall thickness shall be measured at 12 equally-spaced locations around the circumference at both ends of the pipe to ensure conformance with ASTM F 714 or ASTM D 3035, whichever is applicable.
 4. Pipe length shall be measured.
 5. Pipe marking shall be examined and checked for accuracy.
 6. Pipe ends shall be checked to ensure they are cut square and clean.
 7. Subject inside surface to a "reverse bend test" to ensure the pipe is free of oxidation (brittleness).
- E. Stress Regression Testing: The polyethylene pipe manufacturer shall provide certification that stress regression testing has been performed on the specific polyethylene resin being utilized in the manufacture of this product. This stress regression testing shall have been done in accordance with ASTM D 2837 and the manufacturer shall provide a product supplying a minimum Hydrostatic Design Basis (HDB) of 1,600 psi as determined in accordance with ASTM D 2837.
- F. Compatibility: Contractor is responsible for compatibility between pipe materials, fittings and appurtenances.
- G. Warranty: The pipe manufacturer shall provide a warranty against manufacturing defects of material and workmanship for a period of ten (10) years after the final acceptance of the project by the Owner. The manufacturer shall replace at no expense to the Owner any defective pipe/fitting material including labor within the warranty period.

PART 2 - PRODUCTS

2.1 MATERIALS FOR PIPE SIZES 4-INCH DIAMETER AND LARGER

- A. Materials used for the manufacture of polyethylene pipe and fittings shall be made from a PE 3408 high-density polyethylene resin compound meeting cell classification 345434C per ASTM D 3350; and meeting Type III, Class C, Category 5, Grade P34, per ASTM D 1238.
- B. High density polyethylene (HDPE) pipe shall comply with AWWA C 906 specifications.
- C. If rework compounds are required, only those generated in the manufacturer's own plant from resin compounds of the same class and type from the same raw material supplier shall be used.
- D. Dimensions and workmanship shall be as specified by ASTM F 714. HDPE fittings and transitions shall meet ASTM D 3261. HDPE pipe shall have a minimum density of 0.955 grams per cubic centimeter. All HDPE pipe and fittings shall have a Hydrostatic Design Basis (HDB) of 1,600 psi.
- E. HDPE pipe and accessories 4-inch diameter and larger shall be 160 psi at 73.4° F, meeting the requirements of Standard Dimension Ratio (SDR) 17 as Minimum Strength.
- F. The pipe manufacturer must certify compliance with the above requirements.

2.2 MATERIALS FOR PIPE SIZES 2-INCH DIAMETER AND LESS

- A. Materials used for the manufacture of polyethylene pipe and fittings shall be made from a PE 3408 high-density polyethylene resin compound meeting cell classification 345434C per ASTM D 3350; and meeting Type III, Class C, Category 5, Grade P34, per ASTM D 1238.
- B. High density polyethylene (HDPE) pipe shall comply with AWWA C 901 specifications.
- C. If rework compounds are required, only those generated in the manufacturer's own plant from resin compounds of the same class and type from the same raw material supplier shall be used.
- D. Dimensions and workmanship shall be as specified by ASTM D 3035. HDPE fittings and transitions shall meet ASTM D 3261. HDPE pipe shall have a minimum density of 0.955 grams per cubic centimeter. All HDPE pipe and fittings shall have a Hydrostatic Design Basis (HDB) of 1,600 psi.
- E. HDPE pipe and accessories 2-inch and less in diameter shall be 160 psi at 73.4° F, meeting the requirements of Standard Dimension Ratio (SDR) 9 as Minimum Strength.
- F. The pipe manufacturer must certify compliance with the above requirements.

2.3 FITTINGS

- A. All molded fittings and fabricated fittings shall be fully pressure-rated to match the pipe SDR pressure rating to which they are made. All fittings shall be molded or fabricated by the manufacturer. No Contractor-fabricated fittings shall be used unless approved by the Engineer.

- B. The manufacturer of the HDPE pipe shall supply all HDPE fittings and accessories as well as any adapters and/or specials required to perform the work as shown on the Drawings and specified herein.
- C. All fittings shall be installed using butt-fused fittings, thermo-fused fittings/couplings, or flanged adapters, and must be approved by the Engineer. No size-on-size wet taps shall be permitted.
- D. All transition from HDPE pipe to ductile iron or PVC shall be made per the approval of the Engineer, and per the HDPE pipe manufacturer's recommendations and specifications. A molded flange connector adapter within a carbon steel backup ring assembly shall be used for pipe-type transitions. Ductile iron backup rings shall mate with cast iron flanges per ANSI B 16.1. A 316 stainless steel backup ring shall mate with a 316 stainless steel flange per ANSI B 16.1.
 - 1. Transition from HDPE to ductile iron fittings and valves shall be approved by Engineer before installation.
 - 2. No solid sleeves shall be allowed between such material transitions.
 - 3. Fittings and transitions shall be as manufactured by Phillips DRISCOPIPE, Inc., 100 Series Pressure Pipe, Chevron Chemical Company PLEXCO/SPIRALITE pipe, or equal.
 - 4. The pipe supplier must certify compliance with the above requirements.

2.4 PIPE IDENTIFICATION

- A. The following shall be continuously indent-printed on the pipe or spaced at intervals not exceeding five (5) feet:
 - 1. Name and/or trademark of the pipe manufacturer.
 - 2. Nominal pipe size.
 - 3. Dimension ratio.
 - 4. The letters PE followed by the polyethylene grade in accordance with ASTM.
 - 5. D 1248 followed by the hydrostatic design basic in 160's of psi, e.g., PE 3408.
 - 6. Manufacturing standard reference, e.g., ASTM F 714 or D 3035, as required.
 - 7. A production code from which the date and place of manufacture can be determined.
 - 8. Color identification, either striped by co-extruding longitudinal identifiable color markings and shall be solid gray pipe with color identification as follows:
 - a. BLUE – Potable Water.
 - b. GREEN – Sanitary Sewer.
 - c. LAVENDER – IQ cover all.
- B. Tracing Wire: Directional drilled HDPE shall have wire conforming to Copperhead Industries reinforced #1245 extra-high strength tracer wire and affixed to the drilling head/reamer.

PART 3 - EXECUTION

3.1 JOINING METHOD

- A. The pipe shall be joined with butt, heat fusion joints as outlined in ASTM D 2657 and conform to the Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe, Technical

Report TR-33/2005, published by the Plastic Pipe Institute (PPI). All joints shall be made in strict compliance with the manufacturer's recommendations. A factory qualified joining technician as designated by pipe manufacturer or experienced, trained technician shall perform all heat fusion joints in the presence of the Engineer's representative.

- B. Lengths of pipe shall be assembled into suitable installation lengths by the butt-fusion process. All pipes so joined shall be made from the same class and type of raw material made by the same raw material supplier. Pipe shall be furnished in standard laying lengths not to exceed 50 feet, and no shorter than 20 feet.
- C. On days butt fusions are to be made, the first fusion shall be a trial fusion in the presence of the Engineer's representative. The following shall apply:
 - 1. Heating plate surfaces shall be inspected for cuts and scrapes, and shall be free of dirt and residue. Heater surfaces should be between 400° F (minimum) and 450° F (maximum). Measure the temperature at 12:00, 3:00, 6:00 and 9:00 o'clock positions using a pyrometer or infrared thermometer at locations where the heating plate will contact the pipe/fitting ends. The maximum temperature difference between any two points on a single heating surface must not exceed 24° F. If this temperature is exceeded, the heating plate shall be cleaned per the manufacturer's recommendations.
 - 2. The fusion or test section shall be cut out after cooling completely for inspection.
 - 3. The test section shall be 12 inches or 30 times (minimum) the wall thickness in length and 1 inch or 1.5 times the wall thickness in width (minimum).
 - 4. The joint shall be visually inspected as to continuity of "beads" from the melted material, and for assurance of "cold joint" prevention (i.e., joint shall have visible molded material between walls of pipe). Joint spacing between the walls of the two ends shall be a minimum of 1/16 inch to a maximum of 3/16 inch.
- D. The polyethylene flange adapters at pipe material transitions shall be backed up by stainless steel flanges conforming to ANSI B 16.1 and shaped as necessary to suit the outside dimensions of the pipe. The flange adapter assemblies shall be connected with corrosion-resisting bolts and nuts of Type 316 stainless steel as specified in ASTM A 726 and ASTM A 307. All bolts shall be tightened to the manufacturer's specified torques. Bolts shall be tightened alternatively and evenly. After installation, apply a bitumastic coating to bolts and nuts.

3.2 INSTALLATION

- A. High density polyethylene (HDPE) pipe shall be installed in accordance with the instruction of the manufacturer, as shown on the Drawings, and as specified herein. A factory qualified joining technician as designated by the pipe manufacturer shall perform all heat fusion joints.
- B. HDPE shall be installed either by Open Trench Construction or Directional Bore Method as outlined in Section 3.2, Installation, Item Q - Open Trench Installation, or Item R - Directional Bore Installation.
- C. Care shall be taken in loading, transporting and unloading to prevent damage to the pipe. Pipe or fittings shall not be dropped. All pipe or fittings shall be examined before installation, and no piece shall be installed which is found to be defective. Any damage to the pipe shall be repaired as directed by the Engineer. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner by the Contractor, at his own expense.

- D. Under no circumstances shall be pipe or accessories be dropped into the trench or forced through a directional bore upon "pull-back."
- E. Care shall be taken during transportation of the pipe such that it will not be cut, kinked, or otherwise damaged.
- F. Ropes, fabric or rubber-protected slings and straps shall be used when handling pipes. Chains, cables or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe.
- G. Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking of the polyethylene pipe shall be limited to a height that will not cause excessive deformation of the bottom layers of pipes under anticipated temperature conditions. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such width as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.
- H. Pipe shall be stored on clean, level ground to prevent undue scratching or gouging. The handling of the pipe shall be in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. The maximum allowable depth of cuts, scratches or gouges on the exterior of the pipe is 5 percent of wall thickness. The interior pipe surface shall be free of cuts, gouges or scratches.
- I. Pipe shall be laid to lines and grade shown on the Drawings with bedding and backfill a shown on the Drawings.
- J. When laying is not in progress, including lunchtime, the open ends of the pipe shall be closed by fabricated plugs, or by other approved means.
- K. Sections of pipe with cuts, scratches or gouges exceeding 5 percent of the pipe wall thickness shall be removed completely and the ends of the pipeline rejoined.
- L. The pipe shall be joined by the method of thermal butt fusion, as outlined in Part 3.1 - Joining Method. All joints shall be made in strict compliance with the manufacturer's recommendations.
- M. Mechanical connections of the polyethylene pipe to auxiliary equipment such as valves, pumps and tanks shall be through flanged connections which shall consist of the following:
 - 1. A polyethylene flange shall be thermally butt-fused to the stub end of the pipe.
 - 2. A 316 stainless steel backup ring shall mate with a 316 stainless steel flange.
 - 3. All bolts and nuts used shall be 316 stainless steel.
- N. Flange connections shall be provided with a full-face neoprene gasket.
- O. All HDPE pipe must be at the temperature of the surrounding soil at the time of backfilling and compaction.
- P. If a defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to the Owner. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work, and when laid shall conform to the lines and grades required.

Q. Open Trench Installation

1. Section 02535 of these Specifications, Placing Pipe Protection Cover and Compacted Backfill, shall apply in its entirety.
2. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-inch per foot in length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Laying instructions of the manufacturer shall be explicitly followed.
3. Good alignment shall be preserved during installation. Deflection of the pipe shall occur only at those places on design Drawings and as approved by the Engineer. Fittings, in addition to those shown on the Drawings, shall be used only if necessary or required by the Engineer.
4. Each length of the pipe shall have the assembly mark aligned with the pipe previously laid and held securely until enough backfill has been placed to hold the pipe in place. Joints shall not be "pulled" or "cramped."
5. Precautions shall be taken to prevent flotation of the pipe in the trench.
6. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below top of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, pipe bedding shall be placed to fill any voids created and the backfill shall be recompacted to provide uniform side support for the pipe.
7. Restrained joints shall be installed where shown on the Drawings or as directed by the Engineer.

- R. Directional Bore Installation: Refer to Specification Section 02446, Horizontal Directional Drilling, in its entirety.

3.3 CLEANING

- A. At the conclusion of the work, thoroughly clean all of the new pipe lines to remove all dirt, stones, pieces of wood, or other material which may have entered during the construction period, by forcing a cleaning swab through all mains 4 inches or greater. Flushing velocities shall be a minimum of 2.5 feet per second. All flushing shall be coordinated with Engineer and Owner. Debris cleaned from the lines shall be removed from the jobsite.

3.4 TESTING

- A. HDPE installed by directional boring for sanitary sewer siphon may be tested using water placed in pipe during pull-back, or as required and set out below.
- B. All HDPE water mains shall be disinfected prior to pressure testing.
- C. All HDPE mains shall be field-tested. Contractor shall supply all labor, equipment, materials, gauges, pumps, meters and incidentals required for testing. Each main shall be pressure tested upon completion of the pipe laying and backfilling operations, including placement of any required temporary roadway surfacing.

- D. All mains shall be tested at 150 percent of the operating design pressure of the pipe or a minimum of 100 psi, or as otherwise approved by the Engineer.
- E. Pressure testing procedure shall be per manufacturer's recommendations or as follows:
 - 1. Fill line slowly with water. Maintain flow velocity less than 2 feet per second.
 - 2. Expel air completely from the line during filling and again before applying test pressure. Air shall be expelled by means of taps at points of highest elevation.
 - 3. Apply initial test pressure and allow to stand without makeup pressure for two to three hours, to allow for diametric expansion or pipe stretching to stabilize.
 - 4. After this equilibrium period, apply the specified test pressure and turn the pump off. The final test pressure shall be held for one to three hours.
 - 5. Upon completion of the test, the pressure shall be bled off from a location other than the point where the pressure is monitored. The pressure drop shall be witnessed by the Engineer's representative at the point where the pressure is being monitored, and shall show on the recorded pressure readout submitted to the Engineer.
- F. If any test of pipe laid disclosed leakage significant pressure drop greater than the manufacturer's recommended loss, the Contractor shall, at his own expense, locate and repair the cause of leakage and retest the line. The amount of leakage which will be permitted shall be in accordance with AWWA C 600 standards.
- G. All visible leaks are to be repaired regardless of the amount of leakage.

END OF SECTION 02533

SECTION 02534 - PIPE BEDDING MATERIAL FOR GRAVITY SEWERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. The Work to be included under this Section of the Specifications shall consist of providing all material, labor, equipment, tools, supplies, testing and incidentals necessary for the completion of pipe bedding material as shown on the Drawings and as hereinafter specified.

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Contractor shall furnish bedding material from an Arkansas State Highway and Transportation Department approved source for coarse aggregate for Portland cement concrete. The bedding material shall contain a minimum of 95 percent (by weight) crushed particles. The gradation of the bedding material shall conform to the requirements for "Coarse Aggregate Size Number 67" as specified by the latest revision of ASTM D 448, AASHTO M 4382. Aggregate base course, Class 8, as defined in the latest edition of the Arkansas State Highway Department Standard Specifications, or small crusher-run crushed stone as supplied by local quarry, are acceptable as a bedding material.

PART 3 - EXECUTION

3.1 GENERAL

- A. Pipe bedding shall be constructed to the dimensions detailed on the Drawings for all pipe types by placing in lifts of not more than 8 inches and compacting by spading, splicing and tamping with mechanical tamping equipment. Material shall be carefully placed under the pipe haunches.
- B. Testing: The Contractor shall, prior to delivery, furnish the suppliers' certificates that all pipe bedding material furnished meets the requirements of these Specifications.

END OF SECTION 02534

SECTION 02535 - PLACING PIPE PROTECTION COVER AND COMPACTED BACKFILL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. The Work to be included under this Section of the Specifications shall consist of providing all material, labor, equipment, tools, supplies, and incidentals necessary for backfilling areas excavated during the construction of manholes, sewer lines, and other appurtenances. The work shall include every item of construction necessary for a complete and acceptable installation as shown on the Drawings and hereinafter specified. Areas of construction within creek crossing, city streets or state highways shall be backfilled in accordance with other sections of these Specifications.

PART 2 - PRODUCTS

2.1 CRUSHED STONE BACKFILL

- A. Crushed stone backfill (where specified or directed by the Engineer) shall be AHTD aggregate base course, Class 8, as defined in the latest edition of the Arkansas State Highway Department Specifications. The Contractor shall submit suppliers' certificates stating that the material provided is in accordance with these Specifications.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Areas excavated for the construction of manholes, sewer lines, and other appurtenances shall have pipe protection cover placed, and shall be backfilled in accordance with these Specifications.
- B. Pipe Embedment: Pipe embedment, as shown on the Drawings, includes material placed 6 inches below and around and 6 inches above the pipe barrel. Embedment material shall be crushed limestone in accordance with Section 02534 of these Specifications.
- C. Pipe Protection Cover: Pipe protection cover is described as backfill placed after pipe embedment is in place. Material for pipe protection shall consist of select material from excavation free of rocks larger than 2 inches. The intent of select material for backfill is to

protect the pipe during backfill and compaction by heavy equipment. Pipe protection cover depth shall be a minimum of 24 inches for the width of the entire trench.

D. Backfilling: After the pipe protection cover has been placed, the trench excavated areas around manholes, sewer lines, and other appurtenances shall be backfilled with excavated material in accordance with the following Specifications, depending upon the type of area in which excavation occurs.

1. Extra care shall be exercised around manholes to assure that the backfill material is placed evenly around the perimeter of the appurtenance.

a. Compaction: All pipeline trench backfill shall be placed in layers of appropriate thickness and compacted using a mechanical, hydraulically-powered vibratory trench compactor or other equivalent equipment. All trench backfill (except under paved areas) shall be compacted to 90 percent (minimum) of that of the adjacent undisturbed soil. In areas where the trench crosses a street, parking lot or driveway, the material shall be compacted to a minimum of 95 percent of that of the adjacent soils.

1) Crushed stone trench backfill where required shall be compacted to 95 percent modified Proctor density (ASTM D 1557-78).

2) The density of backfill material, including crushed stone trench backfill, shall be determined at locations selected by the Engineer at no less than 500 foot intervals. Two additional tests will be made for each test failure at approximately 100 feet either side of failing test. The test shall be conducted at a depth of 12 to 18 inches below the finished grade prior to the placement of the topsoil. All surfaces to be paved will be tested at various depths below grade. Unpaved roadway surfaces shall be tested at 12 inches below finished grade.

3) The cost for performing all density tests shall be borne by the Contractor. The test shall be performed by a qualified soils laboratory technician approved by the Engineer. The equipment procedures shall also be approved by the Engineer.

b. Mowed or Cultivated Areas (Excluding Gardens): The requirements for backfilling in these areas is identical to that specified in paragraph a above, except that it is the intent of the Specifications to replace the top 6 inches of the soil using the excavated topsoil, regardless of the quality of that material. Only when the Contractor allows the material excavated from the top of the trench to become mixed with the remaining excavation will he be required to haul in additional material to replace the top 6 inches. If the Contractor is required to haul in additional material, he shall haul in good grade topsoil (free of roots, weeds, clay and rocks, and from a source approved by the Engineer) and shall do so without additional cost to the Owner.

E. Cleanup: Cleanup shall be as specified elsewhere in these Specifications.

END OF SECTION 02535

SECTION 02538 - CAST-IN-PLACE MANHOLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section sets forth requirements for the proper construction of cast-in-place manholes. Brick and precast manholes shall be explicitly prohibited.

PART 2 - PRODUCTS

2.1 CONCRETE

- A. Concrete used in the construction of standard and drop cast-in-place manholes shall be as specified in Section 03300 (Cast-in-Place Concrete) of these Specifications.

2.2 NON-SHRINK GROUT

- A. Non-shrink grout shall be as set forth in Section 03315 (Grouts) of these Specifications.
- B. After the addition of water to the dry mix, mixing shall continue until the grout has a consistency that can easily be handled and spread with a trowel. Placement shall be as directed by the manufacturer, and grout shall not be used after the set period. Masonry cement shall be strictly prohibited for use in any part of manhole construction.

2.3 MANHOLE RINGS AND LIDS

- A. All castings for manhole frames, covers, and other purposes shall be in conformance with AASHTO M306 (Drainage, Sewer, Utility, and Related Castings), and shall be of tough quality, cast iron or ductile iron; free from cracks, holes, scale, shrinkage, distortion, grooves, scratches, and other defects; and have a quality finish. Cast iron castings shall conform to the requirements of ASTM A48 (Gray Iron Castings), Class 35B or greater. Ductile iron castings shall conform to the requirements of ASTM A536 (Ductile Iron Castings), Grade 80-55-06 or greater, unless otherwise specified. Castings shall be non-rocking with all bearing and mating surfaces machine-fitted and smooth. The quality shall be such that a blow from a hammer shall produce an indentation on a rectangular edge of the casting without flaking the metal. Before leaving the foundry, all castings shall be thoroughly cleaned and subjected to a hammer inspection.

- B. Manhole rings and lids shall be in accordance with the dimensions shown on the Drawings. The words "CITY OF BATESVILLE – SANITARY SEWER" shall be cast on the lids in 1-1/2 inch tall letters. Lids shall be of solid construction and shall have no openings. All cast iron manhole ring pickholes shall be the closed pickhole (Type 3).
- C. Acceptable manhole rings and lids shall be the "Campression" unit as manufactured by East Jordan Iron Works, or equal. Most manhole rings and covers used for this project shall be sealed "watertight" covers. The unit shall be a 24-inch, heavy-duty (total weight of 231 lbs.) assembly. Weights shall be within $\pm 5\%$ tolerance of the specified weights, as set forth by AASHTO M306. Sealed "watertight" rings and lids, Product No. 42339048W01, shall be provided in flood zone areas, regions of potential flooding, and where otherwise noted on the Drawings.
 - 1. Rings and lids not requiring watertight covers shall have clear opening of 22 inches but without gasket and bolts, East Jordan 1348.

2.4 STUB-OUTS

- A. Stub-outs, consisting of the material noted on the Drawings, shall be placed in manhole walls as indicated on the Drawings. Stub-outs shall extend outside the manhole wall so that a bell joint shall be made a maximum of three (3) feet outside the manhole footing. A waterstop sleeve or collar, as specified herein, shall be used on all stub-outs. A watertight plug shall be placed in the end of the pipe and blocked as necessary for low pressure air testing. The manhole and stub-out shall be tested together.

2.5 CONCRETE MANHOLE ADAPTERS (CMA)

- A. Waterstops for pipe connections to manholes shall be Fernco Concrete Manhole Adaptors, or equal, furnished in the appropriate size for the type and class of pipe used. The adapter shall be designed to provide a positive, watertight seal between the manhole and the pipe, mortared in place with non-shrink grout as specified herein.

2.6 WATERSTOPS

- A. Waterstops shall be as set forth in Section 03310 (Concrete Joints, Waterstops, Sealants and Appurtenant Concrete Materials) of these Specifications.
- B. Waterstops shall be required on all sewer pipes entering manhole walls or bases and at the joints between concrete pours. Waterstops shall be symmetrical, dense, homogenous, and free from imperfections.

2.7 MANHOLE STEPS

- A. Manhole steps shall not be allowed on sanitary sewer manholes, unless otherwise required.

PART 3 - EXECUTION

3.1 GENERAL

- A. **Excavation for Manholes:** Excavation for manholes shall be of such dimension and depth as to allow the construction of the manhole as shown on the Drawings. The area of excavation for the manhole base shall be only that necessary, with the manhole sides and bottom poured against undisturbed earth. All over-excavation below the required grade shall be filled with concrete poured monolithically with the base, unless otherwise approved by the Engineer.
- B. **Base:** The concrete base shall have a minimum thickness of 12 inches below the invert and shall be poured on undisturbed earth, unless otherwise specified by the Engineer. The base shall be poured monolithically with the barrels or formed separately so the top of the base shall be no less than 12 inches above the top of any pipe entering the manhole bottom. If the base is formed separately, the base shall have walls at least 1 foot thick formed in the top to provide a firm foundation for the manhole barrels to rest upon. The base shall have a minimum radius 2 feet greater than the outside of the finished manhole barrel. The base shall be placed only in an adequately dewatered excavation.
- C. **Connections to New Manholes:** In order to ensure that the pipe shall not break immediately adjacent to the manhole, care shall be taken that excavation for the manhole bottom is limited to the area to be filled with concrete. The Contractor shall support the pipe entering the manhole to solid bedding by backfilling under the pipe and up to 6 inches on the pipe with concrete. Each pipe entering the manhole shall have a joint a maximum of three (3) feet outside the manhole footing.
- D. **Connection to Existing Manholes:** Connections to existing brick or otherwise substandard manholes shall not be made. In such cases, the brick or substandard manhole shall be replaced with a new cast-in-place manhole as specified herein. Connections to adequate, existing manholes shall not be made until all other manholes and lines have been completed, cleaned, tested, inspected, and approved for connection by the Engineer.
 - 1. If gravity outfall lines discharge into an existing manhole, the flow of sewage must be diverted around the construction. The Contractor shall intercept the sewage flow at the first upstream manhole from the construction and shall provide suitable pumping equipment and a rerouting conduit to pump the sewage around the construction in a safe and sanitary manner that shall not result in surcharging or overflow either upstream or downstream. Discharge or rerouted flow shall be into an adequate manhole downstream from the construction and as approved by the Engineer.
 - 2. Care shall be taken in making a connection to an existing manhole. Connections to existing manholes or inlets where no plugged stubs exist shall be made by coring a hole in the wall of the existing structure, using suitable coring equipment. A CMA gasket, as specified herein, shall be installed on the pipe prior to placement in the cored hole. The pipe shall be inserted into the hole, filling around the pipe with non-shrink grout, as specified herein, and troweling the inside and outside surface of the joint to a neat finish.
 - 3. The bottom of the manhole shall be shaped to fit the invert of the sewer pipe. Subject to these requirements, the details of making a connection, including securing the end of the pipe in place, shall be reviewed and approved by the Engineer.
- E. **Future Connections and Manhole Stub-outs:** Individual stub-outs shall be extended from the manhole for anticipated connection to future construction as shown on the Drawings. The

stub-out shall be sealed with a watertight plug as necessary for low-pressure air testing. The plug shall remain in the stub-out until future connection is made. The manhole and the stub-out shall be tested together. The stub-out shall be backfilled under the pipe with concrete. Care shall be exercised to assure that the plug is free from concrete. A CMA gasket, as specified herein, shall be used on all pipes entering manhole walls or bases.

- F. Invert: The entire diameter of each pipe entering the manhole barrel shall be either cut smooth with the interior of the manhole barrel or may extend through the manhole barrel no more than 4 inches. The invert of the manhole shall be hand-placed and shaped from the concrete placed for the base, prior to initial set. The invert shall be shaped throughout, from all inlet pipes to the outlet pipe, creating a trough to prevent the free fall of sewage. The invert shall be shaped and smoothed so the manhole shall be self-cleaning and free of areas where solids may accumulate from flow through the manhole.
1. The sidewall depth of the invert shall be approximately one-third to one-half the diameter of the largest abutting pipe, and the shape shall approximate the bottom one-third of the pipe, or as otherwise shown on the Drawings. A flat bench shall be formed on each side of the invert at one-third to one-half of the pipe diameter. Inverts shall be troweled smooth. The flowline of the invert shall connect with the flowline of all main pipes entering the manhole bottom. The flow channel shall be constructed so that all pipes entering the manhole maintain a constant grade throughout each invert, providing as large of a curve as possible.
 2. The Contractor shall support the pipe stub entering the manhole to undisturbed earth by backfilling under the pipe and up to the springline.
 3. Additional smoothing of manhole inverts may be necessary. Mortar for smoothing inverts shall be as specified herein.
- G. Manhole Barrels: Manhole barrels shall have a minimum thickness of 8 inches. The manhole barrel shall be of such construction that the finished manhole shall have an inside diameter dependent on the sewer pipe diameter, as follows:

<u>Pipe Diameter</u>	<u>Manhole Diameter</u>
8-18"	4' - 0"
21-24"	5' - 0"

1. Construction joints shall be as set forth in Section 03310 (Concrete Joints, Waterstops, and Sealants) of these Specifications. A waterstop, as specified herein, shall be installed at the keyway and any other cold joint.
 2. The top section or cone shall be concentric, unless otherwise directed by the Engineer.
- H. Installation of Waterstops and Construction of Joints and Keyways: The installation of waterstops and construction of joints and keyways shall be as set forth in Section 03310 (Concrete Joints, Waterstops, and Sealants) of these Specifications.
- I. Forms: Prior to setting the forms in place, any water that may have accumulated in the excavated area shall be pumped out, and the concrete base shall be thoroughly cleaned, if required, of dirt and debris. Concrete shall not be poured in an insufficiently dewatered excavation.
1. The forms shall be removed after the initial set of the concrete so that holes may be cut into the manhole barrel for the installation of pipes entering the manhole at points other than adjacent to the manhole base. After these pipes have been placed, the barrel shall be repaired using a non-shrink grout mixture as specified herein. If honeycombing of the

barrel is found to be present after removal of the forms, the concrete shall be repaired by sparging the area with hydraulic cement, or as otherwise directed by the Engineer. Manholes with excessive honeycombing shall not be accepted.

- J. Manhole Height: Manholes shall be built to the existing ground surface unless otherwise noted on the Drawings or directed by the Engineer. The tops of the manhole rings and covers shall be level, except in public rights-of-ways where the top shall be set flush with the pavement, sidewalk, or another surface area.
 - 1. The manhole rings and covers shall be attached by casting into the top of the manhole. If, for some reason, manhole rings are grouted to completed manholes, a keyway shall be formed in the top of the manhole outside of where the manhole ring will rest. Grout shall be as specified herein.
- K. Drop Manholes: Drop manholes, unless otherwise shown on the Drawings, shall be constructed when the difference in invert elevation between the influent and effluent lines is two (2) feet or more. Drop manholes shall be constructed of the same materials and dimensions as standard manholes, with the exception of the inlet arrangements. Base elbows shall be encased in concrete.
- L. Watertight Manholes: Construction of watertight manholes shall be of the same materials and dimensions as standard manholes, with the exception of the manhole ring and cover, as specified herein.
- M. Concrete Placement and Curing: Concrete placement and curing shall be as set forth in Section 03300 (Cast-in-Place Concrete) of these Specifications.
- N. Backfilling: Backfilling of pipelines entering manholes shall be as set forth in Section 02598 (PVC) of these Specifications. Manholes shall be tested for leakage prior to backfilling as specified in this section.
 - 1. Extra care shall be exercised around manholes to ensure that backfill material is evenly distributed around the perimeter of the manhole and to the top of the highest pipe entering the manhole. Backfilling around manholes shall not commence until adequate concrete strength has been obtained to support the backfill without damage to the manhole. In no case shall backfilling around manholes be allowed until the concrete is at least 48 hours old, except as otherwise approved by the Engineer.

3.2 VACUUM TESTING OF MANHOLES

- A. General: Set out herein are requirements for the materials, procedures, and acceptable results required for the vacuum testing of manholes.
- B. Vacuum: The Contractor shall furnish a suitable apparatus to provide a vacuum, such as manufactured by Shamrock Glazier, Inc., or equal, made for such purpose.
- C. Watertightness: All manholes constructed shall be watertight, show no visible evidence of infiltration or leakage, and be tested in accordance with these Specifications. Manhole testing shall be conducted by the Contractor in coordination with the Owner and Engineer.
 - 1. Vacuum Test: All incoming and outgoing sewer lines shall be plugged, and the manhole shall be vacuum drawn. A vacuum of 10 inches of mercury (Hg) shall be drawn, and the vacuum pump shut off. With all valves closed, the time shall be measured for the

vacuum to drop to nine (9) inches Hg. The minimum allowable test times for manhole acceptance at the specified vacuum drop shall be as per ASTM C1244 (Concrete Sewer Manholes by the Negative Air Pressure (Vacuum) Test Prior to Backfill) Table 1 but in no case less than one (1) minute.

2. Acceptance: All manholes which fail the leakage test shall be repaired at the expense of the Contractor. Manholes which initially fail testing shall be retested after remedial measures are completed. If a manhole fails the vacuum test three (3) times, the inadequate manhole shall be removed and a new manhole shall be constructed.

END OF SECTION 02538

SECTION 02540 - PROTECTIVE COATING FOR MANHOLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplemental Conditions and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

- A. The work under this section of the Specifications shall consist of providing all materials, labor, equipment, tools, supplies, and incidentals necessary for the successful spray application of a protective coating for cast-in-place manholes.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. The spray-on protective coating shall be the Raven Lining Systems' Raven 405 coating system, or an approved equal. The material shall be a 100 percent solids, solvent-free, two-component epoxy resin system thixotropic in nature and filled with select fillers to minimize permeability and provide sag resistance acceptable to these Specifications (up to 200 mils in a single coat).

Product Type	Amine Cured Epoxy
Color	Light Blue
Solids Content (vol %)	100
Mix Ratio	3:1
Flexural Modulus	600,000 psi
Flexural Strength	13,000 psi
Compressive Strength	18,000 psi
Tensile Strength	7,600 psi
Tensile Elongation	1.50 %
Hardness, Type D	88
Bond Strength - Concrete	>Tensile Strength of Concrete

- B. Materials are to be kept dry, protected from weather and stored under cover. The protective coating materials are to be stored between 50° and 90° F and are not to be stored near flame, heat or strong oxidants. Handling, storage, and use of protective coating materials are to be in strict accordance with their material safety data sheets.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. All contaminants including oils, grease, unsound or incompatible existing coatings, waxes, form release, curing compounds, efflorescence, sealers, salts, or other contaminants shall be removed.
- B. Repair materials shall be used to fill voids as determined necessary by the Engineer and protective coating Applicator. Repair materials must be compatible with the specified epoxy coating and shall be applied in accordance with the manufacturer's recommendations. Repair materials shall be approved in advance of the materials being brought to the job site.
- C. The concrete shall be allowed to cure for a full 28 days prior to application of protective coating.
- D. Surfaces to receive protective coating shall be cleaned and abraded to produce a sound concrete surface with adequate profile and porosity to provide a strong bond between the protective coating and the substrate. Generally, this can be achieved with a low pressure water cleaning, using equipment capable of 5,000 psi at 5 gpm, using a zero degree rotating nozzle. Other methods such as high pressure water jetting (refer to NACE Standard No. 5/SSPC-SP12), abrasive blasting, shotblasting, grinding, scarifying or acid etching may also be used.
- E. Detergent water cleaning and hot water blasting may be necessary to remove oils, grease or other hydrocarbon residues from the concrete. Whichever method(s) are used, they shall be performed in a manner that provides a uniform, sound, clean, neutralized surface.
- F. Test prepared surfaces after cleaning, but prior to application of the epoxy coating to determine if a specific pH or moisture content of the concrete is required according to manufacturer's recommendations.

3.2 APPLICATION

- A. Application procedures shall conform to the recommendations of the protective coating manufacturer, including material handling, mixing, environmental controls during application, safety, and spray equipment. The spray equipment shall be specifically designed to accurately ratio and apply the specified protective coating materials and shall be regularly maintained and in proper working order.
- B. The protective coating material must be spray-applied by a Certified Applicator of the protective coating manufacturer. Temperature of the surface to be coated should be maintained between 40° and 120° F during application. Prior to and during application, care should be taken to avoid exposure of direct sunlight or other intense heat source to the structure being coated. Where varying surface temperatures do exist, care should be taken to apply the coating when the surface temperature is falling versus rising.
- C. The interior manhole surfaces, including the invert, the area where the pipes enter and exit the manhole, and the area of the manhole casting, shall be coated by spray application of a moisture tolerant, solvent-free, 100 percent solids, epoxy protective coating as further described herein.

Average wet film thickness shall be 100 mils with an 80 mil minimum thickness. Specific areas may require a higher film thickness, as directed by the Engineer.

- D. Airless spray application equipment approved by the coating manufacturer shall be used to apply each coat of the protective coating. Air assisted spray application equipment will not be acceptable except upon written approval of the Engineer. If subsequent topcoating or additional coats of the protective coating are required after the initial coating, such additional coating should occur as soon as the basecoat becomes tack free, ideally within 12 hours but no later than the recoat window for the specified product. Additional surface preparation procedures will be required if this recoat window is exceeded.
- E. Applicator shall initiate and enforce quality control procedures consistent with applicable ASTM, NACE and SSPC standards and the protective coating manufacturer's recommendations.

3.3 TESTING AND INSPECTION

- A. During application, a wet film thickness gage, such as those available through Paul N. Gardner Company, Inc. meeting ASTM D4414 - Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be used to ensure a monolithic coating and uniform thickness during application.
- B. After the protective coating has set hard to the touch, it shall be inspected with high-voltage holiday detection equipment. Surfaces shall first be dried, an induced holiday shall then be made on to the coated concrete surface and shall serve to determine the minimum/maximum voltage to be used to test the coating for holidays at that particular area. The spark tester shall be initially set at 100 volts per 1 mil (25 microns) of film thickness applied but may be adjusted as necessary to detect the induced holiday (refer to NACE RPO188-99). All detected holidays shall be marked and repaired by abrading the coating surface with grit disk paper or other hand-tooling method. After abrading and cleaning, additional protective coating material can be hand-applied to the repair area. All touch-up/repair procedures shall follow the protective coating manufacturer's recommendations.
- C. Measurement of bond strength of the protective coating to the substrate will be required as called for by the Engineer. Bond strength shall be measured in accordance with ASTM D4541. Any areas detected to have inadequate bond strength shall be evaluated by the project Engineer. Further bond tests may be performed in that area to determine the extent of potentially deficient bonded area and repairs shall be made by Applicator in strict accordance with manufacturer's recommendations.
- D. A final visual inspection shall be made by the inspector and manufacturer's representative. Any deficiencies in the finished coating shall be marked and repaired by the Applicator in accordance with the procedures set forth herein.

3.4 SUBMITTALS

- A. The following items shall be submitted at the time of the bid opening.
 - 1. Technical data sheet on each product used, including ASTM test results indicating the product conforms to and is suitable for its intended use per these Specifications.

2. Material Safety Data Sheets (MSDS) for each product used.
3. Applicator Qualifications:
 - a. Manufacturer certification that Applicator has been trained and approved in the handling, mixing and application of the products to be used.
 - b. Certification by the protective coating manufacturer that the equipment to be used for applying the products has been approved and Applicator personnel have been trained and certified for proper use of the equipment.
4. Material Certifications:
 - a. Certification that the product meets the minimum characteristics as measured by the applicable ASTM, NACE, and SSPC Standards.
 - b. Certification that the product has successfully passed the Los Angeles County evaluation of protective coatings for concrete. Alternately, the product must have been tested by a bonded third-party testing company and meet or exceed the minimum standards included in this specification.
5. Product References:
 - a. A comprehensive list of cities where the product has been used. List shall include the city name, a contact person familiar with the product application, phone number, and the type of application (manhole rehab, new manholes, wetwells, etc.).

3.5 WARRANTY

- A. The Contractor shall warrant all work against defects in materials and workmanship for a period of one (1) year, unless otherwise noted, from the date of final acceptance of the project. Applicator shall, within a reasonable time after receipt of written notice thereof, repair defects in materials or workmanship which may develop during said one (1) year period, and any damage to other work caused by such defects or the repairing of same, at his own expense and without cost to the Owner.

END OF SECTION 02540

SECTION 02565 - DUCTILE IRON PIPE AND DUCTILE IRON PIPE FITTINGS FOR WATER LINES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplemental Conditions and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

- A. The work to be included under this section of the Specifications shall consist of providing all materials, labor, equipment, tools, supplies, and incidentals necessary for the construction of ductile iron pipe water lines. The work shall include every item of construction necessary for a complete and acceptable installation as shown on the Drawings and hereinafter specified.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Ductile Iron Pipe and Ductile Iron Pipe Fittings with Push-On or Mechanical Type Joints: Unless otherwise shown on the Drawings or specified, all pipe and pipe fittings furnished on this project shall be ductile iron, with either push-on or mechanical type joints. Flanged pipe or pipe fittings shall be used only as indicated on the Drawings, and shall be in conformance with this Specification.
 - 1. Ductile Iron Pipe (3 Inch Through 64 Inch): All ductile iron pipe furnished with either push-on or mechanical type joints shall conform to the requirements of "Thickness Design of Ductile Iron Pipe," ANSI/AWWA C150/A21.50, latest revision, and "Ductile Iron Pipe, Centrifugally Cast, for Water," ANSI/AWWA C151/A21.51, latest version. Pipe shall be the pressure class as set out below:
 - 12 Inch - Pressure Class 350
 - 10 Inch - Pressure Class 350
 - 8 Inch - Pressure Class 350
 - 6 Inch - Pressure Class 350
 - 2. Ductile Iron Pipe Fittings
 - a. Ductile Iron Pipe Fittings (3 Inch Through 24 Inch and 54 Inch Through 64 Inch): All fittings 3 inch through 24 inch and 54 inch through 64 inch shall be ductile iron fittings and shall conform to the requirements of ANSI/AWWA C153/A21.53, latest revision, for "Ductile Iron Compact Fittings, 3 In. Through 24 In. (76 mm through 610 mm) and 54 In. Through 64 In. (1400 mm through 1600 mm), for Water Service." All fittings shall have a minimum pressure rating of 250 psi, and shall be "Made in U.S.A."
 - b. Ductile Iron Pipe Fittings (30 Inch Through 48 Inch): All fittings 30 inch through 48 inch shall be ductile iron fittings and shall conform to the requirements of ANSI/AWWA C110/A21.10, latest revision, for "Ductile-Iron and Gray-Iron

Fittings, 3 In. Through 48 In. (75 mm through 1200 mm), for Water and Other Liquids."

3. Ductile Iron Pipe Joints: All ductile iron pipe and ductile iron pipe fittings with mechanical or push-on type joints shall have rubber gasket joints in conformance with "Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings," ANSI/AWWA C111/A21.11, latest revision.
 4. Restrained Joints: All fittings shall be mechanical joint type. Mechanical joint restraint shall be incorporated into the design of the follower gland. The restraining mechanism shall consist of individually actuated wedges that increase their resistance to pull-out as pressure or external forces increase. The device shall be capable of full mechanical joint deflection during assembly and the flexibility of the joint shall be maintained after burial. The joint restraint ring and its wedging components shall be made of Grade 60-42-10 ductile iron conforming to ASTM A536-84. The wedges shall be ductile iron heat-treated to a minimum hardness of 370 BHN. Dimensions of the gland shall be such that it can be used with the standardized mechanical joint bell conforming to ANSI/AWWA C111/A21.11 and ANSI/AWWA C153/A21.53 of the latest revision. Torque limiting twist-off nuts shall be used to ensure proper actuation of the restraining wedges. The mechanical joint restraint shall be available in the 3 through 48 inch sizes. They shall have a rated working pressures of 350 psi in sizes 16 inch and smaller, and 250 psi in sizes 18 inch through 48 inch. The devices shall be listed by Underwriters Laboratories up through the 24 inch size and approved by Factory Mutual up through the 12 inch size. The restraint shall be the Series 1100 Megalug restraint as produced by EBAA Iron, Inc.
 5. Swivel Fittings and Fire Hydrant Tee: Fire hydrant shall be set using MJ, MJ, swivel joint fittings having retainer lip and swivel rotatable gland for positive restraint without tie rods. Restraint joints shall be used where testing will be done against closed valves, and at other locations at the Contractor's option.
 6. Adapters: Foster adapters are approved for use for restraint of valve and/or fittings.
 7. Tapping Sleeves: Sleeves used for tapping into existing water lines shall be Ford steel sleeve with epoxy coating and Ford FTSC-SH stainless steel bolts.
- B. Cement Mortar Lining: All ductile iron pipe and ductile iron pipe fittings shall have a standard thickness cement mortar lining in conformance to ANSI/AWWA C104/A21.4, latest revision, "Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water." All ductile iron pipe shall receive the following interior lining:
1. All ductile iron pipe and fittings shall be lined with a high-build, multi-component Amine-cured Novalac epoxy lining. The lining system shall be Protecto 401 Ceramic Epoxy as manufactured by Vulcan Painters, Inc. The lining applicator shall have a successful history of applying linings to the interior of ductile iron pipe.
- C. Outside Coating: All ductile iron pipe shall have either a bituminous exterior coating, or shall be delivered to the site factory cleaned and primed as set out below.
1. Factory Primed Pipe: Unless otherwise shown on the Drawings, all exposed pipe and fittings within the limits of structure walls or all pipe exposed above ground shall be delivered to the job site factory blasted, cleaned and primed with one coat of Tnemec Series 140-1211 Pota-Pox Plus, or approved equal compatible with paint systems to be provided by the Contractor.
 2. Bituminous Coating: All pipe and fittings indicated for buried service shall have a bituminous coating approximately 1 mil thick. The coating shall be factory applied to the outside of all pipe and fittings. The finished coating shall be continuous, smooth, neither brittle when exposed to the cold nor sticky when exposed to the sun, and shall be strongly adherent to the pipe or fitting.

- D. Ductile Iron Pipe Joint Lubricant: Joint lubricant shall be provided by the pipe manufacturer, and applied as per the manufacturer's recommendations.
- E. Crushed Stone Trench Backfill: Crushed limestone trench backfill, where required, shall be AHTD aggregate base course, Class 7, as defined in the latest edition of the Arkansas State Highway Department Specifications. The crushed limestone supplier shall submit certificates stating that the materials provided are in conformance with these Specifications.
- F. Concrete: Concrete used for reaction backing, pipe cover, or pipe encasement shall be in conformance with the Concrete section of these Specifications.
- G. Affidavits of Compliance and Independent Laboratory Inspection: All ductile iron pipe and ductile iron pipe fittings furnished and installed on this project shall be inspected and tested by the manufacturer. The manufacturer shall furnish to the Engineer, prior to delivery, certificates stating that all pipe will be manufactured in compliance with these Specifications. The certificate shall also fully describe the pipes proposed to be furnished.
 - 1. If evidence appears that all provisions of the applicable ASTM/AWWA Standards have not been complied with after the pipe has been delivered, the Owner will require such field testing and sampling as necessary for certified statements of compliance to the provisions of said standards to be furnished by an approved independent laboratory. The cost for the testing and sampling or job delay will be the responsibility of the pipe supplier if the pipe is not in compliance. The Owner will pay the cost of the testing and sampling if the pipe is in compliance with the Specifications. However, the Owner will not be responsible for job delay. The independent laboratory shall be one which may be chosen by the pipe manufacturer and approved by the Engineer.
- H. Polyethylene Encasement: All ductile, cast or iron buried pipe and fittings shall have polyethylene encasement in conformance to ANSI/AWWA C105/A21.5, latest revision, "Polyethylene Encasement for Ductile-Iron Pipe Systems." The polyethylene film shall have a minimum nominal thickness of .008 inch (8 mils), and shall be provided in either flat tube or sheet form, at the option of the Contractor.

PART 3 - EXECUTION

3.1 DUCTILE IRON PIPE WATER LINE CONSTRUCTION

- A. General: The Contractor shall, unless otherwise specified, furnish all material, equipment, tools and labor necessary to do the work required under this contract and unload, haul and distribute all pipe, castings, fittings, valves, hydrants and excavate the trenches and pits to the required dimensions; excavate the bell holes, construct and maintain all bridges for traffic control; sheet, brace and support the adjoining ground or structures where necessary; handle all drainage or ground water; provide barricades, guards and warning lights; lay and test the pipe, castings, fittings, valves, hydrants and roadway surface unless otherwise stipulated; remove surplus excavated material; clean the site of the work; and maintain the street or other surface over the trenches as specified.
- B. Alignment and Grade: The water main shall be laid and maintained to the required lines and grades with fittings, valves and hydrants, and other appurtenances, at the required locations, spigots centered in bells, and all valve and hydrant stems plumb.

- C. Installing Ductile Iron Pipe: Ductile iron pipe and ductile iron pipe fittings shall be installed in conformance with the recommendations of AWWA C600, latest revision, for "Installation of Ductile Iron Water Mains and Their Appurtenances," and in conformance with the Specifications hereinafter set out.
- D. Requirements Preparatory to Trench Excavation: In all areas where water lines, valves, or other appurtenances are to be constructed, the existing surface shall be removed prior to excavating the trench. There is no pay item for these requirements and shall be considered part of the trench excavation. These requirements are dependent upon the type of area in which water line construction occurs and are set out elsewhere in these Specifications.
- E. Trench Excavation: All excavation of any nature shall be unclassified and payment for same shall be included in the price bid.
1. The trench shall be excavated so that the pipe can be laid to the alignment and depth required, and it shall be excavated only so far in advance of pipe laying as set out elsewhere in this Specification. The trench shall be so braced and drained that the workmen may work therein safely and efficiently. It is essential that the discharge of any trench dewatering pumps be conducted to natural drainage channels, drains or storm sewers.
 2. The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined, and he shall be held responsible for the repair of such structures when broken or otherwise damaged.
 - a. Trench Depth: The trench shall be excavated to at least 4 inches below the grade required to provide a minimum of 36 inches of pipe cover. This pipe cover shall be measured and is defined as follows:
 - 1) Land Level Normal to the Direction of the Pipeline: A minimum of 60 inches of cover shall be provided. This cover shall be measured from the top of the barrel of the pipe to the top of the existing natural ground surface.
 - 2) Cut Sections: A minimum of 36 inches of cover shall be required. This cover shall be measured from the top of the pipe barrel to the adjacent low surface of the right of way.
 - 3) Fill Sections: A minimum of 36 inches of cover shall be required. This cover shall be measured from the top of the pipe barrel to the natural ground surface underlying the fill.
 - b. Trench Width: Width of trench shall be defined as either the pipe barrel outside diameter plus 16 inches or the pipe barrel outside diameter times 1.25 plus 12 inches, whichever is greater. The Contractor shall at his expense provide additional pipe embedment material as necessary to completely fill the entire width beyond the defined width of the trench as excavated. All additional embedment material required shall be furnished at the Contractor's expense.
 - c. Trench Length: The Engineer shall have the right to limit the amount of trench excavated in advance of laying the pipe. In general, such excavation shall not exceed 300 feet, and trench excavated to grade shall not exceed 150 feet.
 - 1) Every trench in rock shall be fully opened at least 50 feet in advance of the place where pipe is being laid.
- F. Ductile Iron Pipe Embedment: After the trench has been excavated as set out above, the ductile iron pipe shall have a bed prepared according to the type of area through which construction is proceeding.
1. Pipe Embedment: The ductile iron pipe shall be bedded in embedment material as specified elsewhere in these Specifications. The pipe shall be bedded from a point

6 inches below the bottom of the pipe barrel to the pipe springline by the full width of the excavated ditch. All overexcavation below the pipe shall be backfilled with pipe embedment material at the Contractor's expense. The additional material required will be placed in 8 inch lifts and thoroughly tamped. This procedure will be repeated until the established grade has been reached. All pipe bedding shall be tamped so as to provide a uniform and continuous bearing support for the pipe at every point along the pipe barrel. There is no separate pay item for embedment material. This item shall be subsidiary to the pipe.

2. Pipe Embedment and Backfill (Driving Surfaces, Curb and Gutter, or Areas Underlain by Solid Rock): Where the water line excavation is within the limits and approximately perpendicular to or crossing curb and gutter or driving surfaces, including paved and unpaved roads, driveways or parking lots, the bedding material shall be aggregate base course, Class 7. Where the bottom of the trench is solid rock, the pipe bedding material shall be aggregate base course, Class 7.
 - a. All overexcavation below the pipe shall be backfilled with pipe bedding material at the Contractor's expense. The additional material required will be placed in 3 inch lifts and thoroughly tamped. This procedure will be repeated until the established grade has been reached. All pipe bedding shall be tamped so as to provide a uniform and continuous bearing support for the pipe at every point along the pipe barrel.
- G. Excavation in Poor Soil and Refilling to Grade: Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, all types of refuse, vegetable or other organic materials, or large pieces or fragments of inorganic material which in the judgment of the Engineer should be removed, the Contractor shall excavate and remove such unsuitable material to the width and depth ordered by the Engineer. Before the pipe is laid, the subgrade shall be made by backfilling with aggregate base course, Class 7, in 8 inch uncompacted layers. The layers shall be hand or machine tamped as directed by the Engineer so as to provide a uniform and continuous bearing and support for the pipe at all points along the pipe length. Extra payment will be made for the additional trench backfill required in accordance with the Methods of Measurement and Payment section of these Specifications. However, no additional compensation will be made to the Contractor for the additional excavation.
- H. Bracing and Shoring: The sides of any excavation, when deemed necessary, shall be properly supported with bracing, shoring or sheeting as the need may be. Such bracing and shoring shall be withdrawn as the work progresses. In case the excavation is close enough to buildings or other foundations as to endanger their stability by the removing of such bracings, then they shall be made secure and left in place, and the water line trench backfilled and thoroughly tamped with the bracing in place. The Contractor will not be paid for such bracing, sheeting, or shoring whether it is withdrawn or left in the trench.
- I. Removal of Water and Muck: The Contractor shall provide sufficient pumps and other necessary equipment to keep the trench free of water which may accumulate. If the bottom of the trench becomes soft and muddy, the Contractor shall remove all such soft material and replace it with dry loam, sand, or crushed limestone bedding gravel at his own expense. Under no conditions will ductile iron pipe water line be laid in a trench that has not been properly dewatered.
- J. Deviations Occasioned by Other Structures: Whenever obstructions not shown on the Drawings are encountered during the progress of the work and interfere to such an extent that an alteration in the plan is required, the Engineer shall have the authority to change the Drawings and order a

deviation from the line and grade or arrange with the owners of the structures for the removal, relocation or reconstruction of the obstruction.

- K. Concrete Reaction Backing: Unless restrained joints are required as shown on Drawings, all ductile iron pipe fittings shall have concrete reaction backing. Backing shall be placed between solid ground and the fitting to be anchored. The area of bearing on the pipe shall be that shown on the detail sheet of the Drawings or as directed by the Engineer. The backing shall, unless otherwise shown or directed, be so placed that the pipe and fitting joints will be accessible for repair. All fittings shall be wrapped with Visqueen prior to the placement of reaction backing.
- L. Concrete Pipe Cover: Where shown on the Drawings or otherwise directed by the Engineer, concrete cover shall be placed over the top of the water line to the dimensions shown on the Drawings. Where in the opinion of the Engineer additional concrete cover is required, it shall be provided and installed by the Contractor.
- M. Concrete Encasement: Where shown on the Drawings or otherwise directed by the Engineer, the water line shall be encased in concrete to the dimensions shown on the Drawings. Where in the opinion of the Engineer additional encasement is required, it shall be provided and installed by the Contractor. Pipe joints shall not be encased for a distance of 2 feet either side of the joint.
- N. Replacement and Repair of Driving Surfaces: Replacement and repair of driving surfaces shall be made in accordance with these Specifications, as applicable.
- O. Polyethylene Encasement: Polyethylene encasement shall be provided on all buried fittings, and on ductile iron pipe where shown on the Drawings, in accordance with ANSI/AWWA C105/A21.5, latest revision, for either Method A, B, or C installation. Double thickness of polyethylene encasement shall be provided on ductile iron pipe and fittings at the locations as shown on the Drawings. The encasement shall be protected from prolonged exposure to sunlight to prevent deterioration of the polyethylene film.
- P. Relative Locations of Water and Sewer Lines: Water and sewer lines shall be laid a minimum of 10 feet horizontally apart, measured edge to edge.
 - 1. The water main invert shall be a minimum of 18 inches above the crown of the sewer.
 - 2. When it is not possible to obtain proper horizontal and vertical separation as set forth above, the water main shall be encased in a watertight carrier pipe, as indicated on the Drawings. The carrier pipe shall extend a minimum of 10 feet on both sides of the crossings, measured perpendicular to the water main.
 - 3. Water lines and sewers shall not be laid in the same trench except on written approval of the Arkansas Department of Health.
 - 4. Where a water line must unavoidably pass beneath the sewer line, at least 18 inches of separation must be maintained between the outside of the two pipes, in addition to the preceding encasement requirements.

END OF SECTION 02565

SECTION 02566 - POLYETHYLENE ENCASEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplemental Conditions and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

- A. The work to be included under this section of the Specifications shall consist of providing all materials, labor, equipment, tools, supplies, and incidentals necessary for polyethylene encasement of pipe, fittings, valves and other appurtenances as shown on the Drawings and hereinafter specified.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Polyethylene Encasement: Polyethylene shall be in conformance to ANSI/AWWA C105, latest revision. The polyethylene film shall have a minimum nominal thickness of .008 inch (8 mils), and shall be provided in either flat tube or sheet form, at the option of the Contractor.

PART 3 - EXECUTION

3.1 LOCATION

- A. Polyethylene encasement shall be provided on all buried ductile iron pipe and fittings. Double thickness of polyethylene encasement shall be provided on ductile iron pipe and fittings at the locations as shown on the Drawings.
- B. Polyethylene encasement shall be installed in accordance with ANSI/AWWA C105, latest revision, for either Method A, B or C installation. The encasement shall be protected from prolonged exposure to sunlight to prevent deterioration of the polyethylene film.

END OF SECTION 02566

SECTION 02598 - POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS FOR SEWER LINE,
FORCE MAIN, AND WATER LINE

PART 1 - GENERAL

1.1 SUMMARY

- A. The work to be included under this section of the Specifications shall consist of providing all materials, labor, equipment, tools, supplies, and incidentals necessary for the construction of polyvinyl chloride (PVC) sewer lines, force mains, and water lines. The work shall include every item of construction necessary for a complete and acceptable installation as shown on the Plans and hereinafter specified.

1.2 MATERIALS

- A. Polyvinyl Chloride (PVC) Sewer Pipe: All PVC sewer pipe and fittings shall be solid-wall sewer pipe manufactured of compounds conforming to ASTM D1784. All PVC pipe and fittings less than 18 inches in diameter shall be manufactured in accordance with ASTM D3034. PVC pipe and fittings 18 inches and larger shall conform to ASTM F769. Pipe stiffness shall not be less than 115 psi when measured at 5 percent vertical deflection when tested in accordance with STM D2412. Pipe shall have a standard dimension ratio (SDR) of 26.

Joints shall be of the push-on integral bell and spigot type and shall conform to ASTM D3212. Gaskets shall be in accordance with ASTM F477 and shall be factory installed. Joint lubricant shall be the lubricant provided by the pipe manufacturer.

ASTM Standards referenced above are:

1. ASTM D1784, Standard Specification for Rigid Polyvinyl chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (CPVC) compounds, latest revision.
 2. ASTM D3034, Standard Specification for Type PSM Polyvinyl Chloride (PVC) Sewer Pipe and Fittings, latest revision.
 3. ASTM D3212, Standard Specifications for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals, latest revision.
 4. ASTM F477, Standard Specifications for Elastomeric Seals (Gaskets) for Joining Plastic Pipe, latest revision.
 5. ASTM F679, Standard Specification for Polyvinyl Chloride (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings, latest revision.
- B. PVC Force Main and Water Line Pipe: PVC pipe for force mains shall be constructed of compounds conforming to ASTM D1784 with a cell classification of 12454 and shall meet the dimensional, chemical, and physical requirements as outlined in AWWA C900. Standard Dimension Ratio shall be 14.

Sixteen (16) inch PVC pipe for force mains shall be constructed of compounds conforming to ASTM D1784 with a cell classification of 12454 and shall meet the dimensional, chemical, and physical requirements as outlined in AWWA C905. Standard Dimension Ratio shall be 21.

All pipe shall be furnished with an integral gasketed bell and spigot push-on joint conforming to the requirements of ASTM D3139. Gaskets shall conform to ASTM F477.

All fittings shall be Class 350 ductile iron meeting the material requirements as called for elsewhere in these Specifications.

Horizontal bends for the force main and for the water line are called out on the Plans for the sole purpose of aiding the Contractor in determining the number and type of bends required for the lines. The intent of the bends is to keep the water line and the force main within the acquired easement. In the case of the force main, the intent is also to maintain a uniform separation between the force main and the gravity sewer.

Vertical bends are not called out on the Plans. The Contractor shall plan the work so that all downward turns of the water line and force main are accomplished by deflections in the pipe run rather than the installation of manufactured bends. Such pipe deflections shall not exceed 3.5 degrees per joint, or the allowable joint deflection as recommended by the pipe manufacturer, whichever is least.

- C. Trench Backfill Material: Trench backfill material for PVC Pipe shall be as specified elsewhere in these Specifications. This item is considered subsidiary to the cost of pipe laying and shall not be paid for separately.
- D. Crushed Stone Trench Backfill: Crushed stone base trench backfill material shall be aggregate base course Class 7 Base as defined and specified by the Arkansas Highway and Transportation Department. This item shall be considered subsidiary to the cost of pipe laying when used as pipe bedding, initial backfill, pipe embedment, initial backfill, or pipe protection cover. When used as trench backfill material under paved areas, Class 7 Base shall be measured and paid for as Class 7 Base at the unit price given in the Bid.
- E. Quality Assurance and Pipe Identification
 - 1. Manufacturer Certification: All PVC pipe and PVC pipe fittings furnished and installed on this project shall be inspected and tested by the manufacturer. The manufacturer shall furnish to the Engineer, prior to delivery, certificates stating that all pipe will be manufactured in compliance with these Specifications. The certificate shall also fully describe the pipe proposed to be furnished.
 - 2. Independent Laboratory Certification: An independent laboratory as recommended by the manufacturer and acceptable to the Engineer shall submit to the Engineer written evidence that each size of pipe furnished under this Specification is in conformance with all applicable ASTM Standards. Certified copies of independent laboratory test results from the pipe supplier may be considered evidence of compliance provided such tests are performed in accordance with the appropriate ASTM testing standards by experienced, competent personnel.

Independent certification of ASTM Standards will be required for each size of pipe furnished on the project. The number of certifications required for each size of pipe is set out below:

One separate independent certification will be required for each 5,000 linear feet or part thereof of each size of pipe furnished.

Pipe selected for testing shall be pipe specifically manufactured for use on this project. All testing required under this provision shall be paid for by the pipe manufacturer.

3. Pipe Identification: Each PVC sewer pipe length and fitting shall be clearly marked with the following:
- Manufacturer's Name
 - Nominal Pipe Size
 - Cell Classification
 - ASTM F Designation
 - Uni-Bell Plastic Pipe Association Designation ("UNI-B-9")
 - Pipe Stiffness

All pipe shall be factory air tested with gasket in place and marked accordingly.

- F. Concrete: Concrete for pipe cover or pipe encasement as shown on the Plans or as directed by the Engineer shall be as specified elsewhere in these Specifications. This item shall be paid for at the unit price bid and as set out in the Methods of Measurement and Payment.
- G. Transition Couplings: Transition couplings from polyvinyl chloride to clay or ductile iron sewer pipe shall be made of elastomeric plastic material and shall be manufactured by Fernco, Inc., or equal.

1.3 EXECUTION

- A. General: The Contractor shall, unless otherwise specified, furnish all material, equipment, tools and labor necessary to do the work required under this contract and unload, haul and distribute all pipe, castings, fittings, valves, hydrants and excavate the trenches and pits to the required dimensions; excavate the bell holes, construct and maintain all bridges for traffic control; sheet, brace and support the adjoining ground or structures where necessary; handle all drainage or ground water; provide barricades, guards and warning lights; lay and test the pipe, castings, fittings, valves, hydrants and roadway surface unless otherwise stipulated; remove surplus excavated material; clean the site of the work; and maintain the street or other surface over the trenches as specified.
- B. Handling and Storage: Handling and storage shall be as specified elsewhere in these Specifications.
- C. Construction Sequence: Construction of sewers shall begin at the low point of the line and continue in orderly succession throughout the project. Any deviation from this procedure shall be made only with the specific approval of the Engineer.
1. Appurtenances such as fittings, service reconnections, manholes, etc. shall be constructed as the work progresses.
- D. Requirements Preparatory to Trench Excavation: In all areas where sewer lines and appurtenances are to be constructed and/or repaired, the right-of-way shall be cleared and the existing surface shall be removed prior to excavation of the trench. Note: There is no separate pay item for clearing or surface removal. These items of work shall be subsidiary to the PVC sewer pipe. These requirements are dependent upon the type of area in which sewer line construction occurs and are specified elsewhere in these Specifications
- E. Trench Excavation: The trench shall be excavated so that the pipe can be laid to the alignment and depth required, and it shall be excavated only so far in advance of pipe laying as set out

elsewhere in these Specifications. All excavations shall be in compliance with Subpart P of 29 CFR Part 1926 – Occupational Safety and Health Standards – Excavation.

The Contractor shall proceed with caution in the excavation and preparation of the trench so that the exact location of underground structures, both known and unknown, may be determined, and he shall be held responsible for the repair of such structures when broken or otherwise damaged during construction.

1. Trench Depth and Pipe Embedment: The trench shall be excavated to a minimum of 4 inches below the bottom of the pipe when laid at the required grade. Trench bedding material shall be placed to allow for pipe installation to the alignment and grade shown on the Plans. Bell holes shall be excavated in accord with ASTM D-2321. PVC pipe shall be backfilled up to a point 12 inches over the top of the pipe as called for elsewhere in these Specifications. The backfill material will extend to the full width of the trench. (See detail on Plans.) All overexcavation shall be backfilled with embedment material at the Contractor's expense. Material required to backfill overexcavation shall be placed in 8 inch lifts and thoroughly tamped with mechanical compaction equipment to reach the required grade. All pipe embedment shall be tamped so as to provide a uniform and continuous bearing support for the pipe at every point along the pipe barrel.
 2. Width of Trench: Width of trench shall be as shown on the Plans. The Contractor shall at this expense provide additional pipe backfill material as necessary to completely fill the entire width beyond the defined width of the trench as excavated. All additional backfill material required shall be furnished at the Contractor's expense.
 3. Length: The Engineer may limit the trench excavated in advance of installation of pipe. No excavation in advance of installation of pipe shall exceed 300 feet, or that length in which installation may reasonably be completed during the workday. Trench excavated to grade in advance of installation of pipe shall not exceed 150 feet, or that length in which installation may reasonably be completed during the workday.
 - a. Every trench in rock shall be fully opened not less than 50 feet in advance of the place where pipe is being laid or from where cast-in-place concrete operations are in progress.
- F. Excavation in Poor Soil and Refilling to Grade: Where the bottom of the trench at subgrade is found to be unstable or to include ashes, cinders, any type of refuse, vegetable or other organic materials, or large pieces or fragments of inorganic material which in the judgment of the Engineer should be removed, the Contractor shall excavate and remove such unsuitable material to the width and depth ordered by the Engineer. Before the pipe is laid, the subgrade shall be made by backfilling with embedment material backfill as specified elsewhere in these Specifications, in 8 inch uncompacted layers. The layers shall be hand or machine tamped as directed by the Engineer so as to provide a uniform and continuous bearing and support for the pipe at all points along the pipe length. No extra payment will be made for the additional trench backfill required, nor shall additional compensation be made to the Contractor for additional excavation.
- G. Removal of Water and Muck: The Contractor shall provide sufficient pumps and other necessary equipment to keep the trench free of water which may accumulate. If the bottom of the trench becomes soft and muddy, the Contractor shall remove all such soft material and replace it with crushed stone base trench backfill at his own expense. Under no conditions will polyvinyl chloride sewer pipe be laid in a trench that has not been properly dewatered. No additional compensation will be made to the Contractor for dewatering or removal of muck.
- H. Installing PVC Pipe and Fittings: PVC sewer pipe and fittings shall be installed in conformance to the latest revision of ASTM D-2321 "Standard Practice for Underground

Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications." All PVC pipe shall be installed as specified elsewhere in these Specifications and as shown on the Plans.

Note: The pipe manufacturer shall provide a qualified installation representative at the start of construction to demonstrate proper installation techniques for each size and type of pipe to be installed. Training shall be provided to each pipe laying crew.

I. Connections to Manholes

1. New Cast-in-Place Manholes: Excavation for cast-in-place manholes shall be limited to the area to be filled with concrete. Each pipe entering the manhole shall have a joint approximately one (1) foot outside the manhole wall. The Contractor shall support the pipe stub entering the manhole all the way to undisturbed earth by backfilling under the pipe and up to springline with concrete. No additional payment shall be made for concrete at manhole connections. A waterstop sleeve or collar shall be used on all pipes entering manhole walls.
2. Existing Manholes: Connections to existing manholes or inlets, where no plugged stubs exist, shall be made by cutting a hole in the wall of the existing structure, inserting PVC pipe into the hole, filling around the pipe with non-shrink grout, and troweling the inside and outside surface of the joint to a neat finish. A manhole adapter or waterstop shall be placed on the pipe prior to placement in the hole. The bottom of the manhole shall be shaped to fit the invert of the sewer pipe. A bell shall be located one (1) foot outside the manhole wall. The pipe stub shall be supported as described in paragraph 9.a above.

J. Pipe Protection Cover and Backfill: Pipe protection cover and backfill shall be placed as specified elsewhere in these Specifications.

K. Cleanup: Cleanup shall be as specified elsewhere in these Specifications.

L. Testing: PVC sewer lines shall be air tested as called for elsewhere in these Specifications. PVC water lines and force mains shall be hydrostatically tested to at least 1.5 times the working pressure at the point of testing and not less than 1.25 times the working pressure at the highest point along the test section. A leakage test shall be conducted concurrently with the pressure test. Leakage is defined as the quantity of water that must be supplied into the newly-laid test section to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipeline has been filled with water.

No pipeline installation will be accepted for service if the leakage is greater than that determined by the formula:

$$L = S \cdot D \cdot P / 133200; \text{ where}$$

L is the leakage in gallons per hour;

S is the length of pipe tested in feet;

D is the nominal diameter of the pipe in inches; and

P is the average test pressure during the test in psig.

All visible leaks shall be repaired regardless of test results.

END OF SECTION 02598

SECTION 02639 - FIRE HYDRANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplemental Conditions and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

- A. The work to be included under this section of the Specifications shall consist of providing all materials, labor, equipment, tools, supplies, and incidentals necessary for the construction of fire hydrant assemblies. The work shall include every item of construction necessary for a complete and acceptable installation as shown on the Drawings and hereinafter specified.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Catalog Data and Assembly Drawings: For all fire hydrants, auxiliary gate valves and valve boxes hereinafter specified, the manufacturer shall furnish to the Engineer prior to delivery, catalog data, including illustrations and a parts schedule giving the material of which parts are made, in sufficient detail to serve as a guide in the assembly and disassembly of the fire hydrant as well as in ordering repair parts. The manufacturer shall also submit three sets of certified drawings for review by the Engineer, showing the principal dimensions, construction details, and materials used for all parts of the valve. All valves shall be furnished in accordance with the certified drawings after they have been reviewed by the Engineer.
- B. Fire Hydrants: All fire hydrants furnished and installed on this project shall be dry barrel hydrants in conformance with AWWA C502, latest revision, for "Dry Barrel Fire Hydrants," and shall be designed for a working pressure of 250 pounds per square inch gauge. Pressure class 250 fire hydrants shall be three-way, painted red above ground line. Three-way hydrants shall be Mueller Centurion hydrants, Catalog No. A-423, or Waterous 5-1/4 inch WB67. The hydrants on the 4 inch line shall be two-way with a 4 inch shoe.
 - 1. The 3 inch fire hydrants shall be 3 foot bury, with 4 cubic feet of crushed stone beneath hydrant to allow drainage. All working parts shall be brass, with hydrant main valve opening being 2-3/16 inches. Inlet connection shall be 3 inch MJ, with the outlet being 2-1/2 inch NST. The operating rod shall be non-turning, and all operating parts shall be removable from above ground with no special wrenches. This self-draining, non-freeze hydrant barrel will be made of 3 inch ductile iron pipe and shall have a cast iron top stock, as manufactured by Kupferle Foundry, St. Louis, MO, Model #2, or approved equal.

- a. Hydrant Inlet: The hydrant shall have a 6 inch mechanical joint inlet in conformance to the dimensions shown in ANSI/AWWA C110/A21.10, latest revision.
 - b. Main Valve Openings: Three-way hydrants shall have a 5-1/4 inch valve opening.
 - c. Fire Hydrant Connecting Pipe: The connecting pipe shall be ductile iron pipe as specified elsewhere in these Specifications. Three-way hydrants shall have 6 inch connecting pipes.
 - d. Hydrant Barrels and Extensions: All fire hydrants shall be equipped with a two-piece barrel having a flange at the ground line. The pipe shoe shall be designed for a minimum 42 inch bury. However, the Contractor shall provide extensions (Mueller A-320 or equal) as necessary to set the hydrants to the proper elevations at each location.
 - e. Nozzles: Three-way hydrants shall be equipped with two 2-1/2 inch hose nozzles and one 4 inch pumper nozzle.
 - f. Operating Nut: The operating nut shall be a nominal 1-1/2 inch pentagon, National Standard operating nut designed to open left (counterclockwise).
 - g. Safety Stem Coupling and Safety Flange: All hydrants shall be equipped with a safety stem coupling and flange which are intended to fail upon vehicle impact without damage to the stem or main valve.
 - h. Testing: Testing shall be in accordance with AWWA C502, latest revision.
 - i. Affidavit of Compliance: The manufacturer shall furnish to the Engineer, prior to delivery, an affidavit stating that the fire hydrant and all materials used in its construction conform to the requirements of AWWA C502, latest revision, and these Specifications, and that all tests specified therein have been performed and that all test requirements have been met.
- C. Auxiliary Gate Valves, Valve Boxes and Valve Box Collars: All fire hydrant installations shall have auxiliary gate valves, valve boxes, and valve box collars meeting all provisions specified elsewhere in these Specifications.
 - D. Connecting Pipe: The fire hydrant assembly shall have a connecting pipe between the mechanical joint end of the auxiliary gate valve and the fire hydrant. The connecting pipe shall be of the length indicated by the Engineer and shall be a locked hydrant adapter so that no joint separation will occur under pressure.
 - E. Concrete: All concrete used for reaction backing and valve box collars shall be in conformance with the Concrete section of these Specifications. There is no additional pay for concrete for reaction backing or for valve box collars. This item shall be considered subsidiary to fire station installation.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

- A. All fire hydrants shall be installed at the location shown on the Drawings or at the direction of the Engineer and shall be installed in accordance with the detail sheet of the Drawings and these Specifications.

- B. Examination of Material: Prior to installation, all hydrants shall be inspected for direction of opening, cleanliness of inlet elbow, handling damage, and cracks.
- C. Placement: All hydrants shall stand plumb within a tolerance of 1/8 inch horizontally in 12 inches vertically.
 - 1. The nozzles shall be parallel with, or at right angles to, the street with the pumper nozzle facing the curb or street.
 - 2. Hydrants shall be set to established grade with the nozzle centerline at least 18 inches above the ground, unless otherwise directed by the Engineer.
- D. Location: Unless otherwise shown on the Drawings, the hydrants shall be placed as follows.
 - 1. When placed beyond the curb, the hydrant barrel shall be set so that no portion of the pumper or hose nozzle cap will be less than 6 inches nor more than 12 inches from the gutter face of the curb.
 - 2. When set in the lawn space between the curb and the sidewalk, or between the sidewalk and the property line, no portion of the hydrant or nozzle cap shall be within 6 inches of the sidewalk.
- E. Connection to Mains: Each hydrant shall be connected to the main with a 6 inch ductile iron pipe branch and independent 6 inch gate valve as shown on the Drawings. The 6 inch branch of the main line fittings shall be equipped with retaining lip and swivel gland for positive restraint without tie rods.
- F. Hydrant Drainage in Pervious Soil: Wherever a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with coarse sand from the top of the concrete reaction backing to at least 6 inches above the waste opening in the hydrant, and to a distance of 1 foot around the elbow. No drainage system shall be connected to a sewer. Waste opening shall not be blocked by polyethylene encasement or concrete encasement.
- G. Hydrant Drainage in Impervious Soil: Wherever a hydrant is set in clay or other impervious soil, drainage shall be provided at the base of the hydrant by placing coarse gravel or crushed stone mixed with sand from the top of the reaction backing to at least 6 inches above the waste opening in the hydrant, and to a distance 3 feet around the elbow. No drainage system shall be connected to a sewer.
- H. Reaction Backing: The bowl of each hydrant shall be braced against unexcavated earth at the end of the trench with concrete reaction backing as shown on the Drawings or directed by the Engineer.

END OF SECTION 02639

SECTION 02642 - VALVES FOR WATER SERVICE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplemental Conditions and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

- A. The work to be included under this section of the Specifications shall consist of providing all materials, labor, equipment, tools, supplies, and incidentals necessary for the installation of gate, butterfly, and air and vacuum valves. The work shall include every item of construction necessary for a complete and acceptable installation as shown on the Drawings and hereinafter specified.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Valves: Valves specified in this section are intended for buried use on water distribution lines, for use as auxiliary valves for fire hydrants, and for use within structure walls. Unless otherwise shown on the Drawings, all valves 12 inches (nominal diameter) and larger shall be butterfly valves. All valves smaller than 12 inches (nominal diameter) shall be gate valves.
 1. Catalog Data and Assembly Drawings: For all gate valves, butterfly valves and valve boxes hereinafter specified, the manufacturer shall furnish to the Engineer prior to delivery, catalog data, including illustrations and a parts schedule giving the material of which parts are made, in sufficient detail to serve as a guide in the assembly and disassembly of the valve as well as in ordering repair parts. The manufacturer shall also submit three sets of certified drawings for approval by the Engineer, showing the principal dimensions, construction details, and materials used for all parts of the valve. All valves shall be furnished in accordance with the certified drawings after they have been approved by the Engineer.
 2. Gate Valves (0-200 psi Working Pressure): Unless otherwise shown on the Drawings, all gate valves furnished and installed shall be non-rising stem gate valves, in conformance with the requirements of AWWA C509, latest revision, for "Resilient Seated Gate Valves, 3 Through 12 NPS, for Water and Sewage Systems." All gate valves shall be Mueller resilient seat gate valves, Catalog No. A 2370-20, or approved equal, and shall be designed for 200 psi working pressure.
 - a. Stem Seal: All gate valves shall have "O" ring stem seals. The "O" ring stem seal shall be so designed that the seal above the stem collar can be replaced with the valve under pressure in the full-open position.

- b. Valve Ends: All gate valves shall have standard mechanical joint ends unless tapping valves, valves with flanged ends, or valves of a special nature are indicated on the Drawings.
 - c. Operation: All buried gate valves shall be designed for operation with a nominal 2 inch square operating nut. The standard direction of opening shall be open left (counterclockwise) as viewed from the top. Where shown on the Drawings or specified, handwheels in conformance to AWWA C509 shall be provided.
 - d. Interior Protective Coating: The interior of the valve shall have a protective interior coating in compliance with AWWA C550, latest revision, for "Protective Interior Coatings for Valves and Hydrants."
 - e. Testing: The valve shall be tested in accordance with AWWA C509, latest revision.
 - f. Affidavit of Compliance: The manufacturer shall furnish to the Engineer prior to delivery, an affidavit stating that the valve and all materials used in its construction conform to the requirements of AWWA C509 and AWWA C550, latest revisions, and that all tests specified therein have been performed and that all test requirements have been met.
3. Butterfly Valves: All butterfly valves furnished and installed shall be Class 150B in conformance with the requirements of AWWA C504, latest revision, for "Rubber Seated Butterfly Valves." All butterfly valves shall be groundhog type, as furnished by Henry Pratt Company.
- a. Body: The valve body shall be constructed of cast iron ASTM A-126, Class B, and shall have integrally cast mechanical joint ends unless alternate valve ends are indicated on the Drawings. Body thickness shall be in strict accordance with AWWA C504, latest revision, Class 150B.
 - b. Valve Seats: All butterfly valves shall be of the tight closing, synthetic rubber-seat type, as follows.
 - 1) Valves 24 inches (nominal diameter) and smaller shall have bonded seats which are simultaneously molded in, vulcanized and bonded to the body. Seat bond must withstand 75 pounds pull under test procedure ASTM D429, Method B.
 - c. Valve Discs: Valve discs shall be as follows.
 - 1) Valves 12 inches through 24 inches nominal diameter: Valve discs shall be constructed of alloy cast iron ASTM A-436, Type 1.
 - d. Valve Shaft and Bearings: The valve shaft shall be constructed of stainless steel and the bearings shall be corrosion resistant and self-lubricating.
 - e. Operator: The valves shall be equipped with a totally enclosed type operator, fully gasketed and grease packed, suitable for direct burial. The operator shall be designed for operation with a nominal 2 inch square operating nut for use with a T-wrench. Operators shall be designed to open with a counterclockwise rotation of the operator nut.
 - f. Painting: All valves shall be painted in accordance with AWWA C504, latest revision.
 - g. Testing: The valve shall be hydrostatically tested at 150 psi for leakage in accordance with AWWA C504, latest revision.
 - h. Affidavit of Compliance: The manufacturer shall furnish to the Engineer prior to delivery, an affidavit stating that the valve and all materials used in its construction conform to the requirements of AWWA C504, latest revision, and that all tests specified therein have been performed and that all test requirements have been met.

4. Air and Vacuum Valves: Air and vacuum valves for the 1 inch water main shall be Model Ford B11-444, single housing construction, inlet and outlet air valve as manufactured by Ford, or equal. The valve shall be single-body and double-orifice to allow large volumes of air to escape or enter the large diameter air and vacuum orifice when filling or draining the pipeline.
 - a. When the pipeline is filled and pressurized, the large air and vacuum orifice shall stay closed, but the smaller diameter air release orifice shall remain operative and open to allow small pockets of air accumulation to escape automatically and independently of the large orifice.
 - b. The large air and vacuum orifice shall shut off when the free-flowing center-guided plug is raised into the orifice by the lifting force of the concave-bottom float. The large orifice shutoff shall be without spilling.
 - c. The Buna-N seat must be fastened to the valve collar, without distortion, for drop-tight shutoff.
 - d. Provide valve vault as shown on the Drawings.
5. Outside Coating: All gate or butterfly valves shall have either a bituminous exterior coating or shall be delivered to the site factory cleaned and primed as set out below.
 - a. Factory Primed Valves: Unless otherwise shown on the Drawings, all exposed valves within the limits of structure walls or any valves exposed above ground shall be delivered to the job site factory blasted, cleaned and primed with one coat of Kop-Coat 340 Gold Primer, or approved equal.
 - b. Bituminous Coating: All valves indicated for buried service shall have a bituminous coating in accordance with applicable AWWA Standards.
6. Valve Boxes: All buried valves shall be equipped with cast iron valve boxes. The valve boxes, including all appurtenances, shall be cast iron. The valve box and appurtenances shall consist of a base, extensions as required, and a top section with a drop lid. The lid shall be marked with the word "WATER." All valve boxes shall be compatible with the gate or butterfly valves for which they are provided. The manufacturer shall submit three sets of drawings prior to delivery for approval by the Engineer, showing the principal dimensions, construction details, and materials used in construction of the valve box.
7. Concrete: All concrete used for the placement of valve box collars shall be in conformance to the Concrete section of these Specifications.

PART 3 - EXECUTION

3.1 GENERAL

- A. All valves shall be installed at the locations shown on the Drawings or at the direction of the Engineer, and shall be installed in accordance with the detail sheet of the Drawings and these Specifications.
- B. Valve Installation: Gate and butterfly valves shall be installed in accordance with AWWA C600, latest revision, Sections 3.3 and 3.6, and with either AWWA C504 or AWWA C509, as applicable, latest revisions (appendices included), the manufacturer's recommendations, and these Specifications.
- C. Visual Inspection: Prior to installation, all valves shall be visually inspected for defects, and any foreign material in the valve interior removed. The valve shall also be operated through its full range and compared to the manufacturer's published information.

- D. Valve Boxes: A valve box as specified shall be provided for each valve used in a buried service application. The valve box shall be installed so as not to transmit shock or stress to the valve. The valve box shall be centered and plumb over the operating nut of the valve with the box cover flush with the surface of the finished pavement or such level as directed by the Engineer. The valve box shall be backfilled evenly around its perimeter with select material. The material shall be hand tamped so that the ground will not settle after placement of the concrete collar.
- E. Valve Box Collar: All valve box lids shall have an 18 inch square concrete collar placed around them. The collar shall be centered on the valve box lid and shall be 6 inches thick. The top of the pad shall be flush with the top of the box and the surrounding ground or roadway surface. Valve box collars shall not be constructed until every item of cleanup has been completed.
- F. Dead Ends: Valves located at the end of pipelines shall have ductile iron plugs or caps with or without blowoff cocks as shown on the Drawings. All dead end valves shall be restrained as shown on the Drawings or at the direction of the Engineer.

END OF SECTION 02642

SECTION 02643 - FLUSHING, HYDROSTATIC TESTING, DISINFECTION AND DYNAMIC TESTING OF WATER LINES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and General Provisions of the Contract, including General and Supplemental Conditions and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

- A. The work to be included under this section of the Specifications shall consist of providing all materials, labor, equipment, tools, supplies, and incidentals necessary for the flushing, hydrostatic testing, disinfection, and dynamic testing of water lines.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Water: Water for flushing, testing and disinfecting all facilities will be supplied by the Owner. The Contractor shall discharge testing and disinfection water in accordance with NPDES General Permit ARG670000. The Contractor shall schedule and coordinate this work to ensure that it will not be carried on during periods of high water usage.

PART 3 - EXECUTION

3.1 FLUSHING, TESTING AND DISINFECTION

- A. After completion of construction of all water lines, the Contractor shall flush, test and disinfect the new water lines as set out below. A reasonable amount of water will be furnished to the Contractor by the Owner, free of cost to the Contractor. Should the Contractor require additional amounts of water due to water line breaks or neglect on the part of the Contractor, water shall be purchased from the Owner at their bulk rate. Quantities of water which will be paid for by the Contractor shall be determined by the Engineer.
 - 1. Flushing: The Contractor shall fill and flush the newly constructed lines and visually check all valves and fire hydrants to assure proper operation.
 - a. Water Discharge: Discharging test water will be allowed only as approved by permit.
 - 2. Hydrostatic Testing: All pipe on this project shall be tested as set out in AWWA C600, latest revision. Tests will be conducted after the line is completed and backfill made, except those areas around valves and fire hydrants may be left open at the discretion of the Contractor.

- a. **Test Pressure and Duration:** The line shall be tested at 150 percent of the designed operating pressure or a minimum of 150 psi, whichever is greater. The Engineer will assist the Contractor in determining test pressure at any given point. The Contractor shall provide all pumps or other equipment necessary to maintain the test pressure within ± 5 pounds per square inch at the test point for a period of two hours.
- b. **Definition of Leakage:** The leakage test shall be conducted concurrently with the pressure test. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the above specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water. Leakage shall not be measured by a drop in pressure in a test section over a period of time.
- 1) The Contractor shall be responsible for providing all pumps, equipment and appurtenances necessary to maintain the above specified test pressure, and to meter the water supplied to the line in order to maintain the test pressure within the limits specified.
- c. **Allowable Leakage:** Leakage for water pipe shall be within the limits set out in AWWA C600, latest revision. 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, and retest the line until the leakage is within the specified allowance. No pipe installation will be accepted if the leakage is greater than that determined by the following formula:

$$\text{In inch-pound units, } L = \frac{SD\sqrt{P}}{133,200}$$

Where:

- L = allowable leakage, in gallons per hour
- S = length of pipe tested, in feet
- D = nominal diameter of the pipe, in inches
- P = average test pressure during the leakage test, in pounds per square inch (gauge)

ALLOWABLE LEAKAGE PER 1,000 FT. OF PIPELINE - gph

Avg. Test Pressure psi	Nominal Pipe Diameter - in.										
	3	4	6	8	10	12	14	16	18	20	24
450	0.48	0.64	0.95	1.27	1.59	1.91	2.23	2.55	2.87	3.18	3.82
400	0.45	0.60	0.90	1.20	1.50	1.80	2.10	2.40	2.70	3.00	3.60
350	0.42	0.56	0.84	1.12	1.40	1.69	1.97	2.25	2.53	2.81	3.37
300	0.39	0.52	0.78	1.04	1.30	1.56	1.82	2.08	2.34	2.60	3.12
275	0.37	0.50	0.75	1.00	1.24	1.49	1.74	1.99	2.24	2.49	2.99
250	0.36	0.47	0.71	0.95	1.19	1.42	1.66	1.90	2.14	2.37	2.85
225	0.34	0.45	0.68	0.90	1.13	1.35	1.58	1.80	2.03	2.25	2.70
200	0.32	0.43	0.64	0.85	1.06	1.28	1.48	1.70	1.91	2.12	2.55
175	0.30	0.40	0.59	0.80	0.99	1.19	1.39	1.59	1.79	1.98	2.38
150	0.28	0.37	0.55	0.74	0.92	1.10	1.29	1.47	1.66	1.84	2.21
125	0.25	0.34	0.50	0.67	0.84	1.01	1.18	1.34	1.51	1.68	2.01
100	0.23	0.30	0.45	0.60	0.75	0.90	1.05	1.20	1.35	1.50	1.80

- d. Visible Leaks: All visible leaks are to be repaired regardless of the amount of leakage.
- 3. Disinfection: After successful testing, the Contractor shall empty the line of water. The line shall then be disinfected in accordance with AWWA C651, latest revision, for "Disinfecting Water Mains," continuous feed method, except that the placing of hypochlorite granules into the main during construction will not be permitted.
 - a. The transmission line and facilities shall be considered sterilized after the Owner has received two consecutive negative reports on samples taken along each line and at each facility sent to the Arkansas Department of Health for testing. These samples shall be observed, supervised or performed by utility personnel to verify their adequacy. Negative reports must be received on two samples taken at 24-hour intervals. The Owner shall obtain and deliver samples to the Arkansas Department of Health for testing.
- 4. Dynamic Testing: After sterilization is complete the Contractor shall then flush the sterilizing solution from the lines, and the lines will then be placed into service.
 - a. The Contractor shall furnish personnel to assist the Owner in the operation of all valves, etc., to initially start up the system.
- 5. Acceptance: Upon successful completion of the dynamic test and sterilization, and approval of the Arkansas Department of Health, this section of the Contract Documents will be considered complete.

END OF SECTION 02643

SECTION 02645 – LOW-PRESSURE AIR TESTING OF GRAVITY SEWER LINES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This section sets forth requirements of the materials, procedures, and acceptable results required for low-pressure air testing of gravity sewer lines to determine watertightness. On all gravity flow sewers, the Contractor shall conduct low-pressure air tests on the various sections of pipe by use of equipment manufactured for this purpose. Low-pressure air testing is used to indicate damaged piping or improper jointing by measuring the rate at which air escapes under pressure. This method shall not be intended to show water leakage limits and shall not be used as a quantitative measure of leakage under service conditions.

1.3 APPLICABLE STANDARDS

- A. ASTM F 1417, "Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air," latest revision.
- B. UNI-B-6, "Recommended Practice for Low-Pressure Air Testing of Installed Sewer Pipe," latest revision.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Air Compressor, Regulator, and Gauge: The air compressor shall be a portable air source with a main shutoff valve and a regulator to avoid over-pressurizing and possibly damaging an otherwise acceptable line. The compressor shall also have a 9.0 psi pressure relief valve, input pressure gauge, and a continuous monitoring pressure gauge. The equipment test gauge shall have a range of at least 0-10 psi with minimum increments of 0.10 psi and an accuracy of at least ± 0.04 psi.
- B. All necessary equipment to perform the air test in accordance with these Specifications shall be provided by the Contractor.

PART 3 - EXECUTION

3.1 GENERAL

- A. After the sewer line has been installed and after manholes have been constructed, the Contractor shall proceed to air test all gravity sewer lines in accordance with ASTM F 1417 time-pressure drop method and UNI-B-6 to determine if the sewers are free of breaks and other defects which may permit excessive infiltration or leakage.
- B. Procedure: Prior to testing, the line shall be flushed to eliminate debris. The low-pressure air test shall be conducted by plugging each opening in the reach of pipe to be tested, including all branches, laterals, wyes, tees, and stubs. All plugs shall be designed to resist internal testing pressures without the aid of external bracing or blocking; however, external bracing may be used as an added precaution. Plugs shall be braced securely, and one (1) of the plugs provided shall have an inlet tap or other provision for connecting an air hose. After connecting the air control equipment to the air hose, the air pressure shall be monitored so the internal pressure is approximately 4.0 psi but not exceeding 5.0 psi. The starting test pressure shall be increased by 0.433 psi per foot of groundwater level above the pipe invert if groundwater is present. If the groundwater level is two (2) feet or more above the top of the pipe or if the calculated air pressure required for the test is greater than 9.0 psi, the air test method shall not be used or the groundwater level must be lowered by dewatering. In no case shall the test pressure exceed 9.0 psi. After reaching 4.0 psi, the air supply shall be throttled to maintain pressure between 4.0 and 3.5 psi for at least two (2) minutes to allow equilibrium to occur between the air temperature and the pipe walls. If any plugs leak during the test period, the Contractor shall bleed off the air, tighten the plugs, and retest. After stabilization is reached, the pressure shall be allowed to be decreased to 3.5 psi. At 3.5 psi, the Contractor shall begin timing with a stopwatch to determine the test time required for the pressure to drop to 3.0 psi. The observed time shall be compared with the minimum allowable times in the chart set forth in ASTM F 1417 and herein for pass/fail determination. The pipe shall be presumed free of defects if the time in seconds for the air pressure to decrease from 3.5 psi to 3.0 psi is equal to or greater than that shown in the table below.
- C. For pipes 30 inches and larger, the Contractor shall consult with the pipe and appurtenance manufacturers for maximum test pressures.
- D. If, after one (1) hour of testing, no leakage (zero psig drop) has occurred, the test section shall be accepted and the test complete.
- E. Gauges, air piping, manifolds, and valves shall be located on the top of the ground. The line(s) shall not be over-pressurized by exceeding 9.0 psi. The bleeder valve shall be opened after test completion to allow all air to escape. Plugs shall not be removed until pressure in the system has been released.

**SPECIFICATION TIME REQUIRED FOR 0.5 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PVC PIPE INDICATED FOR Q = 0.0015**

1 Pipe Diame- ter (in.)	2 Minimum Time (min: sec)	3 Length for Minimum Time (ft)	4 Time for Longer Length (sec)	Specification Time for Length (L) Shown (min:sec)								
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft	
4	1:53	597	0.190L	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53	1:53
6	2:50	398	0.427L	2:50	2:50	2:50	2:50	2:50	2:50	2:51	3:12	
8	3:47	298	0.760L	3:47	3:47	3:47	3:47	3:48	4:26	5:04	5:42	
10	4:43	239	1.187L	4:43	4:43	4:43	4:57	5:56	6:55	7:54	8:54	
12	5:40	199	1.709L	5:40	5:40	5:42	7:08	8:33	9:58	11:24	12:50	
15	7:05	159	2.671L	7:05	7:05	8:54	11:08	13:21	15:35	17:48	20:02	
18	8:30	133	3.846L	8:30	9:37	12:49	16:01	19:14	22:26	25:38	28:51	
21	9:55	114	5.235L	9:55	13:05	17:27	21:49	26:11	30:32	34:54	39:16	
24	11:20	99	6.837L	11:24	17:57	22:48	28:30	34:11	39:53	45:35	51:17	
27	12:45	88	8.653L	14:25	21:38	28:51	36:04	43:16	50:30	57:42	64:54	
30	14:10	80	10.683L	17:48	26:43	35:37	44:31	53:25	62:19	71:13	80:07	
33	15:35	72	12.926L	21:33	32:19	43:56	53:52	64:38	75:24	86:10	96:57	
36	17:00	66	15.384L	25:39	38:28	51:17	64:06	76:55	89:44	102:34	115:23	
42	19:74	57	20.942L	34:54	52:21	69:49	87:15	104:42	122:10	139:37	157:04	
48	22:47	50	27.352L	45:35	68:23	91:11	113:58	136:46	159:33	182:21	205:09	
54	25:31	44	34.618L	57:42	86:33	115:24	144:15	173:05	201:56	230:47	259:38	
60	28:20	40	42.738L	71:14	106:51	142:28	178:05	213:41	249:18	284:55	320:32	

- F. Any test section less than 100 feet in length shall be tested against the times set forth for 100 feet in the chart.
- G. Acceptance: All gravity sewer lines shall pass the low-pressure air test before acceptance. If the pressure drops 0.5 psig before the appropriate time has elapsed, the air loss rate shall be considered excessive and the section of pipe has failed the test. If the section fails to meet these requirements, the Contractor shall determine at own expense the source(s) of leakage. The Contractor shall repair or replace all defective materials and/or workmanship in the defective section(s), and the entire line segment shall then be retested. The extent and type of repair allowed shall be subject to the approval of the Engineer.

END OF SECTION 02645

SECTION 02741 - HOT-MIX ASPHALT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Hot-mix asphalt paving.
 - 2. Hot-mix asphalt paving overlay.
 - 3. Pavement-marking paint.
- B. Contractor shall provide all necessary testing and retesting to determine compliance with all specified requirements.

1.3 DEFINITIONS

- A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
- B. AHTD: Arkansas State Highway and Transportation Department.
- C. DOT: Department of Transportation.

1.4 APPLICABLE STANDARDS

- A. ASTM D 8 "Standard Terminology Relating to Materials for Roads and Pavements," latest revision.
- B. AHTD Standard Specifications: "Standard Specifications for Highway Construction," Edition of 2003, published by the Arkansas State Highway and Transportation Department.
- C. ASTM D 3549, "Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens," latest revision.
- D. AASHTO T 209, "Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures," latest revision.
- E. AASHTO T 166, "Bulk Specific Gravity of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens," latest revision.
- F. AASHTO T 168, "Sampling Bituminous Paving Mixtures," latest revision.

- G. AHTD 461, "Inplace Density, % Completion, of Asphalt Concrete Hot Mix Using a Nuclear Gauge," latest revision.

1.5 SYSTEM DESCRIPTION

- A. Provide hot-mix asphalt paving according to materials, workmanship, and other applicable requirements of standard specifications of state or local DOT.
 - 1. Standard Specification: Sections 212, 401, 403, 404, 406, 407, 409, 410, 718, and 719 of the AHTD Standard Specifications.
 - 2. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

1.6 SUBMITTALS

- A. Submit information to establish compliance with the Specifications in accordance with Section 01330 Submittals.
- B. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- C. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- D. Shop Drawings: Indicate pavement markings and lane separations.
- E. Qualification Data: For manufacturer.
- F. Material Test Reports: For each paving material.
- G. Material Certificates: For each paving material, signed by manufacturers.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. Manufacturer shall be a qualified paving-mix manufacturer registered with and approved by the jurisdictional authorities or the DOT of the state in which Project is located.
- B. Regulatory Requirements: Comply with the AHTD Standard Specifications for asphalt paving work.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement-marking materials to Project site in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.9 PROJECT CONDITIONS

- A. Environmental Limitations: Do not apply asphalt materials if subgrade is wet, excessively damp, when there is frost on the subbase, or if the following conditions are not met:
 - 1. Prime and Tack Coats: Minimum ambient temperature of 45 deg F (7 deg C).
 - 2. Asphalt Base and Binder Courses: Minimum surface temperature of 40 deg F (4 deg C) and rising at time of placement.
 - 3. Asphalt Surface Course: Minimum surface temperature of 40 deg F (4 deg C) at time of placement.
- B. Pavement-Markings: Proceed with pavement marking only on clean, dry surfaces and at a minimum ambient or surface temperature of 40 deg F (4 deg C) for oil-based materials, 50 deg F (10 deg C) for thermoplastic or water-based materials, and not exceeding 95 deg F (35 deg C).

PART 2 - PRODUCTS

2.1 AGGREGATES

- A. General: Use materials and gradations that have performed satisfactorily in previous installations.
- B. Coarse Aggregate, Fine Aggregate, and Mineral Filler: As specified by Section 409 of the AHTD Standard Specifications.

2.2 ASPHALT MATERIALS

- A. The following materials shall meet the Specifications for their respective sections of the AHTD Standard Specifications:
 - 1. Asphalt Binder: Section 409.
 - 2. Prime Coat: Section 403.
 - 3. Tack Coat: Section 403.

2.3 AUXILIARY MATERIALS

- A. Pavement-Marking Paint: As specified by Section 718 of the AHTD Standard Specifications.
 - 1. Color: As indicated on the Drawings.
- B. Thermoplastic Pavement-Marking: As specified by Section 719 of the AHTD Standard Specifications.
 - 1. Color: As indicated on the Drawings.

2.4 MIXES

- A. Hot-Mix Asphalt: Dense, hot-laid, hot-mix asphalt plant mixes as specified by Section 406 for Asphalt Concrete Hot-Mix Binder Course and Section 407 for Asphalt Concrete Hot-Mix Surface Course.

1. Provide mixes with a history of satisfactory performance in geographical area of the Project.
2. Provide mixes as set forth in Section 407 of the AHTD Standard Specifications for the following nominal, maximum aggregate sizes:
 - a. Binder Course: 1 inch (25 mm), PG 70-22 mix, with a Design Gyration of 160.
 - b. Surface Course: 1/2 inch (13 mm), PG 70-22 mix, with a Design Gyration of 160.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that base course is dry and in suitable condition to support paving and imposed loads.
- B. Proceed with paving only after unsatisfactory conditions have been corrected.

3.2 REPAIRS

- A. Crack and Joint Filling for Overlay: Remove existing joint filler material from cracks or joints to a depth of 1/4 inch (6 mm).
 1. Clean cracks and joints in existing hot-mix asphalt pavement.
 2. Use hot-applied joint sealant to seal cracks and joints more than 1/4 inch (6 mm) wide. Fill flush with surface of existing pavement and remove excess.

3.3 SURFACE PREPARATION

- A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving. Unless the course is to be placed on an existing base or pavement, the subgrade shall be prepared as specified in Section 212 of the AHTD Standard Specifications.
 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- B. Prime Coat: Apply uniformly over surface of compacted unbound-aggregate base course at a rate of 0.15 to 0.50 gal./sq. yd. (0.7 to 2.3 L/sq. m). Apply enough material to penetrate and seal but not flood surface. Allow prime coat to cure for 72 hours minimum, unless otherwise directed by the Engineer.
 1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.
 2. Protect primed substrate from damage until ready to receive paving. If primed surface becomes damaged, Contractor shall clean, patch, and re-treat at own expense.
- C. Tack Coat: Apply uniformly to surfaces of existing pavement at a rate of 0.03-0.10 gal./sq. yd. (0.1 to 0.5 L/sq. m).
 1. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
 2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.

3. Protect tack coat from damage and foreign material. If tacked surface becomes damaged or loses adhesiveness as a result of foreign materials, Contractor shall clean and re-treat at own expense.

3.4 HOT-MIX ASPHALT PLACING

- A. Hot-mix asphalt shall be placed as specified by Section 410 of the AHTD Standard Specifications.
- B. Machine-place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand only in areas inaccessible to equipment and in a manner that prevents segregation of mix. Place each course to required grade, cross section, and compacted thickness.
 1. Place hot-mix asphalt binder course in a minimum 3 inch (80 mm) lift and thickness indicated.
 2. Place hot-mix asphalt surface course in two lifts.
 3. The continuous production of hot-mix shall be within $\pm 25^{\circ}$ F of the mixing temperature of the approved mix design, but in no case shall be placed at a temperature less than of 250 deg F (121 deg C).
 4. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes, unless otherwise indicated.
 5. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- C. Place paving in consecutive strips not less than 10 feet (3 m) wide unless infill edge strips of a lesser width are required.
 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt binder course before placing asphalt surface course.
- D. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.
- E. If segregation of the hot-mix occurs over a large area (3 yd² or more), paving shall cease until the problem has been corrected.

3.5 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.
 1. Clean contact surfaces and apply tack coat to joints.
 2. Offset transverse joints, in successive courses, a minimum of 24 inches (600 mm).
 3. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

3.6 COMPACTION

- A. General: Hot-mix asphalt shall be compacted as specified by Section 410 of the AHTD Standard Specifications. Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors only in areas inaccessible to rollers.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 92 percent of reference maximum theoretical density according to AASHTO T 209, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Protection: After final rolling, do not permit vehicular traffic on pavement until cooled and hardened.
- H. Erect barricades to protect paving from traffic until mixture has cooled enough to not exhibit marking.

3.7 INSTALLATION TOLERANCES

- A. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Binder Course: Plus or minus 1/2 inch (13 mm).
 - 2. Surface Course: Plus or minus 1/4 inch (6 mm).
- B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:
 - 1. Binder Course: 3/16 inch (5 mm).
 - 2. Surface Course: 1/8 inch (3 mm).

3.8 PAVEMENT MARKING

- A. Do not apply pavement-markings until layout, colors, and placement have been verified with Engineer.
- B. Allow paving to age for 30 days before application of pavement marking or as otherwise directed by the Engineer.
- C. Sweep and clean surface to eliminate loose material and dust.
- D. Apply pavement-marking paint in accordance with Section 718 of the AHTD Standard Specifications.
- E. Apply thermoplastic pavement-markings in accordance with Section 719 of the AHTD Standard Specifications.

3.9 FIELD QUALITY CONTROL

- A. Testing Agency: The Contractor, with the approval of the Owner and Engineer, will engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
 - 1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from specified requirements. Test results shall be reported in writing to Engineer, Owner, asphalt manufacturer, and Contractor within 48 hours of testing.
- B. Additional testing and inspection, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
 - 1. One core sample will be taken for every 500 linear feet (153 m) or less of completed binder course, with no fewer than 3 cores taken.
 - 2. One core sample will be taken for every 500 linear feet (153 m) or less of completed surface course, with no fewer than 3 cores taken.
- D. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
- E. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to AASHTO T 168.
 - 1. Reference maximum theoretical density will be determined by averaging results from four (4) samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to AASHTO T 209, and compacted according to job-mix specifications.
 - 2. In-place density of compacted pavement will be determined by testing core samples according to AASHTO T 166 or AHTD 461.
 - a. One core sample will be taken for every 500 linear feet (153 m) or less of completed binder course, with no fewer than 3 cores taken.
 - b. One core sample will be taken for every 500 linear feet (153 m) or less of completed surface course, with no fewer than 3 cores taken.

F. Provisions for Acceptance of Non-Specification Materials:

1. Depth of ACHM Binder: The depth of the binder course shall be within plus or minus 1/2 inch (13 mm) of the required depth. If the average of all depth measurements is less than the required depth, the deficient depth will be added to the required depth of the surface course at no additional cost to the Owner. Any depth in excess of plus 1/2 inch (13 mm) will not be used in computing the average depth.
2. Depth of ACHM Surface: The depth of the surface course shall be within plus or minus 1/4 inch (6 mm) of the required depth plus any additional depth(s) required due to deficient depths in the base and binder courses. The average of all depth measurements shall not be less than the required depth, and any depth in excess of plus 1/2 inch (13 mm) will not be used in computing the average depth. If the average depth is less than the required depth, it will be corrected by overlaying with additional ACHM surface, or as directed by the Engineer at no additional cost to the Owner.
3. Asphalt Density: Average asphalt density shall be 92 percent of the maximum theoretical density. No density of less than 90 percent shall be acceptable. Where densities are less than 90 percent, the asphalt paving shall be removed and replaced using the AHTD criteria for determining the area of replacement.

END OF SECTION 02741

SECTION 02821 - CHAIN-LINK FENCES AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Chain-Link Fences: Industrial.
 - 2. Gates: Swing.
 - 3. Gates: Horizontal Slide Gates – Cantilever.
- B. Related Sections include the following:
 - 1. Division 3 Section 03300 (Cast-in-Place Concrete) for concrete post concrete fill and operator pads.

1.3 DEFINITIONS

- A. IEEE – Institute of Electrical & Electronics Engineers.
- B. NFPA – National Fire Protection Association.
- C. NETA – InterNational Electrical Testing Association.
- D. ETT – Electrical Testing Technicians.
- E. CLFMI – Chain Link Fence Manufacturer's Institute.
- F. UL – Underwriters Laboratory.

1.4 PERFORMANCE REQUIREMENTS

- A. Lightning Protection System: Maximum grounding-resistance value of 25 ohms under normal dry conditions.

1.5 SUBMITTALS

- A. Submit information to establish compliance with the Specifications in accordance with the provisions of Section 01330 Submittals.
- B. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for chain-link fences and gates.

1. Fence and gate posts, rails, and fittings.
 2. Chain-link fabric, reinforcements, and attachments.
 3. Gates and hardware.
 4. Accessories: Barbed wire.
- C. Shop Drawings: Show locations of fences, gates, posts, rails, tension wires, details of extended posts, extension arms, gate swing, or other operation, hardware, and accessories. Indicate materials, dimensions, sizes, weights, and finishes of components. Include plans, gate elevations, sections, details of post anchorage, attachment, bracing, and other required installation and operational clearances.
- D. Product Certificates: For each type of chain-link fence and gate, signed by product manufacturer.
1. Strength test results for framing according to ASTM F 1043.
- E. Qualification Data: For Installer – minimum 5 years experience.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Qualified and skilled personnel experienced in the installation of chain-link fences and gates similar in material, design, and extent to those indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is acceptable to authorities having jurisdiction and a member company of NETA or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7.
1. Testing Agency's Field Supervisor: Person currently certified according to NETA ETT, or the National Institute for Certification in Engineering Technologies, to supervise on-site testing specified in Part 3 of this Section.
- C. Preinstallation Conference: Conduct conference at Project site.

1.7 PROJECT CONDITIONS

- A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

- A. General: Height shall be as indicated on Drawings. Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with ASTM A 392, CLFMI Product Manual CLF 2445, and requirements indicated below:
1. Steel Wire Fabric: Metallic-coated wire with a diameter of 0.148-inch (3.76 mm), No. 9 gauge.

- a. Mesh Size: 2 inches (50 mm).
- b. Weight of Metallic (Zinc) Coating: ASTM A 392, Type II, Class 1, 1.2 oz./sq. ft. with zinc coating applied after weaving.
- 2. Selvage: Twisted top and knuckled bottom.
- 3. PVC Coated Steel Wire Fabric: PVC coating shall comply with ASTM F 668 (Poly-Vinyl Chloride (PVC)-Coated Steel Chain Link Fence Fabric), except that the wire core shall measure 9 gauge prior to application of coating.
 - a. Color: As selected from manufacturer's full color range.

2.2 INDUSTRIAL FENCE FRAMING

- A. Posts and Rails: Comply with ASTM F 1043 for framing, ASTM F 1083 for Group IC round pipe, and the following:
 - 1. Group: IA, round steel pipe, Schedule 40.
 - 2. Fence Height: Indicated on Drawings.
 - 3. Strength Requirement: Heavy industrial according to ASTM F 1043.
 - 4. Post Diameter and Thickness: According to ASTM F 1043 and ASTM F 1083.
 - a. Top Rail: 1.66 inches (42 mm).
 - b. Line Post: 2.375 inches (60 mm).
 - c. End, Corner and Pull Post: 2.875 inches (73 mm).
 - d. Swing Gate Post: According to ASTM F 900, 4-inch (102-mm) diameter, 8.65-lb/ft. (12.88-kg/m) weight for 10-foot gate and 6.625-inch (169 mm) diameter, 18.97-lb/ft. (28.25-kg/m) weight for 26-foot gate.
 - 5. Coating for Steel Framing
 - a. Metallic Coating:
 - 1) Type A, consisting of not less than minimum 2.0-oz./sq. ft. (0.61-kg/sq. m) average zinc coating per ASTM A 123/A 123M.
 - b. PVC Coating for Steel Framing: After galvanizing, the framework, fittings, and accessories shall be finished with manufacturer's standard thermally bonded PVC finish, not less than 10 mils thick.
 - 1) Color: As selected from manufacturer's full color range.

2.3 TENSION WIRE

- A. General: Provide horizontal tension wire at the following location:
 - 1. Location: Extended along bottom of fence fabric.
- B. Metallic-Coated Steel Wire: 0.177-inch- (4.5-mm-) diameter, marcelled tension wire complying with ASTM A 817, ASTM A 824, and the following:
 - 1. Metallic Coating: Type II, zinc coated (galvanized), with the following minimum coating weight:
 - a. Class 2: Not less than 1.2 oz./sq. ft. (366 g/sq. m) of uncoated wire surface.

2.4 INDUSTRIAL SWING GATES

- A. General: Comply with ASTM F 900 for double swing gate types.
 - 1. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F 1043 and ASTM F 1083 for materials and protective coatings.

- B. Frames and Bracing: Fabricate members from round, galvanized steel tubing with outside dimension and weight according to ASTM F 900 and the following:
 - 1. Gate Fabric Height: 2 inches (50 mm) less than adjacent fence height.
 - 2. Leaf Width: As indicated.
 - 3. Frame Members:
 - a. Tubular Steel: 1.90 inches (48 mm) round.
- C. Frame Corner Construction:
 - 1. Welded and 5/16-inch- (7.9-mm-) diameter, adjustable truss rods for panels 5 feet (1.52 m) wide or wider.
- D. Extended Gate Posts and Frame Members: Extend gate posts and frame end members above top of chain-link fabric at both ends of gate frame, as indicated and required to attach barbed wire assemblies.
- E. Hardware: Latches permitting operation from both sides of gate, hinges, center gate stops and keepers for each gate leaf. Fabricate latches with integral eye openings for padlocking. Padlock shall be accessible from both sides of gate.

2.5 HORIZONTAL SLIDE GATES – CANTILEVER

- A. General: Comply with ASTM F 1184 for gate posts and single cantilever sliding gate types. Provide automated vehicular gates that comply with ASTM F 2200.
 - 1. Classification: Type II cantilever slide, Class 1 with external concealed roller assemblies.
 - a. Gate Frame Height: 7' including 1' top extensions for three strands of barbed wire.
 - b. Gate Frame Width: As shown on Drawings.
- B. Pipe and Tubing:
 - 1. Aluminum: Comply with ASTM B 429 / B 429M, manufacturer's standard color range.
 - 2. Gate Post Size and Width: Not less than required by ASTM F 1184, ASTM F 1916. ASTM F 1184 includes only steel members for Type II cantilever slide gates.
 - 3. Gate Frames and Bracing: Round tubular aluminum.
- C. Frame Corner Constructed: Welded and 3/8 inch diameter, adjustable truss rods for panels 5 feet or wider.
- D. Track Assembly: Manufacturer's standard track, with framing supports, bracing, and accessories, engineered to support size, weight, width, operation, and design of gate and roller assemblies.
- E. Hardware: Hangers, roller assemblies, and stops fabricated from mill-finished Grade 319 aluminum-alloy casting with stainless steel fasteners.

2.6 FITTINGS

- A. General: Comply with ASTM F 626.
- B. Post and Line Caps: Provide for each post.
 - 1. Line post caps with loop to receive top rail.

- C. Rail and Brace Ends: Attach rails securely to each gate, corner, pull, and end post.
- D. Rail Fittings: Provide the following:
 - 1. Top Rail Sleeves: Pressed-steel or round-steel tubing not less than 6 inches (152 mm) long.
 - 2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate rails in the fence line-to-line posts.
- E. Tension and Brace Bands: Pressed steel.
- F. Tension Bars: Steel, length not less than 2 inches (50 mm) shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.
- G. Truss Rod Assemblies: Steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.
- H. Barbed Wire Arms: Pressed steel or cast iron, with clips, slots, or other means for attaching strands of barbed wire, integral with post cap; for each post, unless otherwise indicated, and as follows:
 - 1. Line posts with arms that accommodate top rail.
 - 2. Type I, single slanted arm.
- I. Tie Wires, Clips, and Fasteners: According to ASTM F 626.
 - 1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:
 - a. Hot-Dip Galvanized Steel: 0.148-inch- (3.76-mm-) diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.
- J. Finish
 - 1. Metallic Coating for Pressed Steel or Cast Iron: Not less than 1.2 oz. /sq. ft. (366 g/sq. m) zinc.

2.7 BARBED WIRE

- A. Zinc-Coated Steel Barbed Wire: Comply with ASTM A 121, Standard grade for the following two-strand barbed wire:
 - 1. Standard Size and Construction: 0.099-inch- (2.51-mm-) diameter line wire with 0.080-inch- (2.03-mm-) diameter, 2-point round barbs spaced not more than 5 inches (127 mm) on center.

2.8 FENCE GROUNDING

- A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.
 - 1. Material above Finished Grade: Copper.
 - 2. Material on or below Finished Grade: Copper.
 - 3. Bonding Jumpers: Braided copper tape, 1-inch (25 mm) wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

- B. Connectors and Grounding Rods: Comply with UL 467.
 - 1. Connectors for Below-Grade Use: Exothermic welded type.
 - 2. Grounding Rods: Copper-clad steel.
 - a. Size: 5/8 by 96 inches (16 by 2440 mm).

2.9 CONCRETE

- A. Concrete used in post setting shall be as set forth in Section 03300 (Cast-In-Place Concrete) of these Specifications.

2.10 GATE OPERATORS

- A. General: Provide factory-assembled automatic operating system designed for gate size, type, weight, and operation frequency. Provide operation control system with characteristics suitable for Project conditions, with remote-control stations, safety devices, and weatherproof enclosures. Coordinate electrical requirements with building electrical system.
 - 1. Provide operator designed so motor may be removed without disturbing limit-switch adjustment and without affecting auxiliary emergency operator.
 - 2. Provide operator with UL approval.
 - 3. Provide electronic components with built-in troubleshooting diagnostic feature.
- B. Comply with NFPA 70.
- C. Motor Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, within installed environment, with indicated operating sequence, and without exceeding nameplate rating or considering service factor. Comply with NEMA MG-1 and the following:
 - 1. Voltage: As shown on Drawings.
 - 2. Horsepower: 1.
 - 3. Enclosure: Totally enclosed.
 - 4. Duty: Continuous duty at ambient temperature of 105 deg F (40 deg C) and at altitude of 3,300 feet (1105 m) above sea level.
 - 5. Service Factor: 1.0 for totally enclosed motors.
 - 6. Phase: As shown on Drawings.
- D. Gate Operators: Concrete base/pad mounted and as follows:
 - 1. Hydraulic Slide Gate Operators:
 - a. Duty: medium commercial/industrial.
 - b. Gate Speed: Minimum 60 feet per minute.
 - c. Maximum Gate Weight: 500 lbs.
 - d. Frequency of use: 10 cycles per hour.
 - e. Locking: Hydraulic in both directions.
 - f. Heater: Manufacturer's standard track and roller heater with thermostatic control.
 - g. Operator Type: Wheel and rail drive with manual release.
 - 2. Product Reference Standard:
 - a. Manufacturer/Model: Hy Security, Model – SlideDriver 10.
- E. Remote Controls: Electric controls separated from gate and motor and drive mechanism, with NEMA ICS 6, Type 4 enclosure for pedestal mounting, and with space for additional optional equipment. Provide the following remote-control device(s):

1. Digital Keypad Entry Unit: Multiple-programmable, code capability of not less than 500 possible individual codes, consisting of one to seven digit codes and permitting four different access time periods.
 - a. Features: Timed anti-passback; limited-time usage; capable of monitoring and auditing gate activity.
 - b. Face-lighted unit with metal-keyed, keyless-membrane keypad fully visible at night.
 2. Remote Control Keyfob transmitters for gate operator: Quantity of 8.
 3. Telephone Entry System: Hands-free voice-communication system for connection to building telephone system with digital-entry code activation of gate operator and auxiliary keypad entry.
 - a. Multi-Unit System: Designed to be wired to a dedicated telephone line, with capacity to access 20 telephones, and with electronic directory.
 4. Vehicle Loop Detector: System including automatic closing timer with adjustable time delay before closing, timer cutoff switch, and loop detector designed to open and close gate. Provide electronic detector with adjustable detection patterns, adjustable sensitivity and frequency settings, and panel indicator light designed to detect presence or transit of a vehicle over an embedded loop of wire and to emit a signal activating the gate operator.
 - a. Loop: Wire, in size indicated for field assembly, for saw-cut with epoxy-grouted installation.
- F. Obstruction Detection Devices: Provide each motorized gate with automatic safety sensor(s). Activation of sensor(s) causes operator to immediately function as follows:
1. Action: Reverse gate in both opening and closing cycles and hold until clear of obstruction.
- G. Limit Switches: Adjustable switches, interlocked with motor controls and set to automatically stop gate at fully retracted and fully extended positions.
- H. Emergency Release Mechanism: Quick-disconnect release of operator drive system of the following type of mechanism, permitting manual operation if operator fails. Design system so control circuit power is disconnected during manual operation.
1. Type: Integral fail-safe release, allowing gate to be pushed open without mechanical devices, keys, cranks, or special knowledge.
- I. Operating Features:
1. Digital Microprocessor Control: Electronic programmable means for setting, changing, and adjusting control features with capability for monitoring and auditing gate activity. Provide unit that is isolated from voltage spikes and surges.
 2. System Integration: With controlling circuit board capable of accepting any type of input from external devices.
- J. Accessories:
1. Battery Backup System: Battery-powered drive and access control system, independent of primary drive system.
 - a. Fail Secure: Gate cycles on battery power, then fail safe when battery is discharged.
 2. Instructional, Safety, and Warning Labels and Signs: Manufacturer's standard for components and features specified.

2.11 POLYMER FINISHES

- A. Supplemental Color Coating: In addition to specified metallic coatings for steel, provide fence components with polymer coating.
- B. Metallic-Coated Steel Tension Wire: PVC-coated wire complying with ASTM F 1664, Class 2b.
- C. Metallic-Coated Steel Barbed Wire: PVC-Coated wire complying with ASTM F 1665, Class 2b.
- D. Metallic-Coated Steel Framing and Fittings: Comply with ASTM F 626 and ASTM F 1043 for polymer coating applied to exterior surfaces and, except inside cap shapes, to exposed interior surfaces.
 - 1. Polymer Coating: Not less than 10-mil thick PVC finish.
- E. Color: Brown or green – or as otherwise selected by Architect/Engineer, and complying with ASTM F 934.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance.
 - 1. Do not begin installation before final grading is completed, unless otherwise permitted by Engineer.
 - 2. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet (152.5 m) or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

- A. Install chain-link fencing to comply with ASTM F 367 and more stringent requirements specified.
 - 1. Install fencing in accordance with the location shown on the Drawing unless otherwise directed by the Engineer.

3.4 CHAIN-LINK FENCE INSTALLATION

- A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

- B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.
1. Verify that posts are set plumb, aligned, and at the correct height and spacing. Hold in position during setting with concrete or mechanical devices.
 2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.
 - a. Exposed Concrete: Extend 2 inches (50 mm) above grade; shape and smooth to shed water.
- C. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F 567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.
- D. Line Posts: Space line posts uniformly at 10 feet (3 m) on center.
- E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Install braces at end and gate posts and at both sides of corner and pull posts.
1. Locate horizontal braces at midheight of fabric 6 feet (1.83 m) or higher, on fences with top rail and at 2/3 fabric height on fences without top rail. Install so posts are plumb when diagonal rod is under proper tension.
- F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch- (3.05-mm-) diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches (610 mm) on center. Install tension wire in locations indicated before stretching fabric.
1. Bottom Tension Wire: Install tension wire within 6 inches (150 mm) of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps, bending to radius for curved runs and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.
- H. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches (50 mm) between finish grade or surface and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.
- I. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches (380 mm) on center.
- J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one (1) end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing.
1. Maximum Spacing: Tie fabric to line posts at 12 inches (300 mm) on center and to braces at 24 inches (610 mm) on center.
- K. Fasteners: Install nuts for tension bands and carriage bolts on the side of the fence opposite the fabric side. Peen ends of bolts or score threads to prevent removal of nuts.
- L. Barbed Wire: Install barbed wire uniformly spaced, angled toward security side of fence. Pull wire taut and install securely to extension arms and secure to end post or terminal arms.

3.5 GATE INSTALLATION

- A. Install gates according to manufacturer's written instructions, level, plumb, and secure for full opening without interference. Attach fabric as required for fencing. Attach hardware using tamper-resistant or concealed means. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary.

3.6 GROUNDING AND BONDING

- A. Fence Grounding: Install at maximum intervals of 500 feet (450 m) except as follows:
 - 1. Fences within 100 Feet (30 m) of Buildings, Structures, Walkways, and Roadways: Ground at maximum intervals of 500 feet (225 m).
 - a. Gates and Other Fence Openings: Ground fence on each side of opening.
 - 1) Bond metal gates to gate posts.
 - 2) Bond across openings, with and without gates, except openings indicated as intentional fence discontinuities. Use No. 2 AWG wire and bury at least 18 inches (460 mm) below finished grade.
- B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet (45 m) on each side of crossing.
- C. Fences Enclosing Electrical Power Distribution Equipment: Ground as required by IEEE C2, National Electrical Safety Code, unless otherwise indicated.
- D. Grounding Method: At each grounding location, drive a grounding rod vertically until the top is 6 inches (150 mm) below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location, including the following:
 - 1. Each Barbed Wire Strand: Make grounding connections to barbed wire with wire-to-wire connectors designed for this purpose.
- E. Bonding Method for Gates: Connect bonding jumper between gate post and gate frame.
- F. Connections: Make connections so possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.
- G. Bonding to Lightning Protection System: If fence terminates at a lightning-protected building or structure, ground the fence and bond the fence grounding conductor to a lightning protection down conductor or lightning protection grounding conductor complying with NFPA 780.

3.7 FIELD QUALITY CONTROL

- A. Grounding-Resistance Testing: Engage a qualified independent testing and inspecting agency to perform field quality-control testing.
 - 1. Grounding-Resistance Tests: Subject the completed grounding system to a megger test at each grounding location. Measure grounding resistance not less than two (2) full days after last trace of precipitation, without soil having been moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural grounding resistance. Perform tests by two-point method according to IEEE 81.
 - 2. Excessive Grounding Resistance: If resistance to grounding exceeds specified value, notify Engineer promptly. Include recommendations for reducing grounding resistance and a proposal to accomplish recommended work.
 - 3. Report: Prepare test reports certified by a testing agency of grounding resistance at each test location. Include observations of weather and other phenomena that may affect test results.

3.8 ADJUSTING

- A. Gate: Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's personnel to adjust, operate and maintain gates.

END OF SECTION 02821

SECTION 02920 - CLEANUP, SEEDING, AND SOD

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section sets forth requirements for completing proper cleanup of all areas utilized in construction of the Work. This Section also sets forth the materials and procedures required for the seeding, sodding, fertilizing, and mulching of all required areas. Cleanup is an important part of the project, and adequate equipment and qualified personnel shall be applied to this portion of the construction procedures from the beginning of the project. The general classifications of cleanup shall be as set forth below.
 1. Class I Cleanup: Areas of construction within lawns, gardens, and other well-kept areas, including street right-of-ways.
 2. Class II Cleanup: Areas of construction within fields, meadows, and other graded areas not included under Class I.
 3. Class III Cleanup: Areas of construction that are heavily brushed or wooded, steep rocky slopes, and other areas where it is not practical for the area to be cultivated.
 4. Special Cleanup: Areas of construction which require special cleanup procedures.
- B. Final cleanup shall be performed immediately after pipe construction and other facility installations. Cleanup shall be completed on each pipeline segment or other installation, including all necessary seeding and sodding. Sod, where required, shall match the adjacent turf conditions and horticultural species.

PART 2 - PRODUCTS

2.1 TOPSOIL

- A. Topsoil shall be stripped as specified in the Topsoil Removal paragraph in the Site Preparation, Excavation, and Fill Section of these Specifications and shall be used for the establishment and repair of vegetative cover. All disturbed areas shall receive a minimum of six (6) inches of topsoil, regardless of Cleanup Class. In the event there is insufficient topsoil stored along the ditch line to accomplish the topsoiling requirement, the Contractor shall haul in additional topsoil at own expense to meet this requirement.
- B. Topsoil shall be a loam or silty loam, free of clay lumps, rocks, and excessive amount of roots. Topsoil shall have an organic content of at least 1%.

2.2 SEED

- A. Seed shall be labeled in accordance with the rules and regulations of the Arkansas State Plant Board and shall have a minimum of 98% pure seed and 85% germination by weight, as well as contain no noxious weed seeds. Seed that has become wet, moldy, or otherwise damaged in transit or storage shall not be accepted. Seeding shall be at the rates and mixtures as set forth herein, depending on type of seeding and season, unless otherwise specified. Seed shall be uniformly applied using a spreader. Seeds shall be watered as required to obtain an adequate stand of grass cover.
1. Temporary Seeding: Areas denuded of vegetation by grading operations, stockpiles of topsoil, or other areas disturbed by the Contractor which are subject to erosion shall be temporarily seeded with annual rye grass and covered with mulch. Temporary seeding shall be at a rate of 0.25 pounds per 100 square feet.
 2. Permanent Seeding: Permanent seeding shall be composed of the varieties and amounts by weight as listed for the specific class of cleanup set forth herein.

2.3 FERTILIZER

- A. Fertilizer shall be a commercial grade, uniform in composition, free flowing, and suitable for application with mechanical equipment. Fertilizer shall be delivered to the site in labeled containers conforming to all local, state, or federal fertilizer laws and bearing the analyses of the nutrients. Nutrients shall be proportioned 13-13-13 (nitrogen-phosphorus-potash). Fertilizer shall be applied to all seeded and sodded areas at the rates specified herein.

2.4 SOD

- A. Sod shall consist of cuttings procured from areas where the soil is fertile, as indicated by vigorous growth. The grass shall have a healthy root system of dense, thickly matted roots throughout the sod for a minimum thickness of three (3) inches. The sod shall be substantially free from noxious weeds or otherwise undesirable grasses and shall not contain any chemicals or other matter injurious to its growth or hardiness when transplanted, including staples. All sources of sod shall be approved by the Engineer. Palleted and rolled sod shall be acceptable.

2.5 MULCHING STRAW

- A. Straw for mulching shall be from threshed rice, oats, wheat, barley, or rye; hay obtained from various legumes or grasses such as lespedeza, clover, vetch, soybeans, Bermuda, carpet sedge, Bahia, and fescue; or a combination thereof. Mulch shall be dry and reasonably free from Johnson grass or other noxious weeds, chemicals, or other injurious matter and shall not be excessively brittle or in a state of decomposition. All material shall be approved by the Engineer prior to use.

2.6 TACKIFIERS

- A. Tackifiers shall be used to adhere the mulch mat together, keeping it intact under normal climatic conditions, and shall meet all AHTD requirements for approved materials.

2.7 HYDRO-SEEDER APPLICATIONS

- A. Application of seed and fertilizer incorporated into one operation by "Hydro-Seeder" equipment shall be acceptable when prior approved by the Engineer and as specified herein.

2.8 WATER

- A. Water shall be of irrigation quality, free of impurities that would be detrimental to plant growth.

PART 3 - EXECUTION

3.1 The method of cleanup for each of the classes defined above shall be as set forth below.

- A. All Areas: During construction, the Contractor shall keep the construction area clean and neat at all times. For all classes of cleanup, the Contractor shall clean the entire area after construction has been completed.
 - 1. Excess materials, excavation, brush, trash, debris, and other construction materials shall be removed and disposed of as the Work progresses. In built-up areas, such as lawns, the jobsite shall be cleaned up immediately behind construction. Streets and driveways blocked by excess materials after construction is completed shall not be tolerated. All construction areas shall be cleaned to the satisfaction of the Owner.
 - 2. If any trench should settle while the Contractor is still on the job or within one (1) year of the project completion date, the Contractor shall make the required repairs in accordance with these Specifications.
- B. Class I Cleanup: The trench shall be backfilled in accordance with the applicable Section for water or sewer lines in these Specifications. Areas which have been disturbed, including those areas damaged by the tracks of heavy equipment, shall be carefully backfilled and repaired as though part of the actual trench excavation. A minimum of six (6) inches of topsoil shall be placed on all disturbed areas. After the topsoil has been spread over the damaged areas, the Contractor shall immediately hand-rake the entire construction area to remove all rock. Debris of every type shall be removed and all damaged tree limbs shall be pruned in accordance with ANSI A300 (Tree, Shrub, and Other Woody Plant Maintenance - Pruning (Part I)) by a qualified horticulturist, unless otherwise directed by the Engineer.
 - 1. Establishment of vegetation shall be by either seeding or sodding as shown on the Drawings or as otherwise directed by the Engineer.
 - 2. Seeding: The area to be seeded shall be brought to a reasonably smooth and uniform surface to conform to the finished grade indicated on the Drawings. The area shall be thoroughly pulverized by means of disk harrows or another approved means, unless otherwise specified, to a depth of at least six (6) inches below the finished grade. The area shall be lightly firmed with a cultipacker or otherwise rolled before seeding. Water may be required before, during, and after site preparation to maintain an adequate soil moisture content, as directed by the Engineer.
 - a. Fertilizer shall be applied to all seeded areas at a rate of 800 lb/acre. Fertilizer shall be thoroughly incorporated into the soil. Application of seed and fertilizer integrated into one operation by an approved "Hydro-Seeder" method shall be acceptable. A maximum of 800 pounds of fertilizer shall be permitted per 1,500 gallons of water.

- b. After the area has been adequately raked and accepted by the Engineer, the area shall be seeded at the rate of 0.15 pounds per 100 square feet, using the following seed mixture with percent expressed in terms of weight, unless sod shall be otherwise applied.

Lawn Fescue	30%
Blue Grass	30%
Rye Grass (Annual)	35%
White Clover (Common)	5%

- c. Straw for mulch shall be uniformly placed over seeded areas to provide a cover thickness of approximately two (2) inches. Mulch shall be anchored using a tracking or roller method by pressing the mulch into the soil or by applying a tackifier at a rate of approximately 0.05 gallons/square yard. The Contractor may use an approved mulching machine to combine the operations of applying mulch cover and tackifier into one procedure.
3. Sodding: If the existing ground cover does not contain any of the grasses as set out in the seed mixture above, the Contractor shall be responsible for cutting, removing, and stockpiling the existing sod on the job site. After backfilling, the sod shall be replaced to a condition equal to or better than that prior to construction. In the event that an insufficient amount of sod has been stored or if sod has been lost or destroyed, the Contractor shall be responsible for providing and installing new ground cover of the existing type.
- a. The area to be sodded shall be brought to a reasonably smooth and uniform surface to conform to the finished grade indicated on the Drawings. The area shall be firm but compacted, with the top one (1) inch below the finished grade loosened, unless otherwise specified. Water may be required before, during, and after site preparation to maintain an adequate soil moisture content, as directed by the Engineer. Fertilizer shall be applied to the areas receiving sod at a rate of 250 lbs/acre and incorporated into the top inch of soil.
- b. Areas producing sod mulch shall be mowed and raked to remove weeds and undesirable matter. Sod shall be excavated with an approved device, such as a sod cutter, and care shall be taken to retain the native soil intact. Cut sod shall be hauled and placed immediately. Sod shall be kept moist from the time it is cut until hand placement on a moist earth bed. Sod shall be placed at the base of slopes, working upward. At the top of slopes, sod shall be turned slightly into the embankment and a layer of earth placed over it and compacted, so as to direct surface water over and onto the sod.
- c. After the sod has been spread and shaped uniformly, the area shall be firmed with the use of a lawn roller or other approved equipment, with care taken to avoid tearing the end strips. When sodding is completed, the area shall be cleared of loose sod, excess soil, and other foreign material.
- d. Watering shall be required immediately after placement of seeding or sod and at a rate and frequency to sufficiently establish adequate vegetation. The Contractor shall maintain growth areas for 3 weeks after the time of placement or until final acceptance of the project, whichever is greater.

- C. Class II Cleanup: The trench shall be backfilled in accordance with the applicable Section for water or sewer pipe in these Specifications. Areas which have been disturbed, including those areas damaged by the tracks of heavy equipment, shall be carefully backfilled and repaired as though part of the actual trench excavation. A minimum of four (4) inches of topsoil shall be

placed on all disturbed areas. After the topsoil has been spread over the damaged areas, the Contractor shall immediately hand-rake the entire construction area to remove all rock. Debris of every type shall be removed and all damaged tree limbs shall be pruned in accordance with ANSI A300 (Tree, Shrub, and Other Woody Plant Maintenance – Pruning (Part I)) by a qualified horticulturist, unless otherwise directed by the Engineer.

1. Establishment of vegetation shall be by either seeding or sodding as shown on the Drawings or as otherwise directed by the Engineer.
2. Seeding: The area to be seeded shall be brought to a reasonably smooth and uniform surface to conform to the finished grade indicated on the Drawings. The area shall be thoroughly pulverized by means of disk harrows or another approved means, unless otherwise specified, to a depth of at least four (4) inches below the finished grade. The area shall be lightly firmed with a cultipacker or otherwise rolled before seeding. Water may be required before, during, and after site preparation to maintain an adequate soil moisture content, as directed by the Engineer.
 - a. Fertilizer shall be applied to all seeded areas at a rate of 800 lb/acre. Fertilizer shall be thoroughly incorporated into the soil. Application of seed and fertilizer integrated into one operation by an approved "Hydro-Seeder" method shall be acceptable. A maximum of 800 pounds of fertilizer shall be permitted per 1,500 gallons of water.
 - b. After the area has been adequately raked and accepted by the Engineer, the area shall be seeded at the rate of 0.15 pounds per 100 square feet, using the following seed mixture with percent expressed in terms of weight, unless sod shall be otherwise applied.

Blue Grass	40%
Rye Grass (Annual)	55%
White Clover (Common)	5%

- c. Straw for mulch shall be uniformly placed over seeded areas to provide a cover thickness of approximately two (2) inches. Mulch shall be anchored using a tracking or roller method by pressing the mulch into the soil or by applying a tackifier at a rate of approximately 0.05 gallons/square yard. The Contractor may use an approved mulching machine to combine the operations of applying mulch cover and tackifier into one procedure.
3. Sodding: If the existing ground cover does not contain any of the grasses as set out in the seed mixture above, the Contractor shall be responsible for cutting, removing, and stockpiling the existing sod on the job site. After backfilling, the sod shall be replaced to a condition equal to or better than that prior to construction. In the event that an insufficient amount of sod has been stored or if sod has been lost or destroyed, the Contractor shall be responsible for providing and installing new ground cover of the existing type.
 - a. The area to be sodded shall be brought to a reasonably smooth and uniform surface to conform to the finished grade indicated on the Drawings. The area shall be firm but compacted, with the top one (1) inch below the finished grade loosened, unless otherwise specified. Water may be required before, during, and after site preparation to maintain an adequate soil moisture content. Fertilizer shall be applied to the areas receiving sod at a rate of 250 lbs/acre and incorporated into the top inch of soil.
 - b. Areas producing sod mulch shall be mowed and raked to remove weeds and undesirable matter. Sod shall be excavated with an approved device, such as a sod cutter, and care shall be taken to retain the native soil intact. Cut sod shall be

hauled and placed immediately. Sod shall be kept moist from the time it is cut until hand placement on a moist earth bed. Sod shall be placed at the base of slopes, working upward. At the top of slopes, sod shall be turned slightly into the embankment and a layer of earth placed over it and compacted, so as to direct surface water over and onto the sod.

- c. After the sod has been spread and shaped uniformly, the area shall be firmed with the use of a lawn roller or other approved equipment, with care taken to avoid tearing the end strips. When sodding is completed, the area shall be cleared of loose sod, excess soil, and other foreign material.
- d. Watering shall be required immediately after placement of seeding or sod and at a rate and frequency to sufficiently establish adequate vegetation. The Contractor shall maintain growth areas for 3 weeks after the time of placement or until final acceptance of the project, whichever is greater.

D. Class III Cleanup: The trench shall be backfilled in accordance with the applicable Section for water or sewer pipe in these Specifications. After backfill is complete, all damaged brush shall be cut just below ground surface, and all damaged limbs shall be trimmed in accordance with ANSI A300. A minimum of four (4) inches of topsoil shall be placed on all disturbed areas at the discretion of the Engineer. All debris shall be disposed of by the Contractor, and the entire area shall be machine-raked to bring the area of construction to a condition equal or better than pre-construction conditions.

- 1. The area to be seeded shall be brought to a reasonably smooth and uniform surface to conform to the finished grade indicated on the Drawings. The area shall be thoroughly pulverized by means of disk harrows or another approved means, unless otherwise specified, to a depth of at least four (4) inches below the finished grade. The area shall be lightly firmed with a cultipacker or otherwise rolled before seeding. Water may be required before, during, and after site preparation to maintain an adequate soil moisture content.
 - a. Fertilizer shall be applied to all seeded areas at a rate of 800 lb/acre. Fertilizer shall be thoroughly incorporated into the soil. Application of seed and fertilizer integrated into one operation by an approved "Hydro-Seeder" method shall be acceptable. A maximum of 800 pounds of fertilizer shall be permitted per 1,500 gallons of water.
 - b. After the area has been adequately raked and accepted by the Engineer, the area shall be seeded at the rate of 0.15 pounds per 100 square feet, using the following seed mixture with percent expressed in terms of weight, unless sod shall be otherwise applied.

Blue Grass	40%
Rye Grass (Annual)	55%
White Clover (Common)	5%

- c. Straw for mulch shall be uniformly placed over seeded areas to provide a cover thickness of approximately two (2) inches. Mulch shall be anchored using a tracking or roller method by pressing the mulch into the soil or by applying a tackifier at a rate of approximately 0.05 gallons/square yard. The Contractor may use an approved mulching machine to combine the operations of applying mulch cover and tackifier into one procedure.
- d. Water shall be required immediately after placement of seeding or sod and at a rate and frequency to sufficiently establish adequate vegetation. The Contractor shall

maintain growth areas for 3 weeks after the time of placement or until final acceptance of the project, whichever is greater.

- E. Restoration of Damaged Surfaces and Property: If any pavement, vegetation, or other property is damaged, removed, or otherwise disturbed by the Contractor, through intentional or non-intentional failure to carry out the requirements of the contract documents, state laws, municipal ordinances, and/or the specific direction of the Engineer or through failure to employ typical and reasonable safeguards, such property shall be replaced and repaired at the expense of the Contractor.
- F. Access after Construction: Unless otherwise directed by the Engineer, all areas shall be graded after construction to be accessible by a four-wheel-drive vehicle at a minimum.
- G. Erosion Control: Erosion control measures and procedures shall comply with all permit requirements and as set forth in the Erosion Control paragraph in the General Project Considerations Section as well as the Environmental Permits Section found elsewhere in these Specifications.
- H. Final Acceptance: Before final acceptance, the Contractor shall repair or replace any seeding or sodding that is defective or has been damaged.

END OF SECTION 02920

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mixture design and placement procedures.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement and fly ash; subject to compliance with requirements.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Coarse Aggregate Gradation.
- C. Fine Aggregate Gradation.
- D. Concrete strength test results and mix design used from a record of past performance, or the laboratory trial mix designs and results, and the mix design proposed for each mixture and use under this contract in accordance with ACI 301 "Specifications for Structural Concrete."
 - 1. Test records shall consist of data that is not more than 12 months old.
 - 2. Indicate amounts of mixing water to be withheld for later addition at the Project site.
- E. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- F. Qualification Data: For testing agency.
- G. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates. Include service record data or laboratory test results if service record is not available, indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

- H. Material Certificates: For each of the following, signed by manufacturers:
1. Cementitious materials.
 2. Admixtures.
 3. Form materials and form-release agents.
 4. Steel reinforcement and accessories.
 5. Curing compounds.
 6. Bonding agents.
 7. Adhesives.
 8. Repair materials.
- I. Field quality-control test and inspection reports.
- J. Ready-Mix Concrete
1. Provide delivery tickets for ready-mix concrete with each batch before unloading at the Project site per ASTM C 94. The following information shall be printed, stamped, or written on each delivery ticket.
 - a. Name of ready-mix company and batch plant or batch plant number.
 - b. Serial number of ticket.
 - c. Date.
 - d. Truck number.
 - e. Specific designation of job (name and location).
 - f. Specific designation of the concrete.
 - g. Mix design information of accepted mix(s) for job.
 - h. Amount of concrete in cubic yards.
 - i. Time, to the nearest minute, loaded or of first mixing of cement, aggregates, and water.
 - j. Reading of revolution counter at the first addition of water.
 - k. Type, brand, and amount of cement.
 - l. Type, brand, and amount of fly ash.
 - m. Type, brand, and amount of admixtures.
 - n. Weight of coarse aggregate.
 - o. Weight of fine aggregate.
 - p. Source and amount of each volume of metered or weighed water.
 - q. Total amount of mixing water including batch water (metered or weighed) including ice batched at the plant and water added by the truck operator from the mixer tank.
 - r. Allowable amount of water to be added at the Project site.
 - s. Amount of water added at the Project site by receiver of concrete and his/her initials.
 - t. Time, to the nearest minute, corresponding to the times when it arrived at the site, when unloading began, and when unloading was finished.
 - u. Reading of revolution counter when unloading began.
 - v. Reading of revolution counter before and after addition of admixtures or additional water at Project site.
 2. Water added at the plant shall account for moisture in both coarse and fine aggregate. If water is added on the job the total water content shall not exceed the water to cementitious materials ratio of the approved design mix.
 3. Keep records showing time and place of each pour (placement) of concrete, together with transit-mix delivery slips certifying the contents of the pour (placement).
 4. Furnish two (2) delivery tickets/records to Engineer for each batch.

1.5 QUALITY ASSURANCE

- A. **Manufacturer Qualifications:** A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. **Testing Agency Qualifications:** An independent agency, furnished by Contractor and acceptable to Owner and Engineer, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. The Contractor's qualified testing agency must be approved in writing by the Engineer.
 - 2. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 - 3. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Level 1. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Level 2.
- C. **Source Limitations:** Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer.
- D. **ACI Publications:** Comply with the following unless modified by requirements in the Contract Documents:
 - 1. ACI 301, "Specification for Structural Concrete," Sections 1 through 5.
 - 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."
 - 3. ACI 350, "Code Requirements for Environmental Engineering Concrete Structures."
 - 4. ACI 318, "Building Code Requirements for Reinforced Concrete."
- E. **Concrete Testing Service:** Contractor shall engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. **Steel Reinforcement:** Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. **Available Products:** Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. **Available Manufacturers:** Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 FORM-FACING MATERIALS

- A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
 - 1. Plywood, metal, or other approved panel materials.
 - 2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
 - a. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed, with each piece bearing legible inspection trademark.
- B. Rough-Formed Finished Concrete Not Exposed to View: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.
- C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.
- D. Void Forms: Biodegradable paper surface, treated for moisture resistance, structurally sufficient to support weight of plastic concrete and other superimposed loads.
- E. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch (19 by 19 mm), minimum.
- F. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- G. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments and/or finishing of concrete surfaces. Form-release agent shall have a maximum of 350 g/l volatile organic compounds (VOCs).
 - 1. Formulate form-release agent with rust inhibitor for steel form-facing materials.
- H. Form Ties: Factory-fabricated snap-off metal form ties designed to resist the lateral pressure of fresh concrete on forms, to prevent spalling of concrete on removal, and as follows:
 - 1. Removable taper ties shall not be permitted.
 - 2. Form ties shall be provided with a plastic cone or other suitable means for forming a conical hole to ensure that the form tie may be broken at face of the concrete. The maximum diameter of removable cones for rod ties, or of other removable form-tie fasteners having a circular cross-section, shall not exceed 1.5 inches, and all such fasteners shall be such as to leave holes of regular shape for reaming.
 - 3. Form ties shall leave no metal or other material except concrete closer than 1-1/2 inch to the plane of the exposed concrete surface.
 - 4. Form ties for water retaining structures shall have integral neoprene water seal waterstops, at midpoint, designed to tightly fit the form tie so that the waterstops/water seal cannot be moved from the midpoint area of the form tie.

2.3 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Steel Bar Mats: ASTM A 184/A 184M, fabricated from ASTM A 615/A 615M, Grade 60 (Grade 420), deformed bars, assembled with clips.

- C. Plain-Steel Wire: ASTM A 82, as drawn.
- D. Deformed-Steel Wire: ASTM A 496.
- E. Plain-Steel Welded Wire Reinforcement: ASTM A 185, plain, fabricated from as-drawn steel wire into flat sheets.
- F. Dowel Bar Substitutes: Dowel bar substitutes, including but not limited to, end anchors, threaded splicers, threaded dowels, and coupler splice systems, shall not be allowed unless shown otherwise on the Drawings.

2.4 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615 M Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.
- C. Tie wire shall be 16 gauge minimum, black, soft annealed.

2.5 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: Domestic conforming to ASTM C 150, Type I/II, gray. Cement may be supplemented with the following:
 - a. Fly Ash: ASTM C 618, Class F.
- B. Normal-Weight Aggregates: ASTM C 33 and as supplemented by these Specifications, Class 4S coarse aggregate or better, graded. Provide aggregates from a single source with documented service record data of at least 10 years satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials. Aggregates shall be free of any materials or substances with deleterious reactivity to alkali in cement.
 - 1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
 - 2. Fine Aggregate: ASTM C 33, free of materials or substances with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.

2.6 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260 and as follows:
 - 1. Air Entraining Agent: The air-entraining agent shall comply with the requirements of ASTM C260 "Standard Specification for Air-Entraining Admixtures for Concrete," and shall be added to the mixing water in solution. The Contractor shall submit evidence

based on tests made in a recognized laboratory to show that the air-entraining admixture conforms to the requirements of the latest revision (ASTM C260) for seven and 28 day compressive and flexural strengths and resistance to freezing and thawings, except as provided in the following paragraph.

Tests for bleeding, bond strength and volume change will not be required. Tests may be made upon samples taken from a quantity submitted by the Contractor for use on the project or upon samples submitted and certified by the manufacturer as representative of the admixture to be supplied.

- a. An exception to the requirements in the preceding paragraph is the case of admixtures which are manufactured by neutralizing Vinsol resin with caustic soda (sodium hydroxide). When the Contractor proposes to use such an admixture he shall submit a certification concerning the admixture in the following form:

"This is to certify that the product (trade name) as manufactured and sold by the (company) is an aqueous solution of Vinsol resin that has been neutralized with sodium hydroxide. The ratio of sodium hydroxide to Vinsol resin is one part of sodium hydroxide to (number) parts of Vinsol resin. The percentage of solids based on the residue dried at 105° C. is (number). No other additive or chemical agent is present in this solution."

- b. When the Contractor proposes to use an air-entraining admixture which has been previously approved, he shall submit a certification stating that the admixture is the same as that previously approved. If an admixture offered for use is essentially the same (with only minor difference in concentration) as another previously approved material, a certification will be required stating that the produce is essentially the same as the approved admixture and that no other admixture or chemical agent is present.
- c. Either prior to or at any time during construction, the Engineer may require that the admixture selected by the Contractor be further tested to determine its effect upon the strength of the concrete. When so tested, seven day compressive strength of concrete made with the cement and aggregates in the proportions to be used in the work shall be not less than 90 percent of the strength of concrete made with the same materials and with the same cement content and consistency but without the admixture.
- d. The percentage reduction in strength shall be calculated from the average strength of at least five standard 6 inch by 12 inch cylinders of each type of concrete. Specimens shall be made and cured in the laboratory in accordance with the requirements of the latest revision of ASTM C192 and shall be tested in accordance with the requirements of the latest revision of ASTM C39.

2. Available Products:

- a. MB-AE 90; BASF Construction Chemicals – Admixture Systems.
- b. Or equal.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.

4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.7 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete and compliant with local VOC requirements.
 1. Evaporation retarder shall be as recommended by the penetrating liquid floor treatment hardener manufacturer for those floors receiving the penetrating liquid floor treatment hardener.
 2. Evaporation retarder shall be as recommended by the cure and seal manufacturer for those floors receiving a cure and seal finish.
 3. Available Products:
 - a. Conspec by Dayton Superior; Aqua Film.
 - b. Meadows, W. R., Inc.; Evapre.
 - c. Euclid Chemical Company (The), an RPM Company; Eucobar.
 - d. Or equal.
- B. Curing Aids and Materials: Curing aids and materials for concrete not receiving the penetrating liquid floor treatment hardener or the cure and seal:
 1. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq.yd. (305 g/sq.m) when dry. The absorptive cover shall be clean, evenly woven, free of encrusted concrete or other contaminating materials that may discolor or stain the concrete, and shall be reasonably free from cuts, tears, and thin or weak places.
 2. Moisture Retaining Cover: ASTM C 171, white polyethylene film or white burlap-polyethylene sheet. Nominal thickness of polyethylene film shall be 6 mils. The sheet material shall exhibit a water vapor transmission rate (WVTR) of no more than 10 grams per square meter in twenty-four hours when tested according to Procedure E of ASTM E 96 – Test Methods for Water Vapor Transmission of Materials.
 3. Dissipating type white pigmented, resin-based liquid membrane meeting the requirements of ASTM C 309, Type 2, Class B – Liquid Membrane-Forming Components for Curing Concrete and compliant with local VOC requirements. Sodium silicate compounds shall not be allowed.
 - a. Available Products:
 - 1) Conspec by Dayton Superior, White Dissipating Cure EF.
 - 2) L & M Construction Chemicals, Inc., L & M Cure R-2.
 - 3) Or equal.
 4. Water: Potable.

2.8 RELATED MATERIALS

- A. Non-Epoxy Bonding Agents
 1. ASTM C 1059, Type II, non-redispersible, non-yellowing, acrylic emulsion or styrene butadiene, where indicated.
 - a. Available Products
 - 1) W. R. Meadows, Inc.; Acry-Lok.
 - 2) Or equal.
 2. Non-epoxy compound rewettable for up to 10 days, where indicated.

- a. Minimum Performance Properties
 - 1) Tensile Bond Strength ASTM C 932 - 385 psi.
 - 2) Flexural Bond Strength ASTM C 78 - 603 psi.
 - 3) Shear Bond Strength ASTM C 1042 - 740 psi.
 - b. Available Products
 - 1) Larsen Products; Weldcrete.
 - 2) Or equal.
- B. Epoxy Bonding Agent: ASTM C 881, two-component epoxy adhesive capable of humid curing and bonding to damp surfaces.
- 1. Available Products
 - a. Sika Chemical Corporation; Sikadur 32 Hi-Mod.
 - b. Euclid Chemical Company; Euco Epox 452.
 - c. Or equal.
- C. Reglets: Fabricate reglets of not less than 0.022-inch- (0.55-mm-) thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

2.9 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
- 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
 - 2. The criteria hereinafter set out are solely for the purpose of establishing required mixture proportions and do not constitute a basis for confirming the adequacy of concrete strength.
 - a. Required Average Strength Above Specified Compressive Strength: Proportions, including water-cement ratio, shall be established on the basis either of laboratory trial batches or of field experience with the materials to be employed. The proportions shall be selected to produce an average strength at 28 days exceeding the specified compressive strength by the amount indicated below, when both air content and slump are the maximums permitted by the Specifications.
 - b. Determination of the required average strength shall be in accordance with ACI 318 "Building Code Requirements for Reinforced Concrete," except that if suitable data from trial batches or field experience cannot be obtained, permission will not be granted to base concrete proportions on the water-cement ratio limits set out in the above referenced code.
 - 1) Past Plant Performance: Proportions may be established on the actual field performance of the ready-mix producer. Where the concrete production facility has a record, based on at least 30 consecutive strength tests consisting of data that is not more than 12 months old and representing similar materials and conditions to those expected, the strength used as the basis for selecting proportions shall exceed the required f'_c by at least:
 - 400 psi if the standard deviation is less than 300 psi;
 - 550 psi if the standard deviation is 300 to 400 psi;
 - 700 psi if the standard deviation is 400 to 500 psi;
 - 900 psi if the standard deviation is 500 to 600 psi;
 - 1,200 psi if the standard deviation is above 600 psi or unknown.

Strength data for determining standard deviation shall be considered to comply with the foregoing stipulations if they represent either a group of at

least 30 consecutive tests or the statistical average of two groups totaling 30 or more tests. The tests used to establish standard deviation shall represent concrete produced to meet a specified strength or strengths within 1,000 psi of that specified for the proposed work. Changes in materials and proportions within the population of background tests shall not have been more closely restricted than they will be for the proposed work.

3. Laboratory Trial Batches: When the ready-mix producer does not have a record of past performance, the combination of materials and the proportions selected shall be determined from trial mixes having proportions and consistencies suitable for the work based on ACI 211.1.
 - a. When laboratory trial batches are used as the basis for selecting concrete proportions, strength tests shall be made in accordance with "Method of Test for Compressive Strength of Molded Concrete Cylinders" (ASTM C 39) on specimens prepared in accordance with "Method of Making and Curing Test Specimens in the Laboratory" (ASTM C 192).
 - b. Materials used in trial mixtures shall be those to be used for the proposed work.
 - c. Trial mixtures shall be designed to produce a slump within ± 0.75 inch of maximum permitted, and for air-entrained concrete, within ± 0.5 percent of maximum allowable air content.
 - d. For each water-cementitious materials ratio or cementitious materials content, at least three test cylinders for each test age shall be made and cured. Cylinders shall be tested at 28 days or at test age designated for determination of the specified compressive strength.
 - e. A curve shall be established showing the relationship between water-cementitious materials ratio (or cementitious materials content) and compressive strength. The curve shall be based on at least three points representing batches which produce strengths above and below that required. Each point shall represent the average of at least three specimens tested at 28 days or the earlier age designation.
 - f. The average strength required shall exceed the specified compressive strength by 1,200 psi.
 - g. The maximum permissible water-cementitious materials ratio (or minimum cementitious materials content) for the concrete to be used in the structure shall be that shown by the curve to produce the average strength indicated, but in no case shall the water-cementitious materials ratio exceed 0.42 by weight.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows:
 1. Fly Ash: 15 percent.
- C. Admixtures: All materials other than Portland cement, water and aggregates and the specified air-entraining admixture that are added to the concrete shall be subject to the permission of the Engineer. Use admixtures according to manufacturer's written instructions.
 1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

2.10 CONCRETE MIXTURES, SPECIFIC

A. Normal Weight Concrete

1. Minimum Compressive Strength: 4000 psi at 28 days.
2. Minimum cementitious materials content of 564 pounds per cubic yard.
3. Maximum Water-Cementitious Materials Ratio: 0.42 by weight.
4. Slump Limit: 2 to 4 inches without admixtures other than the specified air-entraining admixture at the point of delivery or a maximum slump of 8 inches at the point of delivery for concrete with a verified slump of 2 to 4 inches before adding high-range water-reducing admixture.
5. Air Content: ASTM C 94, 5 percent, plus or minus 1.5 percent at point of delivery, nominal 1 inch maximum aggregate size. Maximum total air content of trowel-finished flatwork protected from the elements shall be 3 percent.
6. Aggregates: The gradation of the aggregate shall be determined by laboratory methods with sieves having square openings and complying with the following:
 - a. Coarse Aggregate: Coarse aggregate size shall be reasonably well graded from coarse to fine and shall conform to ASTM C 33 "Standard Specification for Concrete Aggregates" Size No. 57 Class 4S with the following grading requirements when tested in accordance with ASTM C 136 "Standard Method for Sieve Analysis of Fine and Coarse Aggregate."

<u>Sieve Identification</u>	<u>Percent Passing</u>
1 - 1-1/2"	100%
1"	95-100%
3/4"	-
1/2"	25-60%
3/8"	-
No. 4	0-10%
No. 8	0-5%

Coarse aggregate from any one source shall not vary as to maximum size and shall be uniform to a reasonable degree in gradation with the representative sample and/or gradation submitted by the Contractor. If the fineness modulus varies by more than 0.20 from the value assumed in selecting proportions for the concrete, the aggregate will be rejected unless suitable adjustments are made in concrete proportions to compensate for the difference in grading.

- b. Fine Aggregate: Fine aggregate shall be reasonably well graded from coarse to fine, and shall conform to ASTM C 33 "Standard Specification for Concrete Aggregates" with the following grading requirements:

<u>Sieve Identification</u>	<u>Percent Passing</u>
3/8"	100%
No. 4	95-100%
No. 8	80-100%
No. 16	50-85%
No. 30	25-60%
No. 50	5-30%
No. 100	0-10%

Fine aggregate from any one source shall be uniform to a reasonable degree in gradation with the representative sample submitted by the Contractor.

The fineness modulus of the fine aggregate shall not be less than 2.3 nor more than 3.1 and shall not vary more than 0.20 from the value assumed in selecting proportions for the concrete. If this value is exceeded, the fine aggregate shall be rejected unless suitable adjustments are made in the proportions of fine and coarse aggregates.

2.11 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.12 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and provide delivery tickets as specified in Part 1.4 of this specification.
 1. Discharge of concrete shall be completed within 1-1/2 hours, or before the drum has revolved 300 revolutions, whichever comes first, after the introduction of the mixing water to the cement and aggregates or the introduction of the cement to the aggregates.
 2. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and placement time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and placement time to 60 minutes.
 3. Water added at the plant shall account for moisture in both coarse and fine aggregate. If water is added on the job the total water content shall not exceed the water to cementitious materials ratio of the approved design mix.
 4. Keep records showing time and place of each pour (placement) of concrete, together with transit-mix delivery slips certifying the contents of the pour (placement).
 5. Furnish two delivery tickets/records to Engineer for each batch.

PART 3 - EXECUTION

3.1 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
 2. Class C, 1/2 inch (13 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 1. Install keyways, reglets, recesses, and the like, for easy removal.
 2. Do not use rust-stained steel form-facing material.

3. Use only form or form-tying methods which do not cause spalling of the concrete upon form stripping or tie removal.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports at the base of column and wall formwork where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations, where possible.
- H. Chamfer exterior corners and edges of permanently exposed concrete. Place and secure 3/4 inch minimum chamfer strips in the corners of formwork to produce beveled edges.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
 1. Determine sizes and locations from trades providing such items.
 2. Openings shall be of sufficient size to permit final alignment of pipes or other items without deflection or offsets of any kind. Allow space for packing where items pass through the wall to ensure watertightness. Provide openings with continuous keyways and waterstops. Provide a slight flare to facilitate grouting and the escape of entrained air during grouting. Provide formed openings with reinforcement as indicated in the typical structural details. Reinforcing shall be at least 2 inches clear from the opening surfaces and encased items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcing steel. Do not allow form-release agent to puddle in the forms. Do not allow form-release agent to contact reinforcing steel, embedded items, waterstop, or hardened concrete against which fresh concrete is to be placed.

3.2 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 1. Install anchor bolts/rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 3. Check special castings, channels or other metal parts that are to be embedded in the concrete prior to and again after placing the concrete.
 4. Check nailing blocks, plugs and strips necessary for the attachment of trim, finish and similar work prior to placing the concrete.

3.3 PIPES AND WALL SPOOLS CAST IN CONCRETE

- A. Install wall spools, wall flanges, and wall anchors before placing concrete. Do not weld, tie, or otherwise connect the wall spools or anchors to the reinforcing steel.
- B. Support pipe and fabricated fittings to be encased in concrete on concrete piers or pedestals. Carry concrete supports to firm foundations so that no settlement will occur during construction.
- C. Pipes or spools located below operating water level shall have waterstop ring collars and shall be cast in place. Do not block out such piping and grout after the concrete section is cast, unless otherwise approved by Engineer. Pipes fitted with thrust rings shall be cast in place.

3.4 REMOVING AND REUSING FORMS

- A. Forms shall be removed in such a manner as not to impair safety and serviceability of the structure.
- B. Forms shall not be disturbed until the concrete has adequately hardened. Concrete exposed by form removal shall have sufficient strength not to be damaged by removal operation.
- C. Supporting forms and shores shall not be removed until the member has acquired sufficient strength to safely support both the weight of the member and any construction loads on the member. Do not apply loading on green concrete.
- D. Immediately after forms are removed, the surface of the concrete shall be carefully examined and any irregularities, depressions, and tie holes shall be repaired as specified in Section 03320 – Finishing and Repairs for Cast-In-Place Concrete. Follow repair work immediately with specified curing.
- E. When forms are removed before the specified curing is completed, measures shall be taken to continue the curing and provide adequate thermal protection for the concrete.
- F. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete, if concrete is hard enough to not be damaged by form-removal operations and curing and protection operations are maintained.
- G. Leave formwork for beam soffits, joists, slabs, beams, girders, and other in-place structural elements that supports weight of concrete in place until concrete has achieved 100 percent of its 28-day design compressive strength.
- H. Leave bracing for walls until the top/roof slab concrete has achieved 100 percent of its specified 28-day design compressive strength.
- I. When removal of formwork is based on concrete reaching the specified compressive strength, concrete strength data shall be based on tests of field-cured cylinders. The field-cured cylinders shall be cured under conditions that are not more favorable than the most unfavorable conditions for the concrete the test specimens represent. Cure the cylinders under the same temperature and moisture conditions as used for the concrete they represent.
- J. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

- K. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- L. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces.

3.5 ALUMINUM SURFACES IN CONTACT WITH CONCRETE

- A. Aluminum surfaces in contact with concrete or grout or dissimilar metals shall be protected with a Mylar isolator, bituminous paint or other material approved by Engineer.

3.6 SHORES AND RESHORES

- A. Comply with ACI 318 and ACI 301 for design, installation, and removal of shoring and reshoring.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement.

3.7 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
- B. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- C. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- D. Accurately position, support, and secure reinforcement against displacement, in accordance with the Drawings. Do not exceed the placing tolerances specified in ACI 117 before concrete is placed. Placing tolerances shall not reduce concrete cover requirements except as specified in ACI 117. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
- E. Do not tack weld crossing reinforcing bars. Do not place metal clips or supports in contact with the forms. Bend tie wire ends away from the forms to provide the specified concrete coverage.
- F. Bars additional to those shown in the Drawings, which may be found necessary or desirable by the Contractor for the purpose of securing reinforcement in position, shall be provided by the Contractor at his own expense.
- G. Reinforcement indicated in the Drawings is continuous through the structure to the farthest extent possible. Terminate bars 2 inches clear from faces of concrete. Splices may be used to provide continuity due to bar length limitations. Minimum length of bars spliced for this reason

is 40 feet. Splicing of reinforcement which is detailed to be continuous in the Drawings shall not be permitted unless accepted by the Engineer.

- H. Do not straighten or rebend reinforcing steel in the field. Do not use reinforcing with bends not shown in the Drawings.
- I. Place reinforcement a minimum of 2 inches clear of any metal pipe, fittings, or embedded items unless specifically shown otherwise.
- J. Secure reinforcing dowels in place prior to placing concrete. Do not press dowels into the concrete after the concrete has been placed.
- K. Support and tie wire mesh to prevent movement during concrete placement.
- L. Position and secure dowels for masonry walls to occur at reinforced block cells as indicated in the Drawings.
- M. Splices shall be as indicated in the Drawings.
- N. Place additional reinforcement around pipe or openings as indicated in the Drawings.
- O. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire. Ball reinforcement into position as concrete is placed by means of hooks and work concrete under the reinforcement to ensure reinforcement is placed at the proper distance above the bottom of the slab.

3.8 CONCRETE PLACEMENT

- A. Placement shall conform to ACI 301 and ACI 304, and as modified by these Specifications.
- B. Prior to placing concrete, verify that installation of formwork, reinforcement, and embedded items are complete and that required inspections have been performed. Comply with the following:
 - 1. Notify the Engineer and Resident Project Representative of readiness, not just intention, to place concrete in any portion of the Work. This notification shall be such time in advance of the operation as the Engineer deems necessary to allow observation of the work at the location of the proposed concrete placing (24 hours minimum). Failure of sufficient advance notification will be cause for delay in placing until observations can be completed. Forms, reinforcement, screeds, anchors, ties, inserts, and other embedded items shall be in place before the Contractor's notification of readiness is given.
 - 2. Concrete shall not be placed without a Resident Project Representative present, unless approved otherwise by Engineer.
 - 3. Coordinate in advance of concrete placement the sequence of placement to assure that construction joints will occur only as designed. Provide Engineer with a copy of the sequence of placement in advance of placement.
 - 4. Alternate sections of concrete walls and slabs may be cast simultaneously. Do not place adjacent sections of walls and slabs until seven (7) days after placement of first-placed concrete.
 - 5. Schedule sufficient equipment for continuous concrete placing. Provide for backup equipment and procedures to be taken in case of an interruption in placing. Provide

- backup concrete vibrators at the project site. Test concrete vibrators the day before placing concrete.
6. Remove snow, ice, frost, water and other foreign materials from surfaces, including reinforcement and embedded items, against which concrete will be placed.
 7. Earth surfaces shall be thoroughly moistened with water by sprinkling prior to the placing of any concrete and kept moist by sprinkling up to the time of placing concrete upon the surface in areas where vapor retarder is not used. The surface shall not contain standing water or wet, soft, muddy spots when the concrete is placed.
- C. Conveying Concrete: Concrete shall be conveyed from the mixer to the place of final deposit by methods that prevent segregation or loss of materials. Conveying equipment shall be of a size and design which is capable of providing a supply of concrete at the point of placement without separation of ingredients and without interruptions sufficient to permit loss of plasticity between successive increments. Do not use aluminum pipes or chutes. Clean conveying equipment before each placement.
- D. Before test sampling and placing concrete, water may be added at the Project site, subject to the limitations of ACI 301 and as indicated below:
1. Concrete slump may be adjusted to the required value by adding water up to the amount allowed in the accepted mixture proportions.
 2. Record the amount of water added at the Project site on the concrete delivery ticket.
 3. Addition of water shall be in accordance with ASTM C 94.
 4. Do not exceed the specified water-cementitious materials ratio or slump.
 5. Do not add water to the concrete after high-range water-reducing or plasticizing admixtures have been added to the concrete at the site to achieve flowable concrete.
 6. Do not add water to the concrete after test sampling or during placement of concrete.
- E. Do not place concrete until all free water has been removed or has been diverted by pipes or other means and carried out of the forms, clear of the work. Do not deposit concrete underwater (unless specifically shown and formally approved by Engineer), and do not allow free water to rise on any concrete until the concrete has attained its initial set. Do not permit free or storm water to flow over surfaces of concrete so as to injure the quality or surface finish.
- F. Where a vapor retarder is installed, do not puncture the vapor retarder by stakes or any other concrete accessory.
- G. Deposit concrete at or near its final position to avoid segregation caused by rehandling or flowing. Do not deposit concrete in large quantities in one place to be worked along the forms with a vibrator.
- H. Do not deposit concrete that has surface-dried, partially hardened, or has been contaminated by foreign materials in the structure, nor shall concrete which has been remixed after initial set or retempered concrete be used in the structure.
- I. Use mechanical vibration in placing concrete to eliminate rock pockets and voids, to consolidate each layer with that previously placed, to completely embed reinforcing bars and fixtures, and to bring just enough fine material to exposed surfaces to produce a smooth, dense, and even texture. Vibrators shall be of the high-frequency internal type, and the number in use shall be ample to consolidate the incoming concrete to a proper degree within 15 minutes after it is deposited in the forms. Do not use vibrators to move concrete within the forms. In all cases, at least two vibrators shall be available at the site. Use external vibrators for consolidating concrete when the concrete is otherwise inaccessible for adequate consolidating. Construct

forms with sufficient strength to resist displacement or damage when external vibrators are used.

- J. Do not place concrete during rainstorms. Protect concrete placed immediately before rainstorms to prevent rainwater from coming in contact with freshly placed or uncured concrete. Keep sufficient protective covering ready at all times for this purpose.
- K. Elephant Trunks: Use hoppers and elephant trunks or drop chutes to prevent the free-fall of concrete that results in separation of coarse particles.
- L. Chutes: Use metal or metal-lined chutes with a slope not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long and chutes not meeting the slope requirement may be used only if they discharge into a hopper before distribution.
- M. Deposit concrete continuously and in level layers of such thickness (not exceeding 2 feet in depth) so that no concrete will be deposited on concrete that has hardened sufficiently to cause the formation of seams, planes of weakness, or cold joints.
- N. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
 - 1. Consolidate concrete during placement operations so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 - 2. Maintain reinforcement in position on chairs during concrete placement.
 - 3. Screenshot slab surfaces with a straight-edge and strike off to correct elevations.
 - 4. Slope surfaces uniformly to drains where required.
 - 5. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface. Do not further disturb slab surfaces before starting finishing operations.
- O. At least two hours shall elapse after depositing concrete in the columns or walls before depositing in beams, girders, or slabs supported thereon. Place beams, girders, brackets, column capitals, and haunches monolithically as part of the floor or roof system, unless otherwise indicated in the Drawings.
- P. Maximum Height of Concrete Pours and Free-Fall: Do not drop freely into place from a height greater than 6 feet in unexposed work and 4 feet in exposed work. Use tremies or pumps where the drop exceeds these limits. Provide a formwork design and placement schedule that will limit free-fall of concrete in walls 8 inches or less in thickness to 4 feet, and for walls thicker than 8 inches, limit free-fall to 6 feet. Total vertical lift made in a single pass shall not exceed 2 feet in height.
- Q. Pumping Concrete
 - 1. Conform to the recommendations of ACI 304.2R – Placing Concrete by Pumping Methods, except as modified herein.
 - 2. Base pump size on rate of concrete placement, length of delivery pipe or hose, aggregate size, mix proportions, vertical lift, and slump of concrete.
 - 3. Minimum inside diameter of pipe or hose shall be based on the maximum aggregate size and shall be in accordance with ACI 304.2R.
 - 4. Do not use aluminum pipes for delivery of concrete to the forms.
 - 5. Before pumping is started, prime the delivery pipe or hose by pumping mortar through the line using 5 gallons of mortar for each 50 feet of delivery line. Do not deposit mortar in the forms.

- R. Bonding to Hardened Concrete: Where indicated, thoroughly clean joint surface and coat with bonding agent according to manufacturer's written recommendations.
- S. Backfill Against Walls
1. Do not place backfill against walls until the concrete has achieved 100 percent of its specified 28-day compressive strength. Where backfill is to be placed on both sides of the wall, place the backfill uniformly on both sides.
 2. Do not backfill the walls of structures that are laterally restrained or supported by suspended slabs until the slab is poured and the concrete has reached the specified compressive strength.
- T. Depositing Concrete Under Water
1. Concrete shall not be deposited in water except with the approval of the Engineer, and under his immediate supervision; and in this case, the method of placing shall be as hereinafter designated.
 2. Concrete deposited in water shall be a seal or watertight concrete. To prevent segregation, it shall be carefully placed in a compact mass, in its final position, by means of a tremie, a bottom dump bucket, or other approved method, and shall not be disturbed after being deposited. Still water shall be maintained at the point of deposit and the forms under water shall be watertight.
 3. For parts of structures under water, when possible, seal concrete shall be placed continuously from start to finish. The surface of the concrete shall be kept as nearly horizontal as practicable at all times. To ensure thorough bonding, each succeeding layer of seal shall be placed before the preceding layer has taken initial set.
 4. A tremie shall consist of a tube having a diameter of not less than 10 inches, constructed in sections having flanged couplings fitted with gaskets. The tremies shall be supported so as to permit free movement of the discharge end over the entire top surface of the work and so as to permit rapid lowering when necessary to retard or stop the flow of concrete. The discharge end shall be closed at the start of work so as to prevent water entering the tube and shall be entirely sealed at all times. The tremie tube shall be kept full to the bottom of the hopper. When a batch is dumped into the hopper, the flow of concrete shall be induced by slightly raising the discharge end, always keeping it in the deposited concrete. The flow shall be continuous until the work is completed.
 5. Depositing of concrete by the drop bottom bucket method shall conform to the following specification. The top of the bucket shall be open. The bottom door shall open freely and outward when tripping. The bucket shall be completely filled and slowly lowered to avoid backwash. It shall not be dumped until it rests on the surface upon which the concrete is to be deposited and when discharged, shall be withdrawn slowly until well above the concrete. The slump of concrete shall be maintained between 4 and 8 inches.
 6. Dewatering may proceed when the concrete seal is sufficiently hard and strong. All laitance or other unsatisfactory materials shall be removed from the exposed surface by scraping, chipping or other means which will not injure the surface of the concrete.
- U. Cold-Weather Placement: Comply with ACI 306.1 and as follows:
1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials. Remove all snow, ice, and frost from the surfaces, including reinforcement, against which concrete is to be placed. Before beginning concrete placement, thaw the subgrade to a minimum depth of 6 inches.
 3. Reinforcement and embedded items shall be warmed and maintained at a temperature above 32 deg. F prior to concrete placement.

4. Equipment and materials required for protection shall be available at the Project site before cold-weather concreting, not after concrete has been placed and its temperature begins to approach the freezing point.
5. Place and direct heaters and ducts to avoid areas of overheating or drying of the concrete surfaces. Vent flue gases from combustion heating units to the outside of the enclosure.
6. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators.
7. During cold weather, the period when the average of the highest and lowest temperature during the period from midnight to midnight is expected to fall below 40 deg. F for three successive days, the minimum temperature of concrete immediately after placement shall be as required by ACI 306.1 and as indicated below:
 - a. 55 deg F for sections less than 12 inches in the least dimension.
 - b. 50 deg F for sections 12 to 36 inches in the least dimension.
 - c. 45 deg F for sections 36 to 72 inches in the least dimension.
 - d. 40 deg F for sections greater than 72 inches in the least dimension.

The temperature of concrete as placed shall not exceed the above values by more than 20 deg. F.

8. Cure and protect concrete against damage from freezing for a minimum period of three (3) days, unless otherwise specified. Maintain the surface temperature of the concrete during this period in accordance with the temperatures indicated in Item 7 above, unless otherwise specified. When Type III - High Early Strength Portland Cement meeting the requirements of ASTM C 150 is used, the protection period may be reduced to two (2) days.
9. During the protection period, do not expose the concrete surface to air having a temperature more than 20 deg. F above the temperatures indicated in Item 7 above, unless higher values are required by an accepted curing method.
10. Temperatures specified to be maintained during the protection period shall be those measured at the concrete surface, whether the surface is in contact with formwork, insulation, or air.
11. During periods not defined as cold weather, but when freezing temperatures may occur, protect concrete surfaces against freezing for the first 24 hours after placing.
12. Termination of Concrete Protection: The maximum decrease in temperature measured at the surface of the concrete in a 24-hour period shall not exceed the values in ACI 306.1 and as indicated below:
 - a. 50 deg F for sections less than 12 inches in the least dimension.
 - b. 40 deg F for sections 12 to 36 inches in the least dimension.
 - c. 30 deg F for sections 36 to 72 inches in the least dimension.
 - d. 20 deg F for sections greater than 72 inches in the least dimension.

Do not exceed the above stated values until the surface temperature of the concrete is within 20 deg. F of the ambient or surrounding temperatures. When the surface temperature of the concrete is within 20 deg. F of the ambient or surrounding temperature, protection may be removed.

V. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Concrete placed in hot weather shall not have a placing temperature that will cause loss of slump, flash set, or cold joints.
2. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated and added to the total amount of mixing water and without exceeding the specified water to cementitious materials ratio of the concrete mix. Using liquid nitrogen to cool concrete is Contractor's option.
3. When temperature of steel reinforcement, embedments, or forms is greater than 120 deg. F, fog spray steel reinforcement, embedments, forms, and subgrade with water just before

placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

4. When necessary, place concrete during cooler hours or at night if approved by the Engineer.
5. Protect placed concrete against thermal shrinkage cracking due to rapid drops in concrete temperature greater than 40 deg. F during the first 24 hours.

3.9 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.10 CONCRETE PROTECTING AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder

1. Apply evaporation retarder to unformed concrete surfaces if conditions such as low humidity, wind, direct sunlight, hot weather, or placement of heated concrete during cold weather cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
2. Evaporation retarders used for Penetrating Liquid Floor Treatment Hardeners shall be as recommended by the Penetrating Liquid Floor Treatment Hardener manufacturer.
3. Evaporation retarders, if used, for Cure and Seal treatments shall be as recommended by the Cure and Seal manufacturer.

C. Curing Methods

1. Concrete shall be maintained above 50 deg. F and in a moist condition for not less than seven days after placement, except that high-early-strength concrete, if used, shall be maintained above 50 deg. F in a moist condition for at least the first three days after placement.
2. Water cure cast-in-place concrete for hydraulic/liquid containing walls, slabs, channels, footings, and other parts of the concrete work required to be watertight by Method 1, 2, or 3 for the entire seven-day (minimum) curing period and prior to applying other curing methods.
3. Water used for curing concrete shall be potable, or meet the requirements of ASTM C 94 and be free of materials that have the potential to stain concrete.
4. The temperature of the curing water shall not be more than 20 deg F cooler than the surface temperature of the concrete at the time the water and concrete come in contact.
5. Do not submerge concrete placed in the dry until it has attained sufficient strength to adequately sustain the stress involved, nor subject it to flowing water across its surface until it has cured four days.
6. Start curing concrete as soon as possible without damaging the surface and not later than two hours after placing.
7. Where absorbent wooden forms are used, the forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until form removal.

8. Where steel forms are used, the exposed concrete surfaces shall be kept continuously wet as soon as the concrete has set sufficiently to avoid marring or eroding the surface.
9. After removal of formwork, cure concrete according to one of the methods in Item 11 below for the remainder of the curing period.
10. Use proper concrete placing and curing methods at all times to limit the amount of crazing and cracking of the structures during initial setting and shrinking of the concrete.
11. Cure concrete surfaces in accordance with the methods specified herein for the different parts of the work and described in the following paragraphs. These methods are considered to be a minimum for curing. The conditions that exist in the field during concrete placement and curing may require additional curing procedures and efforts to ensure proper protection and curing of the concrete. Select and implement the appropriate method according to the surface to be cured and climate conditions.

<u>Curing Method</u>	<u>Surface to be Cured</u>
1	All surfaces.
2	All surfaces.
3	Slabs and floors.
4	All surfaces when maximum ambient temperature will not exceed 80°F and humidity will not drop below 40% on the day of concrete placement and for the three days following.

a. Method 1 – Addition of Water Method

- 1) Concrete shall be kept completely and continuously wet with water by ponding, fog spray, sprinkling, or other means for at least seven (7) consecutive days beginning as soon as the concrete has sufficiently set, to avoid marring or eroding the surface.
- 2) Tightly close off concrete surfaces to be cured by bulkheads or entirely surround by tight enclosures or other means to keep the concrete surfaces moist.
- 3) Do not allow alternate wetting and drying of concrete surfaces.

b. Method 2 – Wet Absorptive Cover Method

- 1) Thoroughly wet and cover concrete surfaces to be cured with wet absorptive covers as soon as the concrete has sufficiently set to avoid marring or eroding the surface, or the forms have been removed.
- 2) Keep entire concrete surface and absorptive covers completely and continuously wet both during and after normal working hours during the entire curing period.
- 3) Do not allow concrete surfaces to dry or alternate with wetting and drying cycles.
- 4) The absorptive cover shall be weighted or substantially secured to maintain close contact with the concrete surface during the entire curing period to prevent being dislodged by wind or any other causes.

c. Method 3 – Moisture Retaining Cover Method

- 1) Thoroughly wet concrete surfaces to be cured and curing blanket if required, cover with moisture retaining cover as soon as the concrete has set sufficiently to avoid marring or eroding the surface.
- 2) The curing cover/blanket shall be placed flat on the concrete surface, avoiding wrinkles, and shall be weighted to maintain close contact with the concrete surface during the entire seven (7) consecutive day curing period.

- 3) Curing covers/blankets shall be placed in widest practicable widths, with sides and ends lapped over adjacent absorptive covers at least 12 inches, and sealed by waterproof tape or adhesive.
- 4) During the curing period, do not permit traffic of any nature or the depositing of materials, temporary or otherwise, on the moisture retaining cover.
- 5) Should moisture retaining cover become torn or otherwise ineffective, keep concrete surfaces moist and replace damaged sections.
- 6) Water shall be added under the curing cover/blanket as often as necessary to maintain damp concrete surfaces at all times during the curing period.

d. Method 4 – Curing Compound Method

- 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
- 2) Curing compounds used with penetrating liquid floor treatment hardener shall meet the penetrating liquid floor treatment hardener manufacturer's recommendations. Application and removal of curing compound shall meet the penetrating liquid floor treatment hardener manufacturer's recommendations.
- 3) Do not use curing compound on surfaces which are to be treated or coated unless such curing compound is recommended by the treatment or coating manufacturer.
- 4) Apply curing compound immediately after the disappearance of the surface water sheen and when the surface cannot be marred following final finishing on unformed surfaces.
- 5) Recoat areas subjected to heavy rainfall within three hours after initial application or if seal is broken by degradation of curing compound.
- 6) Curing compound shall be applied within two hours after removal of forms on formed surfaces. Immediately after removal of forms, keep exposed concrete surfaces moist with a uniformly damp appearance, until curing compound is applied. Repair formed surfaces within the two-hour period after form removal, provided, however, that any such repairs which cannot be made in the said two-hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, sandblast the area to remove the compound, then repair.
- 7) Where the curing compound method is used, exercise care to avoid damage to the seal during the curing period. Should the seal become damaged or broken before the expiration of the curing period, repair the damaged portions immediately by the application of additional curing compound.
- 8) Wherever curing compound may have been applied to surfaces against which concrete subsequently is to be placed and to which it is to adhere, remove the curing compound entirely by sandblasting prior to the placement of new concrete.
- 9) After the curing period has elapsed, remove all visible traces of curing compound from all surfaces without damaging the concrete surface finish using a method recommended by the curing compound manufacturer.

D. Curing in Cold Weather

1. Water curing of concrete may be reduced to six (6) days during periods when the average daily temperature falls below 40 deg. F; provided that, during the prescribed period of water curing, when temperatures are such that concrete surfaces may freeze, addition of

- water to the concrete surface shall be temporarily discontinued prior to exposure of concrete to freezing temperatures.
2. Concrete cured by water shall be protected against freezing temperatures for 72 hours immediately following the 72-hour protection period specified under Cold-Weather Placement in Part 3.9 of this specification section (above).
 3. Concrete cured by application of curing compound will require no additional protection from freezing if the concrete temperature is maintained for the duration of the protection period as specified under Cold-Weather Placement in Part 3.9 above; otherwise the concrete shall be protected against freezing temperatures for 72 hours immediately following the specified protection period.
 4. Termination of concrete protection shall be such that the drop in temperature of any portion of the concrete in a 24-hour period will be gradual and will not exceed the values in ACI 306.1, and indicated in Cold-Weather Placement in Part 3.9 above.

3.11 FIELD QUALITY CONTROL

- A. Testing: Contractor shall engage a qualified testing agency, acceptable to the Owner and Engineer, to perform field tests and prepare test reports.
 1. The Contractor's qualified testing agency must be approved in writing by the Engineer.
- B. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 - b. Obtain composite concrete samples for slump, air content, concrete temperature, and test cylinders at the placement end of the hose for concrete being placed by pumping.
 2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change, or when requested by Engineer or Resident Project Representative.
 3. Air Content: ASTM C 231, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 4. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
 5. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens (four specimens total) for each composite sample.
 - b. Cast and field cure two sets of two standard cylinder specimens (four specimens total) for each composite sample as required to verify concrete strength for form removal, in addition to the two sets of laboratory cured specimens.
 6. Compressive-Strength Tests: ASTM C 39/C 39M; test one specimen from one set of two laboratory-cured and field-cured specimens (as required to verify concrete strength for form removal) at 7 days and one set of two specimens at 28 days; hold and secure the remaining fourth specimen for verification.

- a. Results from the one specimen at 7 days will be considered information, not compressive strength. The set of two specimens to be tested at 28 days will be for acceptance or rejection of the compressive strength.
- b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
9. Test results shall be reported in writing to Engineer, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, water to cementitious materials ratio, compressive breaking strength, and type of break for both 7- and 28-day tests.
10. If either of the above strength requirements is not met, steps shall be taken immediately to increase the average of subsequent strength test results.
 - a. If any strength test of laboratory-cured cylinders falls below required f'_c by more than 500 psi, steps shall be taken to assure that load-carrying capacity of the structure is not jeopardized.
 - b. If the likelihood of low-strength concrete is confirmed and computations indicate that load-carrying capacity may have been significantly reduced, tests of cores drilled from the area in question may be required in accordance with "Methods of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete" (ASTM C-42). In such case, three cores shall be taken for each strength test more than 500 psi below required f'_c .
 - c. If concrete in the structure will be dry under service conditions, cores shall be air dried (temperature 60° to 80°F, relative humidity less than 60 percent) for 7 days before test and shall be tested dry. If concrete in the structure will be more than superficially wet under service conditions, cores shall be immersed in water for at least 48 hours and be tested wet.
 - d. Concrete in an area represented by core tests shall be considered structurally adequate if the average of three cores is equal to at least 85 percent of f'_c and in no single core is less than 75 percent of f'_c . To check testing accuracy, locations represented by erratic core strengths may be re-tested. If these criteria are not met, and if structural adequacy remains in doubt, the Engineer may order load tests for the questionable portion of the structure, or take other action as he deems necessary, including non-acceptance of the structure.
 - e. The cost of any additional testing to determine structural adequacy shall be borne by the Contractor.

END OF SECTION 03300

SECTION 03310 - CONCRETE JOINTS, WATERSTOPS, SEALANTS AND APPURTENANT
CONCRETE MATERIALS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies concrete construction, expansion and control joints, PVC waterstops, hydrophilic waterstops, joint sealants, bond breaker tape, backing rod, and bonding agents for concrete structures and as indicated.

1.3 TYPES OF JOINTS

- A. Joints in concrete structures shall be the types defined below and shall be permitted only where indicated unless approved otherwise in writing by the Engineer.
 - 1. Construction Joints: Where fresh concrete is placed against a hardened concrete surface. Unless otherwise indicated, joints in water bearing members and joints for slabs below grade shall be provided with a waterstop.
 - 2. Expansion Joints: To allow the concrete to expand freely, a space is provided between the two (2) pours, and the joint shall be formed as indicated. The space is obtained by placing a filler joint material against the earlier pour, to act as a form for the later pour. Unless otherwise indicated, expansion joints in water bearing members and joints for slabs below grade shall be provided with a center-bulb type waterstop as indicated. Unless otherwise indicated, expansion joints will utilize smooth steel expansion dowels and PVC tubing.
 - 3. Control Joints: The function of the control joint is to provide a weaker plane in the concrete, where shrinkage cracks will probably occur. A groove, of the shape and dimensions indicated, is formed or saw-cut in the concrete. This groove is afterward filled with a joint sealant or joint filler material.

1.4 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Waterstops.
 - 2. Bonding agents.

C. Material Samples

1. Waterstops: Prior to production of the material required under this Section, qualification samples of waterstops shall be submitted which represent in all respects the material proposed. Such samples shall consist of extruded or molded sections of each size or shape to be used. The balance of the material to be used shall not be produced until after the Engineer has reviewed the pre-qualification samples.

- D. Technical data sheets for the Contractor and Owner covering joint preparation, priming and sealant materials application.

1.5 QUALITY ASSURANCE

- A. Waterstop Inspection: It is required that all waterstop field joints shall be subject to rigid inspection, and no such work shall be scheduled or started without having made prior arrangements with the Engineer for the required inspections. Not less than 24 hours notice shall be given for scheduling such inspections.

- B. Field joints in waterstops shall be subject to rigid inspection for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects which would reduce the potential resistance of the material to water pressure at any point. Defective joints shall be replaced with material which passes inspection; faulty material shall be removed from the site and disposed of.

- C. The following waterstop defects represent a partial list of defects which shall be grounds for rejection:

1. Offsets at joints greater than 1/16 inch or 15 percent of material thickness, at any point, whichever is less.
2. Exterior crack at joint, due to incomplete bond, which is deeper than 1/16 inch or 15 percent of material thickness, at any point, whichever is less.
3. Any combination of offset or exterior crack which will result in a net reduction in the cross section of the waterstop in excess of 1/16 inch or 15 percent of material thickness at any point, whichever is less.
4. Misalignment of joint which results in misalignment of the waterstop in excess of 0.5 inch in 10 feet.
5. Porosity in the welded joint as evidenced by visual inspection.
6. Bubbles or inadequate bonding which can be detected with a penknife test. (If, while prodding the entire joint with the point of a penknife, the knife breaks through the outer portion of the weld into a bubble, the joint shall be considered defective.)
7. Visible signs of separation when the cooled splice is bent by hand at any sharp angle.
8. Any evidence of burned material.

- D. PVC Waterstop Samples: Prior to use of the waterstop material in the field, a sample of a prefabricated (shop-made fitting) mitered cross and a tee constructed of each size or shape of material to be used shall be submitted. These samples shall be prefabricated (shop-made fitting) so that the material and workmanship represent in all respects the fittings to be provided. Field samples of prefabricated (shop-made fitting) fittings (crosses, tees, etc.) will also be selected at random by the Engineer for testing by a laboratory at the Contractor's expense. When tested, tensile strength across the joints shall be at least 1120 psi.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Waterstops: Store waterstops under cover to protect from moisture, sunlight, dirt, oil and other contaminants, and in accordance with manufacturer's recommendations.
- B. Appurtenant Materials: Store protected in accordance with manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection.
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 WATERSTOPS

- A. Flexible PVC Waterstops: CE CRD-C 572, with factory-installed metal eyelets, for embedding in concrete to prevent passage of fluids through joints. Provide factory fabricated (prefabricated/shop made) corners, intersections, and directional changes.
 - 1. Available Manufacturers:
 - a. Greenstreak.
 - b. Vinylex Waterstop & Accessories.
 - c. Or equal.
 - 2. Waterstops shall be of the dimensions and profiles indicated on the Drawings.
 - 3. Extruded from virgin elastomeric PVC compound. Resistant to chemical action with Portland cement, alkalis, acids, and not affected by mildew or fungi. It shall show no effect when immersed for 10 days in a 10 percent solution of sulfuric or hydrochloric acid, saturated lime solution or salt water. Waterstops shall be such that any cross section will be dense, homogeneous, and free from porosity and other imperfections. They shall be symmetrical in shape. The material shall meet the following minimum requirements.

<u>Requirement</u>	<u>ASTM Spec.</u>
Tensile strength, 2,000 psi min.	D 638
Hardness, Shore A, 79±3	D 2240
Elongation, ultimate, 350% min.	D 638
Water absorption, 0.15% max.	D 570
Specific gravity, 1.45 max.	D 792
Stiffness in flexure, 600 psi min.	D 747
Cold brittleness, -35° F	D 746
Tear resistance, 200 lbs/inch	D 624

- B. Pre-Form Hydrophilic Waterstops: Manufactured rectangular or trapezoidal strip, Bentonite-free hydrophilic polymer modified chloroprene rubber, for adhesive bonding to concrete. Hydrophilic waterstop shall be the type that expands in the presence of water to form a watertight joint seal without damaging the concrete in which it is cast.

1. Hydrophilic waterstops shall be 1/4 inch thickness by 1 inch width unless indicated otherwise.
2. Waterstop shall be manufactured from chloroprene rubber and modified chloroprene rubber with hydrophilic properties. Waterstop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete. The minimum expansion ratio of modified chloroprene shall be not less than 2 to 1 volumetric change in distilled water at 70°F.

<u>Physical Property, Chloroprene</u>	<u>Value</u>	<u>ASTM Std.</u>
Tensile Strength – min (psi)	1275	D 412
Ultimate Elongation – min (percent)	350	D 412
Hardness, Shore A	55±5	D 2240

<u>Physical Property, Modified Chloroprene</u>	<u>Value</u>	<u>ASTM Std.</u>
Tensile Strength – min (psi)	300	D 412
Ultimate Elongation – min (percent)	600	D 412
Hardness, Shore A	52±5	D 2240

3. Bonding agent for hydrophilic waterstop shall be the manufacturer's recommended adhesive for wet, rough concrete.
4. Available Products:
 - a. Greenstreak, Hydrotite.
 - b. Or equal.

2.3 JOINT SEALANT FOR CONCRETE STRUCTURES

A. Joint sealant for concrete structures and/or water bearing joints:

1. Multi-part, light gray, non-staining, non-sagging polyurethane sealant designed for bonding to concrete which is continuously submerged in water. Joint sealant shall cure at ambient temperature to a firm, flexible, resilient, tear-resistant material.
2. Joint sealant shall meet U.S. Federal Specification TT-S-00227 E (3) Type I, Class A for horizontal joints.
3. Joint sealant shall meet U. S. Federal Specification TT-S-00227 E (3) Type II, Class A for vertical joints.
4. Joint sealant shall meet ASTM C 920 uses related to Exposure T (traffic), NT (non-traffic), and I (immersion).
5. Joint sealant shall also meet the following requirements (at 73°F and 5% R.H.):

	<u>Requirements</u>
Work Life	1 to 3 hours
Hardness	25 Shore A, ±5
Elongation	500%, ASTM D 412
Tensile Strength	120 psi, ASTM D 412
Peel Strength on Concrete	No adhesion loss at 25 pounds
Temperature Service Range	-40°F to 170°F
Immersion in Water	Continuous

6. Joint sealant used in liquid containment joints shall also use primer.
 - a. Primer materials shall conform to the printed recommendations of the manufacturer.

7. Available Products:
 - a. Sika Corporation; Sikaflex 2C.
 - b. Or equal.
- B. Backing Rods: Extruded closed-cell polyethylene foam rod.
1. The backing rod material shall be compatible with the joint sealant material and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25 percent at 8 psi.
 2. The backing rod shall be 1/8 inch larger in diameter than the joint width except that a 1 inch diameter rod shall be used for a 3/4 inch wide joint.
 3. Where the joint sealant material requires a primer, the Contractor shall not apply primer to the backing rod.
 4. Install backing rod at locations indicated on the Drawings.
 5. Available Manufacturers:
 - a. Sonneborne.
 - b. Industrial Systems; Hercules, Inc.
 - c. Or equal.
- C. Bond Breaker: Bond breaker shall be an adhesive backed glazed butyl or polyethylene tape which will adhere to the premolded joint material or to the concrete surface. Bond breaker tape shall be compatible with the sealant.
- D. Bonding Agents: Bonding agent for hydrophilic waterstop shall be the manufacturer's recommended adhesive for wet, rough concrete.

2.4 RELATED MATERIALS

- A. Premolded Joint Filler:
1. Joint filler material for expansion joints in liquid-containing structures shall be of the preformed non-extruding type joint filler constructed of cellular sponge rubber of firm texture. Bituminous fiber type will not be permitted. All non-extruding and resilient-type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D 1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction, for Type I, except as otherwise indicated.
 2. Joint filler material for expansion joints in other locations shall be of the preformed non-extruding foam type joint filler with a closed-cell structure. Bituminous fiber type will not be permitted.
 3. Available Manufacturers:
 - a. W. R. Meadows, Inc.
 - b. Or equal.
- B. Bearing Pad: Neoprene conforming to ASTM D 2000 with 60 durometer hardness, unless otherwise indicated.
- C. Foam Filler: Foam filler blocks where indicated.
1. Available Products:
 - a. Dow Chemical Company; Styrofoam SM.
 - b. Or equal.
- D. Reglets: Fabricate reglets of not less than 0.022 (0.55 mm) thick, galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.

PART 3 - EXECUTION

3.1 PVC WATERSTOPS

- A. Install waterstops in construction and expansion joints in hydraulic structures and slabs below grade unless indicated otherwise.
- B. Waterstops shall be properly heat spliced at ends and intersections to ensure continuity. Bend waterstops up from footing and slab joints and splice to wall waterstop to result in a watertight structure. Construct forms for construction joints in such a manner as to prevent injury to waterstops. Hold waterstops securely in position in the construction joints by wire ties, continuous bars, and rings as indicated.
- C. Make field splices with a Teflon-covered thermostatically controlled heating iron in conformance with the manufacturer's current recommendations. Allow at least 10 minutes before pulling or straining the new splice in any way. The finished splices shall provide a cross section that is dense and free of porosity with tensile strength of not less than 80 percent of the unspliced materials. The continuity of the waterstop ribs and of its tubular center axis must be maintained. No edge welding is allowed.
- D. Butt joints of the ends of two (2) identical waterstop sections may be made while the material is in the forms.
- E. All joints with waterstops involving more than two (2) ends to be jointed together, and all joints which involve an angle cut, alignment change, or the joining of two (2) dissimilar waterstop sections shall be prefabricated (shop-made fitting) prior to placement in the forms, allowing not less than 24 inch long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated (shop-made fitting) waterstop joint assemblies shall be installed in the forms and the ends of the 24 inch strips shall be butt-welded to the straight run portions of waterstop in place in the forms.
- F. When a centerbulb waterstop intersects and is jointed with a non-centerbulb waterstop, care shall be taken to seal the end of the centerbulb, using additional PVC material if needed.
- G. The symmetrical halves of the waterstops shall be equally divided between the concrete pours at the joints. The center axis of the waterstops shall be coincident with the joint openings. Maximum density and imperviousness of the concrete shall be ensured by thoroughly working it in the vicinity of all joints.
- H. In placing PVC waterstops in the forms, means shall be provided to prevent them from being folded over by the concrete as it is placed. Waterstops shall be held in place with light wire ties on 12 inch centers which shall be passed through hot rings at the edge of the waterstop and tied to the curtain of reinforcing steel, unless indicated otherwise.
- I. In placing centerbulb waterstops in expansion joints, the centerbulb shall be centered on the joint filler material.
- J. Waterstop in vertical wall joints shall stop 6 inches from the top of the wall where such waterstop does not connect with any other waterstop and is not to be connected to a future concrete placement.

- K. The Contractor shall take suitable precautions and means to support and protect the waterstops during the progress of the Work and shall repair or replace at Contractor's expense any waterstops damaged during the progress of the Work.
- L. When any waterstop is installed in concrete on one (1) side of the joint, while the other half or portion of the waterstop remains exposed to the atmosphere for more than two (2) days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

3.2 HYDROPHILIC WATERSTOP

- A. Where a hydrophilic waterstop is indicated, it shall be installed with the manufacturer's instructions and recommendations except as modified herein.
- B. When requested by the Engineer, the Contractor shall arrange for the manufacturer to furnish technical assistance in the field.
- C. Hydrophilic waterstop shall only be used where complete confinement by concrete is provided. Hydrophilic waterstop shall not be used in expansion or contraction joints, nor in the first 6 inches of any non-intersecting joint.
- D. The hydrophilic waterstop shall be located as near as possible to the center of the joint and it shall be continuous around the entire joint. The minimum distance from the edge of the waterstop to the face of the member shall be 5 inches.
- E. Where the thickness of the concrete member to be placed on the hydrophilic waterstop is less than 12 inches, the waterstop shall be placed in grooves formed or ground into the concrete. The groove shall be at least 0.75 inch deep and 1.50 inches wide at the bottom of the groove. Each side of the groove shall be equally sloped such that the width of the groove is 2.25 inches across the top of the groove. When placed in the groove, the minimum distance from the edge of the waterstop to the face of the member shall be 2.5 inches.
- F. Where a hydrophilic waterstop is used in combination with PVC waterstop, the hydrophilic waterstop shall overlap the PVC waterstop for a minimum of 6 inches and shall be adhered to PVC waterstop with single component water-swelling sealant as recommended by manufacturer.
- G. The hydrophilic waterstop shall not be installed where the air temperature falls outside the manufacturer's recommended range.
- H. The concrete surface under the hydrophilic waterstop shall be smooth and uniform. The concrete shall be ground smooth, if needed. Alternately, the hydrophilic waterstop shall be bonded to the surface using an epoxy grout, which completely fills all voids and irregularities beneath the waterstop material. Prior to installation, the concrete surface shall be wire brushed to remove any laitance or other materials that may interfere with the bonding of epoxy.
- I. The hydrophilic waterstop shall be secured in place with concrete nails and washers at a 12-inch maximum spacing. This shall be in addition to the adhesive recommended by the manufacturer.
- J. The hydrophilic waterstop shall be protected from moisture to avoid premature expansion. When hydrophilic waterstop exhibits expansion before the next placement of concrete

(premature expansion), remove the swelled material and replace with new hydrophilic waterstop.

3.3 JOINTS

- A. General: Concrete joints shall be as indicated and in accordance with the following, unless indicated or noted otherwise:
1. Provide horizontal construction joints at top of foundation members and slabs on grade and at the soffit of supported slabs and beams.
 2. Space the construction joints at a maximum horizontal distance of 40 feet and a maximum vertical distance of 16 feet.
 3. Space the corner vertical construction joints between 4 and 8 feet from the corner of walls or wall intersections.
 4. Space horizontal construction joints at least 8 inches below bottom of slabs.
- B. **Construction Joints:** Construction joints shall be keyed, unless indicated otherwise. Form keyways by beveled strips or boards placed at right angles to the direction of the shear. Except where otherwise shown on the Drawings or specified, keyways shall be at least 1-1/2 inches in depth over at least 25 percent of the area of the section. After the pour has been completed to the construction joint and the concrete has hardened, thoroughly clean the entire surface of the joint of surface laitance, loose or defective concrete, and foreign material, and expose clean aggregate by sandblasting the surface of construction joints before placing the new concrete.
- C. **Emergency Construction Joints:** In the case of an emergency, construction joints shall be placed as directed by the Engineer. Shear keys and/or inclined or straight reinforcement shall be used as determined by the Engineer. Furnishing and placing all shear keys, reinforcement, appurtenances, labor and all costs associated with emergency construction joints shall be the Contractor's responsibility.
- D. **Expansion Joints:** Provide expansion joints with continuous edge reservoirs, which shall be filled with a joint sealant. Leave the material used for forming the reservoirs in place until immediately before the grooves are cleaned and filled with joint sealant. After removing edge forms from the reservoir, remove grout, loose concrete, and fins; then sandblast the slots. Allow the reservoirs to become thoroughly dry; then blow out the reservoirs and immediately prime and fill with the expansion joint sealant and backup materials. The primer used shall be supplied by the same manufacturer supplying the joint sealant.
1. **Expansion Dowels and PVC Tubing:** Install parallel to wall or slab face, perpendicular to the joint face and in true horizontal position. Secure tightly in forms with rigid ties. Orient dowels to permit joint movement. Lubricate (grease) only dowel area within PVC tubing.
- E. **Installation of Premolded Joint Filler:** Install in joint accurately as indicated. Attach to concrete with a bonding agent recommended by the joint sealant and joint filler manufacturer for compatibility.
- F. **Installation of Joint Sealants:** Construction joints in slabs and elsewhere as indicated shall be provided with tapered grooves which shall be filled with joint sealant.
1. The material used for forming the tapered grooves shall be left in the grooves until just before the grooves are cleaned and filled with joint sealant. After removing the forms from the grooves, all laitance and fins shall be removed, and the grooves shall be sandblasted. The grooves shall be allowed to become thoroughly dry, after which they shall be blown out; immediately thereafter, they shall be primed, bond breaker tape

placed in the bottom of the groove, and filled with the construction joint sealant. The primer shall be furnished by the sealant manufacturer. No sealant for liquid containment joints shall be permitted to be used without a primer. Care shall be used to completely fill the sealant grooves. Areas designated to receive a sealant fillet shall be thoroughly cleaned, as outlined for the tapered grooves, prior to application of the sealant.

2. The primer and sealant shall be strictly in accordance with the printed recommendations of the manufacturer, taking special care to properly mix the sealant prior to application. The sides of the sealant groove shall not be coated with bond breaker, curing compound, or any other substance which would interfere with proper bonding of the sealant. Sealant shall achieve final cure at least seven (7) days before the structure is filled with water.
3. Sealant shall be installed by a competent waterproofing specialty contractor who has a successful record of performance in similar installations.
4. Thorough, uniform mixing of two-part, catalyst-cured materials is essential; special care shall be taken to properly mix the sealer before its application. Before any sealer is placed, the Contractor shall arrange to have the crew doing the Work carefully instructed on the proper method of mixing and application by a representative of the sealant manufacturer.
5. Any joint sealant which fails to fully and properly cure after the manufacturer's recommended curing time for the conditions of the Work hereunder shall be completely removed; the groove shall be thoroughly sandblasted to remove all traces of the uncured or partially cured sealant and primer, and shall be resealed with the indicated joint sealant. Costs of such removal, joint treatment, resealing, and appurtenant work shall be the Contractor's responsibility.

G. Control Joints: Control joints shall be constructed and located as indicated.

1. Control joints may be formed or saw cut.
 - a. Grooved Joints: Form control joints after initial floating by grooving and finishing each edge of joint to a radius of 1/8 inch. Repeat grooving of control joints after applying surface finishes. Eliminate groover tool marks on concrete surfaces.
 - b. Sawed Joints: Form control joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8 inch wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random cracks. Saw-cut joints within 12 hours of placing concrete.
2. Control joints shall be sealed with joint sealant or joint filler unless indicated otherwise.
 - a. Exterior control joints and interior control joints shall be cleaned and sealed with joint sealant according to the manufacturer's printed recommendations.
 - b. Interior control joints in areas intended for wheeled traffic shall be cleaned and filled with joint filler according to the manufacturer's printed recommendations.

END OF SECTION 03310

SECTION 03315 - GROUTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies grouts including:
 - 1. Cement grout.
 - 2. Non-shrink grout.
 - 3. Epoxy grout.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Certified test results verifying compliance with the compressive strength, shrinkage and expansion requirements and manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of non-shrink and epoxy grout.
- C. Fine Aggregate Gradation.
- D. Concrete strength test results and mix design used from a record of past performance, or the laboratory trial mix designs and results, and the mix design proposed for each cementitious mixture and use under this contract, in accordance with ACI 301 "Specifications for Structural Concrete."
 - 1. Test records shall consist of data that is not more than 12 months old.
 - 2. Indicate amounts of mixing water to be withheld for later addition at the Project site.
- E. Qualification Data: For testing agency.
- F. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
 - 1. Aggregates. Include service record data or laboratory test results if service record is not available, indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
 - 2. Non-shrink grout.
 - 3. Epoxy grout.
- G. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Non-shrink grout.
 - 3. Epoxy grout.
 - 4. Admixtures.

- H. Field quality-control test and inspection reports.
- I. Ready Mix Concrete (Cement Grout):
 - 1. Provide delivery tickets for ready-mix concrete (cement grout) with each batch before unloading at the Project site, or weigh master's certificate per ASTM C94, and each delivery ticket shall have the required information as specified in "Cast-In-Place Concrete" Section 03300, Part 1.4.J.1.
 - 2. Water added at the plant shall account for moisture in the aggregate. If water is added on the job, then the total water content shall not exceed the water to cementitious materials ratio content of the approved design mix.
 - 3. Keep records showing time and place of each pour (placement) of concrete cement grout, together with transit-mix delivery slips certifying the contents of the pour (placement).
 - 4. Furnish two (2) delivery tickets/records to Engineer for each batch.

1.4 QUALITY ASSURANCE

- A. Manufacturer's Qualifications for Cement Grout: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. Testing Agency Qualifications: An independent agency, furnished by Contractor and acceptable to Owner and Engineer, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.
 - 1. The Contractor's qualified testing agency must be approved in writing by the Engineer.
 - 2. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-01 or an equivalent certification program.
 - 3. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician - Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician - Grade II.
- C. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from one source, and obtain admixtures through one source from a single manufacturer. Cementitious material, aggregate and admixtures for cement grout shall be of the same source used for cast-in-place concrete.
- D. Concrete Testing Service: Engage a qualified independent testing agency to perform material evaluation tests and to design cement-grout mixture.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:
 - 1. Portland Cement: Domestic conforming to ASTM C150, Type I/II, Type III, gray. Cement may be supplemented with the following:
 - a. Fly Ash: ASTM C 618, Class F.
- B. Fine Aggregate: ASTM C33. Provide aggregates from a single source with documented service record data of at least 10 years satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials. Aggregates shall be free of any materials or substances with deleterious reactivity to alkali in cement. Aggregates for cement grout shall be provided from the same source as aggregate for the cast-in-place concrete.
- C. Water: ASTM C94 and potable.

2.3 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C260 and as follows:
 - 1. The air-entraining agent shall comply with the requirements of ASTM C260 "Standard Specification for Air-Entraining Admixtures for Concrete," and shall be added to the mixing water in solution. The Contractor shall submit evidence based on tests made in a recognized laboratory to show that the air-entraining admixture conforms to the requirements of the latest revision (ASTM C260) for seven and 28 day compressive and flexural strengths and resistance to freezing and thawings, except as provided in the following paragraph.

Tests for bleeding, bond strength and volume change will not be required. Tests may be made upon samples taken from a quantity submitted by the Contractor for use on the project or upon samples submitted and certified by the manufacturer as representative of the admixture to be supplied.

- a. An exception to the requirements in the preceding paragraph is the case of admixtures which are manufactured by neutralizing Vinsol resin with caustic soda (sodium hydroxide). When the Contractor proposes to use such an admixture he shall submit a certification concerning the admixture in the following form:

"This is to certify that the product (trade name) as manufactured and sold by the (company) is an aqueous solution of Vinsol resin that has been neutralized with sodium hydroxide. The ratio sodium hydroxide to Vinsol resin is one part of sodium hydroxide to (number) parts of Vinsol resin. The percentage of solids based on the residue dried at 105° C. is (number). No other additive or chemical agent is present in this solution."

- b. When the Contractor proposes to use an air-entraining admixture which has been previously approved, he shall submit a certification stating that the admixture is the same as that previously approved. If an admixture offered for use is essentially the same (with only minor difference in concentration) as another previously approved material, a certification will be required stating that the product is essentially the same as the approved admixture and that no other admixture or chemical agent is present.

- c. Either prior to or at any time during construction, the Engineer may require that the admixture selected by the Contractor be further tested to determine its effect upon the strength of the concrete. When so tested, seven day compressive strength of concrete made with the cement and aggregates in the proportions to be used in the work shall be not less than 90 percent of the strength of concrete made with the same materials and with the same cement content and consistency but without the admixture.
 - d. The percentage reduction in strength shall be calculated from the average strength of at least five standard 6-inch by 12-inch cylinders of each type of concrete. Specimens shall be made and cured in the laboratory in accordance with the requirements of the latest revision of ASTM C192 and shall be tested in accordance with the requirements of the latest revision of ASTM C39.
2. Available Products:
- a. MB-AE 90; BASF Construction Chemicals – Admixture Systems.
 - b. Or equal.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
- 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.4 CEMENT GROUT MIXTURE

- A. Prepare design mixture proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301. Submit proposed mixture design to Engineer for review.
 - 1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based upon laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete and cement grout as follows:
 - 1. Fly Ash, 15 percent.
- C. Admixtures: All materials other than Portland cement, water and aggregates, and the specified air-entraining admixture that are added to the concrete or cement grout, shall be subject to the permission of the Engineer. If so approved, use admixtures according to manufacturer's written instructions.
 - 1. Use water reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.

- D. Minimum compressive strength: 2000 psi at 28 days.
- E. Minimum cementitious material of 846 pounds (9 bags) per cubic yard of cement grout.
- F. Air content: ASTM C94, 5 percent, plus or minus 1.5 percent at point of delivery.
- G. Aggregate shall be fine aggregate meeting the requirements of ASTM C 33.
- H. Water - cementitious material ratio. The Contractor shall submit a proposed mix design to the Engineer for review. The amount of water shall be the minimum amount of water necessary to make a workable mixture.
- I. Slump: 4 inches, plus or minus 1.0 inch.

2.5 NON-SHRINK GROUT

- A. Non-shrink grout: Shall conform to the USACOE (Corps of Engineers) Specification for Non-shrink Grout, CRD-621 and as follows:
 - 1. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating, non-metallic, cement-based premixed product requiring only the addition of water for the required consistency.
 - 2. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged.
 - 3. The chemical formulation of the non-shrink grout shall be as recommended by the non-shrink grout manufacturer for the specific application.
 - 4. Available products:
 - a. BASF Building Systems, MasterFlow 713 Plus.
 - b. Or equal.

2.6 EPOXY GROUT

- A. Epoxy Grout: Non-shrink 100 percent solids system. The epoxy grout shall have 3 components: resin, hardener and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Variation of component ratios is not permitted.
 - 1. The chemical formulation of the epoxy grout shall be as recommended by the epoxy grout manufacturer for the specific application.
 - 2. Manufacturer's instructions shall be printed on each container in which the materials are packaged.
 - 3. Creep shall be less than 0.005 in./in. when tested per ASTM C 1181. The tests shall be at 70°F and 140°F with a load of 400 psi.
 - 4. Linear shrinkage shall be less than 0.080% and thermal expansion less than 17×10^{-6} in./in./°F when tested per ASTM C 531.
 - 5. Compressive strength shall be a minimum of 12,000 psi after seven days when tested per ASTM C 579, Method B.
 - 6. Bond strength to Portland concrete shall be greater than 2,000 psi when tested per ASTM C 882.
 - 7. Epoxy grout shall pass the thermal compatibility test per ASTM C 884 when overlaid on Portland cement concrete.
 - 8. Determine tensile strength and modulus of elasticity per ASTM D 638. The tensile strength shall not be less than 1,700 psi and the modulus of elasticity shall not be less than 1.8×10^6 psi.

9. Determine gel time and peak exothermic temperature per ASTM D 2471. Peak exothermic temperature shall not exceed 100°F when a specimen 6 inches in diameter by 12 inches high is used. Gel time shall be at least 150 minutes.
10. The grout shall be suitable for supporting precision machinery subject to high impact and shock loading in industrial environments while exposed to elevated temperature as high as 150°F, with a load of 1,200 psi.
11. Available Products
 - a. ITW Philadelphia Resins, Escoweld 7505E with 7530 aggregate.
 - b. Or equal.

B. Epoxy Primer: Lead free, chrome free, rust inhibitive, two-component epoxy primer specifically designed for use on metal substrates and in conjunction with epoxy grout products.

1. Available Products:
 - a. ITW Philadelphia Resins, ESCOWELD 1014E Rust Inhibitive Epoxy primer.
 - b. Or equal.

C. Epoxy Bonding Compound: ASTM C 881, two-component epoxy adhesive capable of humid curing and bonding to damp surfaces.

1. Available Products:
 - a. Sika Chemical Corporation, Sikadur 32 Hi-Mod.
 - b. Euclid Chemical Company, Euco Epox 452.
 - c. Or equal.

D. Non-Epoxy Bonding Compound: Non-epoxy compound rewettable for up to 10 days and shall have the following minimum performance properties:

Tensile Bond Strength	ASTM C-932	385 psi
Flexural Bond Strength	ASTM C-78	603 psi
Shear Bond Strength	ASTM C-1042	740 psi

1. Available Products:
 - a. Larsen Products, Weldcrete.
 - b. Or equal.

E. Nonbond filler for sleeves: Where indicated.

1. Available Products:
 - a. ITW Philadelphia Resins, ESCOWELD 7506.
 - b. Or equal.

F. Epoxy Grout Liquid:

1. Available Products:
 - a. ITW Philadelphia, EXCOWELD 7502E or 7507E.
 - b. Or equal.

2.7 CEMENT GROUT MIXTURE (OPEN SCREW PUMP)

A. Prepare design mixture proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301. Submit proposed mixture design to Engineer for review.

1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based upon laboratory trial mixture

- B. Provide grout mixture in accordance with equipment manufacturer's written recommendations for grout mixture.

PART 3 - EXECUTION

3.1 CEMENT GROUT

- A. Place cement grout topping over concrete slabs where indicated in the drawings. The finish surface of the structural slab below the topping cement grout shall be a heavy broom finish. The finish surface of the cement grout shall be a smooth steel trowel finish.

3.2 NON-SHRINK GROUT

- A. Non-Shrink Grout:
 - 1. Used for repair of holes and defects and at locations indicated where epoxy grout is not indicated. Execution shall follow manufacturer's recommendations.

3.3 EPOXY GROUT

- A. Epoxy Grout: Used to embed all anchor bolts and reinforcing steel set in grout, specific machinery base plates, as indicated, and at other locations as indicated. Execution shall follow manufacturer's recommendation.

3.4 FIELD QUALITY CONTROL

- A. Testing: Contractor will engage a qualified testing agency suitable to the Owner and Engineer to perform field tests and inspections and prepare test reports.
 - 1. The Contractor's qualified testing agency must be approved in writing by the Engineer.
- B. Field Test:
 - 1. Compression test specimens will be taken during construction from the first placement of each type of grout and at intervals thereafter selected by the Engineer to insure continued compliance with these specifications. The specimens will be made by the qualified testing agency.
 - 2. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed in accordance with ASTM C 109. A set of three (3) specimens will be made for testing at 7-days, 28-days, and each additional time period as appropriate.
 - 3. Compression tests and fabrication of specimens for epoxy grout will be performed in accordance with ASTM C 579. A set of three (3) specimens will be made for testing at 7-days, and each earlier time period as appropriate.
 - 4. Grout which fails to meet requirements is subject to removal and replacement.

END OF SECTION 03315

SECTION 03320 - FINISHING AND REPAIRS FOR CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies materials and methods of concrete finishes and repairs of defects for cast-in-place concrete including the cast-in-place concrete portions of composite construction.

1.3 SUBMITTALS

- A. Material Certificates:
 - 1. Portland cement.
 - 2. Repair materials.
 - 3. Bonding agent.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. In other part 2 articles where titles below introduce lists, the following requirements apply to product selection:
 - 1. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products specified.
 - 2. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.2 CEMENTITIOUS MATERIAL

- A. For finishing and repairs, use Dosmetic Portland Cement, Type I/II of the same type and manufacturer used throughout the project.
- B. Comply with Section 03300, "Cast-in-Place Concrete."

2.3 MORTAR FOR REPAIR AND FINISHING OF CONCRETE

- A. Mortar for Repair: One part Portland cement to one part sand. Water shall be the minimum necessary for placing. The sand gradation shall be such that 100 percent shall pass the No. 16 sieve and not more than 30 percent shall be retained on a No. 30 sieve.
- B. Mortar for Finishing: One part Portland cement to 1-1/2 parts sand. Water shall be the minimum necessary for placing. The sand gradation shall be such that 100 percent shall pass the No. 16 sieve and not more than 30 percent shall be retained on a No. 30 sieve.

2.4 FINE AGGREGATE

- A. ASTM C 33. Provide aggregates from a single source with documented service record data of at least 10 years satisfactory service in similar applications and service conditions using similar aggregate and cementitious materials. Aggregates shall be free of any materials or substances with deleterious reactivity to alkali in cement. Aggregates for mortar shall be provided from the same source as aggregate for the cast-in-place concrete.

2.5 BONDING AGENT FOR FINISHING

- A. Non-epoxy, ASTM C 1059, Type II, non-redispersable, non-yellowing, acrylic emulsion or styrene butadiene.
- B. Available Products
 - 1. WE. R. Meadows, Inc.; Sealtight Acry-Lok.
 - 2. Or equal.

2.6 BONDING AGENT FOR REPAIRS

- A. Epoxy Bonding Agent: Where indicated or specified, two-component epoxy adhesive capable of humid curing and bonding to damp surfaces.
- B. Available Products:
 - 1. Sika Chemical Corporation; Sikadur 32 Hi-Mod.
 - 2. Euclid Chemical Company; Euco Epoxy 452.
 - 3. Or equal.
- C. Non-Epoxy Bonding Agent: Where indicated or specified, ASTM C 1059, Type II, non-redispersable, non-yellowing, acrylic emulsion or styrene butadiene.
 - 1. Available Products:
 - a. W. R. Meadows, Inc.; Sealtight Acry-Lok.
 - b. Or equal.

PART 3 - EXECUTION

3.1 GENERAL

- A. Formed Surfaces

1. Water cure surfaces until finishing and repairing are completed.
2. Perform finish work as soon as possible after forms are removed. Remove fins and irregularities by grinding or rubbing, fill depressions deeper than specified with mortar, and fill tie holes.
3. Ream tie holes with toothed reamers until surface of hole is rough and clean. Coat surface with epoxy bonding compound and fill with mortar.
4. During construction, a wall area shall be designated by the Engineer for use as a rubbed finish trial area where the texture and color of the final surface will be established as a job standard.

B. Floors, Slabs and Unformed Surfaces

1. Comply with ACI 302.1R recommendations for screeding, re-straightening and finishing operations for concrete surfaces.
2. Do not wet concrete surfaces.

3.2 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections.

1. Fill depressions, holes, tie holes, repair broken corners, edges and small honeycombs with repair mortar. Repair defects according to Specifications. All repair or patchwork shall be smoothed to match adjoining surfaces.
2. Construction and expansion joints in the completed work shall be left carefully tooled and free of mortar and concrete. The joint filler shall be left exposed for its full length with clean and true edges.
3. Apply to:
 - a. Concrete surfaces not exposed to view.
 - b. Concrete surfaces of the interior of tanks, boxes, or other structures containing water, wastewater or other liquids from the bottom of the structure to 1 foot below the normal high water level as indicated.
 - c. Concrete surfaces to be coated.

B. Rubbed Finish: Apply the following to smooth-formed finished as-cast concrete.

1. Immediately upon removal of forms, all fins or irregular projections shall be completely smoothed. Cavities produced by form ties and other holes, small honeycombs, broken edges or corners, shall be filled with repair mortar. Repair defects according to Specifications. All repair or patchwork shall be smoothed to match adjoining surfaces.
2. The rubbing of concrete shall be started as soon as its condition will permit and no later than 24 hours after removal of forms or water curing, whichever comes first. Immediately before starting this work the concrete shall be thoroughly saturated with water. Sufficient time shall have elapsed before the wetting down to allow mortar used in the filling of holes and/or repairs to thoroughly set. Surfaces to be finished shall be coated with a rubbing mixture of finishing mortar and bonding admixture. The bonding admixture will be at a 1:1 ratio with the water used for the mortar. Apply the rubbing mixture using the medium coarse carborundum rubbing stone, unless approved otherwise by the Engineer, to the consistency of thick paint, coating surfaces and filling holes. Add white Portland cement in amounts determined by trial patches so color of dry rubbing mixture will match adjacent surfaces. Surfaces to be finished shall be rubbed with a medium coarse carborundum stone using a small amount of rubbing mixture on its face. Rubbing shall be continued until form marks, projections and irregularities have been removed, voids filled, and a uniform surface has been obtained. The paste produced by this rubbing shall be left in place at this time.

3. After rubbing mixture has whitened, the final finish shall be obtained by rubbing with a fine carborundum stone and water. The rubbing shall be continued until all paste has been removed and the entire surface is of a smooth texture and uniform color.
4. Keep surface(s) damp for 36 hours.
5. After the rubbing and dampening are completed and the surface has dried, it shall be rubbed with burlap to remove loose powder and shall be left free from all unsound patches, paste, powder, and objectionable marks.
6. Construction and expansion joints in the completed work shall be left carefully tooled and free of mortar and concrete. The joint filler shall be left exposed for its full length with clean and true edges.
7. Finish surfaces that are contiguous, completed and accessible.
8. Repeat process if directed by Engineer.
9. Apply to:
 - a. Exterior and interior concrete surfaces above grade or exposed to view.
 - b. Concrete surfaces to be painted.
 - c. Concrete surfaces of the interior of tanks, boxes, or other structures containing water, wastewater or other liquids from the top of the structure down to 1 foot below the normal high water level as indicated.
 - d. Underside of formed floors or slabs.

- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.3 FINISHING FLOORS AND SLABS

- A. General: Comply with ACI 302.1R recommendations for screeding, re-straightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.
- B. Float Finish: Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and re-straightening until surface is left with a uniform, smooth, granular texture.
 1. Apply float finish to:
 - a. Concrete surfaces to be covered with membrane waterproofing, roofing, concrete, and as an initial finish for other finishes as set forth.
- C. Trowel Finish: After first applying Float Finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Troweling shall begin as soon as the concrete has hardened so that water and fine material are not brought to the surface. Excess water should be allowed to evaporate or be removed with a squeegee prior to troweling. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
 1. Apply trowel finish to concrete surfaces as:
 - a. Top of concrete roof slabs.
 - b. Exposed concrete floor slabs in buildings.
 - c. Concrete floor slabs which receive painting or floor coverings.
 - d. Floor or foundation slabs in tanks, boxes, or other structures containing water, wastewater or other liquids.
 - e. Cement-grout not placed by mechanical equipment.

- D. Light Broom Finish: After first applying Float Finish, apply light non-slip broom finish by slightly roughening the concrete surface with fiber bristle broom perpendicular to main traffic route. The roughened texture shall be uniform in appearance without patches of non-textured surface. Coordinate required final finish with Engineer before application.
 - 1. Apply Light Broom Finish to:
 - a. Exterior stairs.
 - b. Exterior walkways, platforms, ramps, steps.
 - c. Curb and gutter.
 - d. Concrete swales.

- E. Heavy Broom Finish: After first applying Float Finish, apply a heavy non-slip broom finish by roughening with a stiff, coarse broom or metal wire broom perpendicular to main traffic route. The roughened texture shall be uniform in appearance without patches of non-textured surface. Coordinate required final finish with Engineer before application.
 - 1. Apply Heavy Broom Finish to:
 - a. Slabs to receive cement grout.
 - b. Other as indicated.

3.4 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

3.5 CONCRETE SURFACE REPAIRS

- A. Do not repair defects until concrete has been reviewed by Resident Project Representative.
- B. Defective Concrete: Repair and patch defective areas when approved by Engineer. Remove and replace concrete that cannot be repaired and patched to Engineer's approval.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
- D. Smaller Surface Defects (Non-Structural)
 - 1. Repair surface defects that are smaller than 1 foot across in any direction and are less than 1/2 inch in depth.
 - 2. Repair by removing the honeycombed and other defective concrete down to sound concrete, make the edges perpendicular to the surface and at least 3/8 inch deep.
 - 3. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with repair mortar before bonding agent has dried. Fill form-tie voids with repair mortar or cone plugs secured in place with bonding agent.
 - 4. Repair defects on surfaces exposed to view so that, when dry, repair mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
- E. Severe Surface Defects (Non-Structural)

1. Repair severe defects that are larger than surface defects but do not appear to affect the structural integrity of the structure.
 2. Repair by removing the honeycombed and other defective concrete down to sound concrete, make the edges of the hole perpendicular to the surface, sandblast the surface, coat the sandblasted surface with epoxy bonding compound, place nonshrink grout as specified, match the finish on the adjacent concrete, and cure as specified.
- F. Major Defects: Repair defects apparent or concealed on formed surfaces that affect concrete's durability and structural performance as determined by Engineer.
1. If the defects are serious or affect the structural integrity of the structure or if patching does not satisfactorily restore the quality and appearance to the surface, the Engineer may require the concrete to be removed and replaced, complete, in accordance with the provisions of the Specifications.
- G. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25-mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with repair mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 5. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4 inch (19 mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 6. Repair single holes 1 inch (25 mm) or less in diameter with repair mortar. Cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place repair mortar before bonding agent has dried. Compact repair mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- H. Perform structural repairs of unformed concrete surfaces, subject to Engineer's approval, using epoxy adhesive and repair mortar. If the defects are serious or affect the structural integrity of the structure or if patching does not satisfactorily restore the quality and appearance to the surface, the Engineer may require the concrete to be removed and replaced, complete, in accordance with the provisions of the Specifications.
- I. Repair of Cracks in Concrete
1. Repair concrete cracks that are 1/10 inch or less in width by epoxy pressure injection.
 - a. Preparation: Insert and anchor a one-way polyethylene valve or pipe nipple in holes drilled into crack. Position them every 6 inches or 18 inches on center,


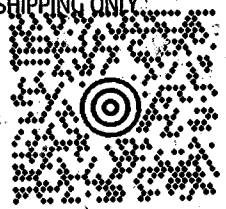


depending on the width of the crack. The injecting operation for vertical cracks shall consist of pumping the epoxy grout into the lowest position first and working vertically up in the cracks. Maintain a slow, steady pressure rather than a rapid buildup of pressure. When grouting material reaches the next tube, stop off the present position and follow the same procedure on the next position.

- b. Upon completion of the epoxy grouting, remove the epoxy gel used to hold the valve or nipple by applying a direct flame to the epoxy and scraping it off. Fill the holes with the same material as used for patching the surface.
 - c. While the valves or nipples are installed first, the grouting operation shall not commence until after the patch work has been completed and has sufficiently cured.
2. Repair cracks in concrete structures that are wider than 1/10 inch by cutting out a square edged and uniformly aligned joint 3/8 inch wide by 3/4 inch deep, preparing exposed surfaces of the joint, priming the joint, and applying polyurethane joint sealant in accordance with the Specifications.
 3. If the cracks are serious or affect the structural integrity or function of the element, the Engineer may require the concrete to be removed and replaced, complete, in accordance with the provisions of this section.
 4. After repairing leaking concrete cracks, retest the structure.
- J. Repair materials and installation not specified above may be used, subject to Engineer's approval.

END OF SECTION 03320

**MAP(S)/PLAN(S) SCANNED IN
SEPARATE FILE**

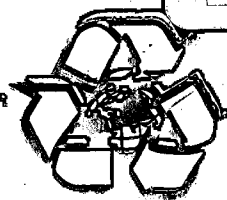
Additional Handling Charges \$100.00

<p>FROM: MR. JIM ULMER, P.E. (479) 443-3404 MCGOODWIN, WILLIAMS AND YATES, 302 E. MILLSAP RD. FAYETTEVILLE AR 72703</p>	<p>4 LBS 1 OF 1  FOR UPS SHIPPING ONLY</p> 	<p>AR 722 9-21</p> 
<p>SHIP TO: MR. MILES JOHNSON (501) 682-0631 ARKANSAS DEPT. OF ENVIRON. QUALITY 5301 NORTSHORE DRIVE NORTH LITTLE ROCK AR 72118-5317</p>	<p>UPS GROUND TRACKING #: 1Z 573 362 03 7797 0968</p>	
<p>REF 1: MWY Project No. Ba-138BI REF 2: ags</p>		
<p>BILLING: P/P</p>		<p>WS 15.0.16 HP LaserJet 1 30.0A 07/2012</p>

ap[®] Bag

Patented

PLEASE RECYCLE



Style B

P. BOX 3 S. 38th
 0968
 0968
 0968
 ARKANSAS DEPT OF ENVIRON QUALITY
 5301 NORTSHORE DRIVE
 NORTH LITTLE ROCK AR 72118-5317
 1Z5733620377970968
 11 SEP 11 09:22:34 2012