WHEREAS, Symsonia Water District proposes to provide upgraded drinking water service for industrial, institutional, commercial, and residential growth in the Symsonia area, and

WHEREAS, the Symsonia Water District endorses said proposed service, and,

WHEREAS, under the terms of the Safe Drinking Water Act Amendments of 1996 (Public Law 104-182) and amendments to KRS 224A, the State is authorized to render financial assistance to eligible project applicants by way of capitalization grants from the U. S. Environmental Protection Agency and State match funds comprising the Federally Assisted Drinking Water Revolving Fund (State Revolving Loan Program). The program is established to aid in the construction of drinking water treatment facilities improvements and certain related facilities with consideration for approval to be based on applications submitted through the Kentucky Energy and Environment Cabinet and the Kentucky Infrastructure Authority, and,

WHEREAS, the improvements proposed for construction by the Symsonia Water District within the Symsonia area are considered eligible for such loan assistance.

NOW THEREFORE, BE IT RESOLVED by the Symsonia Water District that the Chairman and Successors-in-Title are hereby authorized to execute and submit an application through the Kentucky Energy and Environment Cabinet and the Kentucky Infrastructure Authority with such assurances and required supporting data as is necessary to obtain loan assistance from the Federally Assisted Drinking Water Revolving Fund (State Revolving Loan Program) for the proposed water treatment facilities improvements, and are hereby authorized as Symsonia Water District's Official Project Representative to carry out necessary negotiations for and administer the loan assistance the applicant may obtain from the Federally Assisted Drinking Water Revolving Fund (State Revolving Loan Program).

Adopted this 16 day of July, 2012.

RECEIVED

DEC 14 2012

PUBLIC SERVICE COMMISSION

Keith Cooper, Chairman

Symsonia Water District

ATTEST: Wm. Wade Williams

7-15-12

① MOTION & DISCUSSION ON RESOLUTION FOR SYMSONIA WATER DISTRICT TO ASK FOR FUNDS FROM STATE REVOLVING LOAN PROGRAM TO FINISH FUNDING FOR THE SYMSONIA WATER DISTRICT.

— MOTION BY STUART BELL 2ND BY KEITH COOPER

MOTION - PASSED UNANIMOUSLY.

② MOTION TO ADJOURN AT 1935

PASSED

AFFP

INVITATION TO BIDThe Symsonia

Affidavit of Publication

STATE OF KENTUCKY }
COUNTY OF MCCRACKEN } SS

Judy Lynch, being duly sworn, says:

That she is Admin/Customer Service Manager of the Paducah Sun, a daily newspaper of general circulation, printed and published in Paducah, McCracken County, Kentucky; that the publication, a copy of which is attached hereto, was published in the said newspaper on the following dates:

March 09, 2012, March 10, 2012, March 11, 2012

INVITATION TO BID

The Symsonia Water District will receive bids for the installation of two (2) new ground water wells 150,000 gallon ground storage, tank, chemical building, booster pump station, and trunk line.

Bids must be received prior to 2:00 PM (CST) on March 26, 2012, at the office of Austin Engineering, 110 South 3rd St, Paducah, KY 42001, at which time they will be publicly opened and read aloud.

A MANDATORY PRE BID MEETING WILL BE HELD AT 2:00 PM (CST) ON MARCH 19, 2012 AT THE OFFICE OF AUSTIN ENGINEERING. ALL PRIME CONTRACTORS WANTING TO BID ON THE PROJECT MUST ATTEND.

A satisfactory Bid Bond executed by the bidder and acceptable sureties in an amount equal to five percent (5%) of the bid shall be submitted with each bid.

Proposed forms of Contract Documents, Plans and Specifications are on file for viewing at the office of the West Kentucky Construction Association (AGC), 2201 McCracken Blvd, Paducah, KY 42001. Copies of Contract Documents, Plans and Specifications may be obtained at the office of Austin Engineering, Inc. 110 S 3rd St, Paducah, KY 42001 (270) 442-0906. A Non-refundable Fee of $250.00 will be required for each set of documents obtained.

That said newspaper was regularly issued and circulated on those dates.

SIGNED:

Admin/Customer

Subscribed to and sworn to me this 11th day of March 2012.

Judy L. Gordon, Notary Public, McCracken County,

My commission expires: July 30, 2012

20032998 20084492 270-442-3361

MARY AUSTIN
AUSTIN ENGINEERING
110 SOUTH THIRD STREET
PADUCAH, KY 42001

Estimated Quantities

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
1	6" PVC WATER MAIN	1750	LF	15.50	27,125.00
2	6" STREAM CROSSING	25	LF	204.00	5,100.00
3	6" DI WATER MAIN IN STEEL ENCASEMENT, BORE AND JACK	65	LF	143.00	9,295.00
4	1" PVC WATER SERVICE	140	LF	8.00	1,120.00
5	6" GATE VALVE & BOX	4	EA	905.00	3,620.00
6	6" X 6" TAPPING SLEEVE & VALVE WTH BOX (WET CONNECTION	3	EA	2,440.00	7,320.00
7	INSTALL 6" HYDRANT AND ASSEMBLY	2	EA	3,660.00	7,320.00
8	TREATMENT PLANT SITE WORK	1	LS	17,850.00	17,850.00
9	VINYL COATED FENCE W/GATES	670	LF	31.00	20,770.00
10	BUILDING	1	LS	199,000.00	199,000.00
11	BOOSTER PUMP ROOM	1	LS	55,750.00	55,750.00
12	FLOURIDE ROOM	1	LS	17,370.00	17,370.00
13	LIQUID CHLORINE ROOM	1	LS	9,040.00	9,040.00
14.	CAUSTIC SODA ROOM	1	LS	9,040.00	9,040.00
15.	CHEMICAL FEED VAULT & ASSOCIATED PIPING	1	LS	7,865.00	7,865.00
16.	RAWWATER SAMPLE POINT MANHOLE	2	EA	4,030.00	8,060.00
17.	WELL PUMPS & ASSEMBLY	2	EA	16,370.00	32,740.00
18.	WATER STORAGE TANK FOUNDATION	1	LS	159,000.00	159,000.00
19.	150,000 GAL WATER STORAGE TANK	1	LS	246,000.00	246,000.00
20.	ELECTRICAL CONTROLS, TRANSFER SWITCH & SCADA	1	LS	133,680.00	133,680.00
21.	GRAVEL DRIVE REPLACEMENT	15	LF	23.00	345.00
22.	CONCRETE DRIVE PUSH BORE	20	LF	43.00	860.00

TOTAL BID.....$ 978,270.00

Note: The cost for concrete thrust blocking, dense graded aggregate (DGA) and all other items not specifically called out in the above bid tabulation, but required for a complete and functional system, are considered incidental to the cost of construction and included in the above items.

Certified Bid Tabulation

Project: **Water Improvements Project Symsonia, KY**

Bid Open Time: 2:00 PM

Date: 3/26/2012

						LOW BIDDER	
	CONTRACTOR'S NAME			API CONTRACTORS		MURTCO, INC	
				5%		5%	
Bid Bond							
ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST	UNIT COST	TOTAL COST
1	6" PVC WATER MAIN	1750	LF	$ 25.00	$ 43,750.00	$ 15.50	$ 27,125.00
2	6" STREAM CROSSING	25	LF	$ 80.00	$ 2,000.00	$ 204.00	$ 5,100.00
3	6" DI WATER MAIN IN STEEL ENCASEMENT BORE & JACK	65	LF	$ 135.00	$ 8,775.00	$ 143.00	$ 9,295.00
4	1" PVC WATER SERVICE	140	LF	$ 14.00	$ 1,960.00	$ 8.00	$ 1,120.00
5	6" GATE VALVE & BOX	4	EA	$ 750.00	$ 3,000.00	$ 905.00	$ 3,620.00
6	6" X 6" TAPPING SLEEVE & VALVE WITH BOX (WET CONNECTION	3	EA	$ 1,900.00	$ 5,700.00	$ 2,440.00	$ 7,320.00
7	6" HYDRANT & ASSEMBLY	2	EA	$ 2,900.00	$ 5,800.00	$ 3,660.00	$ 7,320.00
8	TREATMENT PLANT SITE WORK	1	LS	$ 47,000.00	$ 47,000.00	$ 17,850.00	$ 17,850.00
9	VINYL COATED FENCE W/GATES	670	LF	$ 31.50	$ 21,105.00	$ 31.00	$ 20,770.00
10	BUILDING	1	LS	$ 120,000.00	$ 120,000.00	$ 199,000.00	$ 199,000.00
11	BOOSTER PUMP ROOM	1	LS	$ 55,000.00	$ 55,000.00	$ 55,750.00	$ 55,750.00
12	FLUORIDE ROOM	1	LS	$ 25,000.00	$ 25,000.00	$ 17,370.00	$ 17,370.00
13	LIQUID CHLORINE ROOM	1	LS	$ 25,000.00	$ 25,000.00	$ 9,040.00	$ 9,040.00
14	CAUSTIC SODA ROOM	1	LS	$ 25,000.00	$ 25,000.00	$ 9,040.00	$ 9,040.00
15	CHEMICAL FEED VAULT & ASSOCIATED PIPING	1	LS	$ 10,335.00	$ 10,335.00	$ 7,865.00	$ 7,865.00
16	RAW WATER SAMPLE POINT MANHOLE	2	EA	$ 8,000.00	$ 16,000.00	$ 4,030.00	$ 8,060.00
17	WELL PUMPS & ASSEMBLY	2	EA	$ 14,000.00	$ 28,000.00	$ 16,370.00	$ 32,740.00
18	WATER STORAGE TANK FOUNDATION	1	LS	$ 155,000.00	$ 155,000.00	$ 159,000.00	$ 159,000.00
19	150,000 GAL WATER STORAGE TANK	1	LS	$ 230,000.00	$ 230,000.00	$ 246,000.00	$ 246,000.00
20	ELECTRICAL CONTROLS, TRANSFER SWITCH & SCADA	1	LS	$ 150,000.00	$ 150,000.00	$ 133,680.00	$ 133,680.00
21	GRAVEL DRIVE REPLACEMENT	15	LF	$ 25.00	$ 375.00	$ 23.00	$ 345.00
22	CONCRETE DRIVE PUSH BORE	20	LF	$ 60.00	$ 1,200.00	$ 43.00	$ 860.00
	TOTAL				**$ 980,000.00**		**$ 978,270.00**

I hereby certify that the figures above accurately represent the bids received.

Mary Austin, PE

Mary Austin, PE

MURTCO INC.

815 Abell Street
Paducah, KY 42003
(270) 444-0679
Fax (270) 444-0770
Toll Free 1-800-795-2554
www.murtco.com

Symsonia Water Improvements Project

Cost Reduction Items	Deduction amount
Glass lined tank (price from original bid form)	$51,000.00
Reduced foundation design (price from original bid form)	$71,000.00
Remove (4) overhead doors	$6,800.00
Move booster pump room overhead door	$0.00
Remove septic tank and pipe to cleanout near building	$1,500.00
Remove chemical equipment	$32,950.00
Use shingled roof w/ western cedar decking	$4,100.00
Remove building paint	$11,000.00
Remove fencing	$20,770.00
Remove concrete pad for generator	$600.00
Remove (2) sample vaults and install near well head.	$5,160.00
Remove DGA for the lot and drive	$6,000.00
Move utility sink to booster room.	$0.00
Move electrical panels to booster pump room	$0.00
Remove storage room	$4,300.00
Remove 6' from length of booster pump room	$2,500.00
Matrix control changes	$3,800.00
Total Deductions	$221,480.00

Original bid amount	***$978,270.00***
Deductions listed above	***$221,480.00***
REVISED BID TOTAL	***$756,790.00***

Estimated Quantities

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
1	6" PVC WATER MAIN	1750	LF	25.00	43,750.00
2	6" STREAM CROSSING	25	LF	80.00	2,000.00
3	6" DI WATER MAIN IN STEEL ENCASEMENT, BORE AND JACK	65	LF	135.00	8,775.00
4	1" PVC WATER SERVICE	140	LF	14.00	1,960.00
5	6" GATE VALVE & BOX	4	EA	750.00	3,000.00
6	6" X 6" TAPPING SLEEVE & VALVE WTH BOX (WET CONNECTION	3	EA	1900.00	5,700.00
7	INSTALL 6" HYDRANT AND ASSEMBLY	2	EA	2900.00	5,800.00
8	TREATMENT PLANT SITE WORK	1	LS	47,000.0	47,000.00
9	VINYL COATED FENCE W/GATES	670	LF	31.50	21,105.00
10	BUILDING	1	LS	120,000	120,000.00
11	BOOSTER PUMP ROOM	1	LS	55,000	55,000.00
12	FLOURIDE ROOM	1	LS	25,000	25,000.00
13	LIQUID CHLORINE ROOM	1	LS	25,000	25,000.00
14.	CAUSTIC SODA ROOM	1	LS	25,000	25,000.00
15.	CHEMICAL FEED VAULT & ASSOCIATED PIPING	1	LS	10,335	10,335.00
16.	RAWWATER SAMPLE POINT MANHOLE	2	EA	8,000	16,000.00
17.	WELL PUMPS & ASSEMBLY	2	EA	14,000	28,000.00
18.	WATER STORAGE TANK FOUNDATION	1	LS	155,000	155,000.00
19.	150,000 GAL WATER STORAGE TANK	1	LS	230,000	230,000.00
20.	ELECTRICAL CONTROLS, TRANSFER SWITCH & SCADA	1	LS	150,000	150,000.00
21.	GRAVEL DRIVE REPLACEMENT	15	LF	25	375.00
22.	CONCRETE DRIVE PUSH BORE	20	LF	60	1,200.00

TOTAL BID.....$ 980,000.00

Note: The cost for concrete thrust blocking, dense graded aggregate (DGA) and all other items not specifically called out in the above bid tabulation, but required for a complete and functional system, are considered incidental to the cost of construction and included in the above items.

API Contractors

2950 Little Cypress Rd. • Calvert City, KY 42029
(270) 898-8090 • Fax (270) 898-8910

Submitted To	Phone	Date
Symsonia Water District		**May 2, 2012**
Street	*Job Name*	
	Symsonia Water Improvements	
City, State, and Zip Code	Job Location	
Symsonia, KY	**Symsonia, KY**	

Item Cost Deductions

Item Description	Deduction
Use Glass Lined Tank	$50,000.00
Reduced Foundation	75,000.00
Remove (4) Overhead Doors	10,000.00
Move Booster Pump Room Overhead Door To End	0.00
Remove Septic Tank	2,000.00
Remove Chemical Equipment	65,000.00
Use Shingle Roof w/Coated Roof Board-not Cedar	7,000.00
Remove Paint	6,500.00
Remove Fencing	21,105.00
Remove Concrete Pad for Generator	900.00
Remove (2) Sample Vaults, Install Sample Point and Meter on Wellhead	5,000.00
Remove Final DGA for Lot and Driveway	6,000.00
Move Utility Sink	0.00
Move Electrical Panels	0.00
Remove Storage Room (Reduce building by 120 S.F.)	18,000.00
Remove 6' From Length of Booster Room	8,800.00
Electrical Changes, Mott Electric/Matrix	7,900.00
Total Deductions	283,205.00

Dan Rudolph

Symsonia Water District

Water Improvements
Symsonia, KY

March 2012
Project 09010

Austin Engineering, Inc.

110 South Third Street, Paducah, KY 42001
(270) 442-0906
www.AustinEngineeringInc.com

Table of Contents

INVITATION TO BID

The Symsonia Water District will receive bids for the installation of two (2) new ground water wells 150,000 gallon ground storage, tank, chemical building, booster pump station, and trunk line.

Bids must be received prior to 2:00 PM (CST) on March 26, 2012, at the office of Austin Engineering, 110 South 3rd St, Paducah, KY 42001, at which time they will be publicly opened and read aloud.

A MANDATORY PRE BID MEETING WILL BE HELD AT 2:00 PM (CST) ON MARCH 19, 2012 AT THE OFFICE OF AUSTIN ENGINEERING. ALL PRIME CONTRACTORS WANTING TO BID ON THE PROJECT MUST ATTEND.

A satisfactory Bid Bond executed by the bidder and acceptable sureties in an amount equal to five percent (5%) of the bid shall be submitted with each bid.

Proposed forms of Contract Documents, Plans and Specifications are on file for viewing at the office of the West Kentucky Construction Association (AGC), 2201 McCracken Blvd, Paducah, KY 42001.

Copies of Contract Documents, Plans and Specifications may be obtained at the office of Austin Engineering, Inc. 110 S 3rd St, Paducah, KY 42001 (270) 442-0906. A Non-refundable Fee of $250.00 will be required for each set of documents obtained.

INSTRUCTIONS TO BIDDERS

BIDDING DOCUMENTS

Bidders will be furnished a complete set of Drawings, Specifications and any Addenda in force. **Two copies** of the following forms will be required:

A. Bid Proposal
B. Form of Bid Bond
C. List of Proposed Sub-Contractors and Materials Equipment Suppliers

INTERPRETATIONS

All interpretations will be in writing in the form of addenda and all bidders shall be bound by such addenda, whether or not received. All addenda will be emailed or faxed to holders of plans and specifications at least two (2) days prior to the Bid Opening date.

PROPOSALS

All bids must be submitted on forms furnished by the Engineer. Two (2) copies of the original shall be submitted.

BID GUARANTY

The bid must be accompanied by a Bid Guaranty which shall not be less than five percent (5%) of the amount of the bid, and shall be a bid bond secured by a guaranty or surety company on the surety company's standard form. Cashier's check may be submitted in lieu of bond.

TIME FOR RECEIVING BIDS

Bids received prior to the time of receipt of bids will be kept sealed and unopened. Bids received after the time of receipt of bids will not be considered, no exceptions.

BID OPENING

At the time and place fixed for the opening of bids, every bid received within the time fixed will be opened and recorded.

WITHDRAWAL AND MODIFICATION OF BIDS

Provided notification is received by the Engineer prior to time set for receipt of bids, bids may be:

A. Withdrawn, in person, or by fax, or email.
B. Modified, in person, or by fax, or email..

AWARD OF CONTRACT: REJECTION OF BIDS

The Owner and Engineer may select the best or qualified bidder as evaluated by the OWNER and ENGINEER. No bidder shall have any right or claim whatsoever against Owner or Engineer for failure to accept his bid. The Owner reserves the right to reject any and all bids or to waive any informalities in bidding.

PERFORMANCE BOND, LABOR & MATERIALS PAYMENT BOND, EXECUTION OF CONTRACT

A. Subsequent to the award and within ten (10) days after the forms are presented to him for signature, the successful bidder shall execute and deliver to the Owner a Contract in the form included in the specifications, in such number of counterparts as the Owner may required.

B. Having satisfied all conditions of award as set forth elsewhere in these documents, the successful bidders shall within the period specified in Paragraph 9A above, furnish a Performance bond in the amount of 100% of the contract price as awarded, and a Labor and Materials Payment Bond in the amount of 100% of the contract price. Such bonds shall be in the form included in the specifications and shall bear a date the same as or subsequent to, the date of the contract. The bonds of individual sureties are not acceptable, and neither are those issued by partnerships or corporations not in the surety business.

C. The failure of the successful bidder to execute such a contract and to supply the required bonds within ten (10) days after the prescribed forms are presented for signature, or within such extended period as the Owner may grant, based upon reasons determined adequate by it, shall constitute a default, and the Owner may award the contract to the next responsible bidder or re-advertise for bids, and may charge against the bidder the amount of the bid bonds.

SITE INSPECTION

Before submitting the bid, each bidder should inspect the site of the proposed work to arrive at a clear understanding of the conditions under which the work is to be done.

TIME FOR COMPLETION

The work which the Contractor is required to perform under this Contract shall be commenced the time stipulated by the Owner in the Notice to Proceed to the Contractor and be fully completed within **ONE HUNDRED FIFTY (150)** consecutive calendar days thereafter.

For each consecutive calendar day beyond, the sum of $250.00 per day will be assessed as liquidated damages and will be withheld from the final payment. In case of inclement weather, the Time of Completion may be extended upon the direction of the Engineer and/or Owner.

BID FORM

Proposal of _____ (BIDDER), doing business in the State of Kentucky as ☐ a Corporation, ☐ a Partnership, ☐ an Individual to the Symsonia Water District (OWNER).

BIDDER hereby agrees to commence work according to the CONTRACT DOCUMENTS (Plans and specifications entitled "Symsonia Water Improvements".) All work is to be completed within 150 consecutive calendar days, as provided for in the Owner-Contractor Agreement. BIDDER recognizes that a $250.00 per day penalty will be withheld from final payment for each calendar day the project extends past 150 days. The Engineer and/or Owner may make adjustments to the Time of Completion due to inclement weather.

In submitting this BID, the BIDDER recognized the right of the OWNER to reject any and all bids, and of all other rights set forth in the CONTRACT DOCUMENTS. Upon acceptance within 90 calendar days of the BID opening, the BIDDER agrees to execute the Owner-Contractor Agreement included in the CONTRACT DOCUMENTS within 10 days. Failure to do so will constitute a default, in which case the OWNER may re-bid the contract, or award the contract to the next responsible bidder, and may charge against the BIDDER the amount of the bid bonds.

Security in the sum of _____ DOLLARS ($_____) in the form of a Bid Bond is submitted herewith in accordance with the specifications.

BIDDER acknowledges receipt of the following Addendum(s):

_____

BIDDER agrees to perform all work described in the Contract Documents for the following amount:
Use Words: _____
Note: Bids shall include sales tax and all other applicable taxes and fees.

In compliance with the Invitation to Bid, BIDDER hereby proposes to perform all work for the project in strict accordance with the Plans and Specifications, within the time set forth, and at the prices below:

Estimated Quantities

ITEM NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	TOTAL COST
1	6" PVC WATER MAIN	1750	LF		
2	6" STREAM CROSSING	25	LF		
3	6" DI WATER MAIN IN STEEL ENCASEMENT, BORE AND JACK	65	LF		
4	1" PVC WATER SERVICE	140	LF		
5	6" GATE VALVE & BOX	4	EA		
6	6" X 6" TAPPING SLEEVE & VALVE WTH BOX (WET CONNECTION_	3	EA		
7	INSTALL 6" HYDRANT AND ASSEMBLY	2	EA		
8	TREATMENT PLANT SITE WORK	1	LS		
9	VINYL COATED FENCE W/GATES	670	LF		
10	BUILDING	1	LS		
11	BOOSTER PUMP ROOM	1	LS		
12	FLOURIDE ROOM	1	LS		
13	LIQUID CHLORINE ROOM	1	LS		
14.	CAUSTIC SODA ROOM	1	LS		
15.	CHEMICAL FEED VAULT & ASSOCIATED PIPING	1	LS		
16.	RAWWATER SAMPLE POINT MANHOLE	2	EA		
17.	WELL PUMPS & ASSEMBLY	2	EA		
18.	WATER STORAGE TANK FOUNDATION	1	LS		
19.	150,000 GAL WATER STORAGE TANK	1	LS		
20.	ELECTRICAL CONTROLS, TRANSFER SWITCH & SCADA	1	LS		
21.	GRAVEL DRIVE REPLACEMENT	15	LF		
22.	CONCRETE DRIVE PUSH BORE	20	LF		

TOTAL BID.....$ _____

Note: The cost for concrete thrust blocking, dense graded aggregate (DGA) and all other items not specifically called out in the above bid tabulation, but required for a complete and functional system, are considered incidental to the cost of construction and included in the above items.

Schedule of Alternatives

ITEM	DESCRIPTION	QUANITY	UNIT	UNIT COST	ADDITIONAL AMOUNT	DEDUCTION AMOUNT
1.	PUSH BORE 6" PVC	300	LF			
2.	6" C900	890	LF			
3.	FOUNDATION W/OUT FUTURE EXPANSION OF STORAGE TANK	1	LS			
4.						
5.						

TOTAL DEDUCTION.....$_____

TOTAL ADDITIONAL.....$_____

Please use item numbers 4 and 5 to list deductions for surface restoration items if push bore is used.

Alternative Equipment Information

Equipment Item	Base Bid Equipment Manufacturer	Alternate Bid Equipment Manufacturer	Lump Sum Deduction
1.		a.	a.
		b.	b.
2.		a.	a.
		b.	b.
3		a.	a.
		b.	b.
4.		a.	a.
		b.	b.
5.		a.	a.
		b.	b.
6		a.	a.
		b.	b.

1. Should the Bidder choose to offer for consideration to the Owner, any alternate manufacturers/products to those listed in the specs, the Bidder shall provide a detailed submittal of applicable items such as catalog cut sheets, pump curves, hydraulic calculations, specifications, wiring diagrams, technical literature, dimensional drawings, etc., or any other information requested by Owner. This submittal information shall be included with

the Bidder's bidding documents for proper evaluation by the Owner. These submittal items shall be in addition to the submittal requirements listed in the respective technical specifications section of the equipment item or product hereinafter

The BIDDER has examined the Plans, Contract Documents, Specifications, and Location of Work and is familiar with the local conditions where the work is to be performed under this Contract.

BIDDER ACKNOWLEDGES THE FOLLOWING ADDENDUMS:

_____

_____

_____

_____

DATE: _____

_____
Bidder

_____
Address

_____
Signature

_____
Title

LIST OF PROPOSED SUBCONTRACTORS

NOTE: To be executed as part of the Bidder's proposal. Failure to fill out this form completely shall be just cause for rejection of Bid.

All sub-contractors are subject to approval. The following are the proposed sub-contractors to be used in connection with this work.

Division of Work	Work Done by General Contractor (Check)		Name and Address of Sub-Contractor
1. Trenching & Other Earthwork	Yes	No	
2. Concrete	Yes	No	
3. Piping	Yes	No	
4. Bore & Jack	Yes	No	
5. Landscaping	Yes	No	
6. Electrical	Yes	No	
7. Tank	Yes	No	
8. Other	Yes	No	

_____
Contractor

_____
Address

_____
Signature

_____
Title

OWNER / CONTRACTOR AGREEMENT

THIS AGREEMENT, made this _____ day of, 2012, by and between the Symsonia Water District, called the OWNER, and _____ hereinafter called the CONTRACTOR,

WITNESSES, that the Owner and Contractor for the consideration hereinafter named agree as follows:

SCOPE OF WORK

The Contractor shall perform all of the work shown on the Drawing and described in the Specification entitled Symsonia Water Improvements prepared by Austin Engineering Inc., acting as, and in these Contract Documents, entitled the Engineer; and shall do everything required by this Agreement, the Special Provisions of the Contract, the Specifications and the Drawings.

TIME OF COMPLETION

The work to be performed under this Contract shall be commenced within 10 calendar days after receipt of written Notice to Proceed from the Owner. The work shall be completed within **150 days**. For each Consecutive calendar day beyond, the sum of $250.00 per day will be assessed as liquidated damages and will be withheld from the final payment.

THE CONTRACT SUM

The Owner shall pay the Contractor for the performance of the Contract, subject to additions and deductions provided therein, in current funds: _____ Dollars ($_____) quoted in the Bid proposal by the Contractor, dated_____, 2012, which shall constitute full compensation for the work and services authorized herein.

PROGRESS PAYMENTS

The Owner shall make partial payments on or about forty-five (45) after submission of an estimate on account of the Contract as provided therein, as follows:

Ninety (90) percent of the value, based on the contract prices of labor and materials incorporated in the work and ninety (90) percent of materials suitably stored on the site thereof; partial payment quantities will be based on estimates prepared by the Engineer on or about the first of each month of the account of the work performed by the Contractor on each item of work included in the original contract, and materials properly stored, no partial payment will be made when the amount due is less than $5,000.00; upon final completion of the entire work, engineer certification, and receipt of all lien releases from sub-contractors and suppliers, a sum sufficient to increase the total payments to one hundred percent (100%) of the Contract Price.

ACCEPTANCE AND FINAL PAYMENT

Final payment shall be due sixty (60) days after final completion of the work provided the work be then fully completed and the Contract fully performed.

Upon receipt of written notice that the work is ready for final inspection and acceptance, the Engineer shall promptly make such inspection, and when he finds the work acceptable under the Contract and the Contract fully performed, he shall promptly issue a final certificate, over his own signature, stating that the work provided

for in this Contract has been completed and is accepted by him under the terms and conditions thereof, and that the entire balance found to be due the Contractor, and noted in said final certificate, is due and payable.

Before issuance of final payment the Contractor shall submit lien wavers or evidence satisfactory to the Engineer that all payrolls, material bills, and other indebtedness connected with the work have been paid or otherwise satisfied.

The Contractor shall warrantee all work for a period of one (1) year. This warranty shall include, but not limited to Trench Settlement and Landscaping and Seeding.

THE CONTRACT DOCUMENTS

The General Conditions of the Contract, the Special Conditions, the Specifications and the Drawings, together with this Agreement, form the Contract and they are as fully a part of the Contract as if hereto attached or herein repeated.

IN WITNESS WHEREOF

The parties hereto have executed this Agreement, the day and year first above written.

_____ By: _____
Witness Owner

_____ By: _____
Witness Contractor

By: _____

_____
Address

_____

FORM OF BID BOND

KNOW ALL MEN BY THESE PRESENT, that we _____ as Principal, hereinafter called the Principle, and _____ a corporation duly organized under the laws of the State of _____ as Surety, hereinafter called the Surety, are held and firmly bound unto _____ as Obligee, hereinafter called the Obligee in the sum of _____ Dollars ($_____) for the payment of which sum well truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these present.

WHEREAS, the Principal has submitted a bid for _____

_____

Dated:_____, 2012, to _____

_____.

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or contract documents with good sufficient surety for the faithful performance of such contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this _____ day of _____, 2012.

_____	_____
Principal	Surety
_____	_____
Title	Title
_____	_____
Witness	Witness

CERTIFICATE AS TO CORPORATE PRINCIPAL

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

_____(Corporate Seal)

PERFORMANCE BOND

KNOW ALL MEN BY THESE PRESENTS: That we,_____,
as Principal, and the _____INSURANCE
COMPANY, a _____corporation, as surety, and held and firmly bound unto as Obligee, in the
(State)
sum of _____ DOLLARS ($_____),
for which sum, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, by these present.

WHEREAS, on the _____ day of _____ 2012, the Principal entered into a contract with the Obligee for _____ which contract is by reference made a part hereof and is hereafter referred to as the Contract:

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that, if the Principal shall faithfully perform said contract according to its terms, covenants, and conditions, then this obligation shall be void; otherwise it shall remain in full force and effect.

Dated this _____ day of _____, 2012.

_____
Insurance Company

_____
Attorney-in-Fact

LABOR AND MATERIAL PAYMENT BOND

KNOW ALL MEN BY THESE PRESENTS: That we, _____,
as Principal, and the _____Insurance
Company, a _____ corporation, as Surety, and held and firmly bound unto _____
(State)
_____as Obligee, in
the sum of _____ DOLLARS
($_____) for which sum, we bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, by these presents.

WHEREAS, on the _____day of_____, 2012, the Principal entered into a contract with the Obligee for _____
_____ which contract is by reference made a part hereof and is hereafter referred to as the Contract:

NOW THEREFORE, THE CONDITIONS OF THIS OBLIGATION IS SUCH, That if the Principal shall pay all laborers, mechanics, subcontractors, material men and all persons who shall supply said Principal or said subcontractors with provisions and supplies for the carrying on of such work, then this obligation shall be null and void; otherwise to remain in full force and effect.

Dated this _____day of_____, 2012.

_____
Signature

_____
Insurance Company

_____
Attorney-in-Fact

INSURANCE REQUIREMENTS

The Contractor shall carry the following insurance *in addition* to the insurance required by law:

Contractor's Public Liability Insurance

Not less than $500,000.00 for damages arising out of bodily injuries to or death to one person. Not less than $1,000,000.00 for damages arising out of bodily injuries to or death to two or more persons.

Contractor's Property Damages Liability Insurance

Not less than $100,000.00 for all damages arising out of injury or destruction of property in any one accident. Not less than $500,000.00 for all damages during the policy record.

Contractor's Protective Public Liability & Property Damage Insurance

The Contractor shall furnish evidence with respect to operations performed for him by sub-contractors that he carries in his own behalf for the above-stipulated amounts.

Workman's Compensation Insurance

The Contractor shall furnish evidence of coverage of all his employees or give evidence of self insurance by submitting a copy of certificate issued by the Workmen's Compensation Board.

NOTICE OF AWARD

To: _____

_____

_____

Project: Symsonia Water Improvements

The Owner has considered the BID submitted by you for the above-described WORK in response to its Advertisement for Bids dated _____, 2012. You are hereby notified that your BID has been accepted in the amount of $_____.

You are required by the Instructions for Bidders to execute the Agreement and furnish the required Contractor's Performance Bond and Payment Bond within ten (10) calendar days from the date of this Notice to you.

If you fail to execute said Agreement and to furnish said bonds within ten (10) days from the date of this Notice, said OWNER will be entitled to consider all your rights arising out of the OWNER's acceptance of your BID as abandoned and as forfeiture of your Bid Bond. The OWNER will be entitled to such other rights as may be granted by law.

You are required to return an acknowledged copy of this NOTICE OF AWARD to the OWNER.

Dated this _____ day of _____, 2012

Mary Austin
Owner/Agent

_____
Signature

Engineer
Title

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE OF AWARD is hereby acknowledged by _____

_____

_____, this the _____ day of _____, 2012.

_____
Signature

_____
Title

NOTICE TO PROCEED

Date: _____

To: _____

_____

_____

PROJECT: Symsonia Water Improvements

You are hereby notified to commence work in accordance with the Agreement dated _____ _____, 2012, on or before_____, 2012, and you are to complete the WORK within **150** consecutive calendar days thereafter.

The date of completion of all WORK is therefore _____, 2012.

_____
Owner

_____
Signature

_____
Title

ACCEPTANCE OF NOTICE

Receipt of the above NOTICE TO PROCEED is hereby acknowledged by _____

_____

_____, this the _____ day of _____, 2012.

_____
Signature

_____
Title

CONTRACT CHANGE ORDER

CHANGE ORDER #: _____

PROJECT: Symsonia Water Improvements

DATE: _____

LOCATION: _____

TO (Contractor): _____

You are hereby requested to comply with the following changes from the Contract plans and specifications:

Item No.	Description of Changes- Quantities, Units, Unit Prices, Completion Schedule, Etc.	Decrease in Contract Price	Increase in Contract Price
_____	TOTAL DECREASE	$ _____	$ _____
_____	TOTAL INCREASE	$ _____	$ _____
	NET (Increase / Decrease)	$ _____	$ _____
	TOTAL CONTRACT PRICE (Before this Change)	$ _____	$ _____
	NEW TOTAL CONTRACT PRICE (Including this Change)	$ _____	$ _____

The time provided for completion in the Contract is ☐ unchanged, ☐ increased or ☐ decreased by ____ calendar days. The new date for completion of all work will be _____(date). This document shall become an amendment to the Contract and all provisions of the Contract will apply thereto.

Recommended by: _____ Date: _____
(Engineer)

Accepted by: _____ Date: _____
(Contractor)

Approved by: _____ Date: _____
(Owner)

ATTACH A DESCRIPTION OF CHANGE ORDER TO THIS PAGE

SECTION 01

SECTION 01110 - SUMMARY OF WORK

PART 1 - GENERAL

1.01 SCOPE OF WORK PERFORMED UNDER THIS CONTRACT

The installation of two (2) new ground water wells, 150,000 gallon ground storage tank, chemical building, booster station, and trunk line.

1.02 ENUMERATION OF DRAWINGS & SPECIFICATIONS

Following are the Drawings and Specifications which form the Contract Documents as set forth in Section 1.1 of the General Conditions:

Drawings	Sheet Number
Cover	1
Index	2
Details	3
Water Line Plan	4
Water Line Plan	5
Treatment Site Plan	6
Well Details	7
Booster Pump Details	8
Building Details	9
Chemical Feed Details	10
Chemical Feed Details	11
Tank Details	12

Specifications

See Table of Contents

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

SECTION 01120 - GENERAL PROVISIONS

PART 1 - GENERAL

1.01 DESIGNATION OF PARTIES

A. All references in the Specifications, Contract Documents and Drawings to "Owner" shall mean Symsonia Water District; all references to "Engineer" shall mean Austin Engineering, Inc, 110 South Third St, Paducah, KY.

1.02 EXPERIENCE CLAUSE

A. Wherever experience is required of equipment manufacturers in manufacturing or in records of satisfactory operation for a specified period of time, in lieu of the experience, the manufacturer may furnish a 100 percent (100%) performance guarantee bond or a cash deposit. The bond or cash deposit provided by the manufacturer shall guarantee replacement of the equipment process in the event of failure or unsatisfactory service. The period of time for which the bond or cash deposit is required shall be the same as the experience period of time specified.

1.03 ACCESS TO INSPECTION OF WORK

A. Representatives of the State Department of Health, the State Department for Natural Resources and Environmental Protection, local public health agencies, Owner, and Engineer shall at all times have full access to the project site for inspection of the work accomplished under this Contract and for inspection of all materials intended for use under the Contract. The Contractor shall provide proper facilities for such access and inspection.

1.04 EQUIPMENT LUBRICATION

A. The Contractor shall make suitable provision for the proper lubrication of all equipment furnished under this Contract. Accessible grease fittings shall be provided where required. A supply of oil, grease and other lubricants of proper quality, as recommended by the manufacturer of the equipment, shall be furnished. Lubricants shall be furnished in their original, unopened containers, in sufficient quantity for initial fillings and for at least one (1) year of operation.

1.05 PRE-CONSTRUCTION CONFERENCE

A. The Contractor, Engineer and Owner, or their duly appointed representative, shall meet in a preconstruction conference prior to the initiation of construction to organize, schedule and determine responsibilities for the work as it pertains to each party of the Contract. The contractor's project manager and field superintendent must be in attendance.

1.06 CONSTRUCTION SCHEDULE CHART

A. Prior to start of any construction, the Contractor shall furnish a construction schedule or progress chart. The schedule or chart shall be subject to the approval of the Engineer, and be of sufficient detail to show the chronological relationship of all activities of the project, the order in which the Contractor proposes to carry on the work, estimated starting and completion dates of major features, procurement of materials, and scheduling of equipment. The schedule shall be in a form suitable for appropriately indicating the percentage of work scheduled for completion at any time. The schedule shall be kept current and shall reflect completion of all work under the Contract within the specified time and in accordance with these Specifications.

1.07 CONSTRUCTION PROGRESS MEETINGS

A. Monthly construction progress meetings shall be held at the project site or at a designated location established by the Owner. The Contractor, appropriate Sub-Contractors, the Engineer and the Owner shall meet to review construction progress, equipment or material submittals, construction schedules, etc. Contractor's project manager and field superintendent must be in attendance.

1.08 PRECONSTRUCTION PHOTOGRAPHS

A. Prior to construction and mobilization of equipment, Contractor shall take record photographs of all areas of the project site.

B. In lieu of photographs, a videographic record may be made of the project site.

1.09 SPARE PARTS

A. Spare parts for routine maintenance and minor repairs shall be provided for specified equipment items in the respective technical sections of these Specifications. Required spare parts to be provided are listed in the particular equipment Specifications.

B. Parts shall be coated to protect them from a moist atmosphere. All spare parts shall be plainly tagged, marked for identification and reordering, and shall be delivered properly boxed. Required identification includes (but is not limited to):

1. Name of the manufacturer or supplier of equipment.
2. Name of the unit for which the part is intended.
3. Name of the spare part.
4. Name of the supplier of the spare part.
5. Manufacturer's catalogue part number.
6. Precautionary information.
7. Any other identifying information deemed appropriate.

C. All spare parts for a single equipment item shall be crated together in containers suitable for handling with hoisting equipment and designed for prolonged storage and stenciled to identify contents.

D. Where oil or grease lubricated equipment is concerned, sufficient oil or grease of types recommended by the equipment manufacturer shall be supplied for one year's operation.

E. The Contractor shall furnish and deliver the spare parts to the Owner at such time as he (Owner) may direct but prior to Contract expiration date. Furnish to the Engineer for record purposes a list of spare parts delivered to the Owner.

1.10 CLEANING

A. The Contractor shall at all times keep the construction site and the surrounding area presentable to the public, and clean of rubbish caused by the Contractor's operation. At completion of the work, the Contractor shall remove all the rubbish, all tools, equipment, temporary work and surplus materials, from and about the premises, and shall leave the site clean and ready for use.

B. After completion of all work and before final acceptance of the work, the Contractor shall thoroughly clean all equipment and materials and shall remove all foreign matter such as grease, dirt, plaster, labels, stickers, etc., from the exterior of the piping, equipment and all associated fabrication.

C. All waste and excess materials shall be disposed of off the project site and at no additional expense to the Owner. In no case shall waste materials (any removed concrete, piping, equipment, etc.) be buried on the site. Burning is not permitted.

D. Upon completion of the project, the Contractor is responsible for leaving the project site in as good as or better condition than the original. This includes site grading, landscaping, replacement of sidewalks, driveways, curbs, mailboxes, clotheslines, fences, etc. and removal of all construction debris.

1.11 TAXES

A. Proposals shall be made to include any applicable taxes on payrolls, materials, equipment, vehicles, utilities, etc., including State sales taxes and shall include compensation for such taxes on all work under this Contract.

1.12 LINES AND GRADES

A. The Contractor shall be responsible for all other lines and grades required for the construction of structures. The Contractor shall set line and grade stakes for all gravity sewers, offset from the centerline of the trench or the axes of the pipelines.

B. The Contractor shall use a laser beam instrument to set the grades on gravity sewer lines. In using such an instrument, the Contractor shall be responsible for maintaining grades and elevations as called for on the drawing profiles, and any variances found shall be corrected by the Contractor at his expense. The Contractor shall verify invert elevation at each manhole for a check. A blower shall be used with the laser beam instrument during warm or hot weather to assure accurate line and grade for the laser beam.

C. When water lines, process piping and other such buried pressure pipelines are involved, Contractor is responsible for any detailed layout requiring surveying, or excavation including that required for establishing the grade of the pipeline.

D. The Contractor shall furnish all materials, stakes and grade boards that are required for layout by the Contractor's forces. In addition, the Contractor shall furnish any necessary survey personnel to mark the location of the various facilities on the ground, establishing bench levels and determining as-built conditions after work is completed. The Contractor's personnel engaged in the layout work described herein shall be fully capable of performing the duties set out herein and shall be fully qualified as required. Contractor shall be responsible for verifying all profiles and elevations prior to construction.

1.13 BLASTING

A. All blasting operations shall be conducted in strict accordance with the Rules and Regulations of the State Department of Mine and Minerals, Division of Explosives and Blasting, which shall be deemed to be included in these Specifications the same as though herein written in full. The Contractor shall also comply with applicable municipal ordinances, Federal Safety Regulations and Section 9 of the Manual of Accident Prevention in Construction, published by the Associated General Contractor's of America, Inc. All explosives shall be stored in conformity with said ordinances, laws and safety regulations. No blasting shall be done within five feet of any water mains, or ten feet of any gas mains except with light charges of explosives. Any damage done by blasting is the responsibility of the Contractor and shall be promptly and satisfactorily repaired by him. All blast events shall be designed in accordance with state laws. These guidelines are established to limit peak particle velocities occurring as a result of blasting to protect structures from damage due to ground motions from blast events. The peak particle velocity is the maximum velocity of particle excitation measured along any of the three orthogonal axes (longitudinal, vertical or transverse). In addition the following guidelines shall be applicable to new concrete.

Age of Concrete, Days*	Maximum Permissible Particle Velocity, IPS**
0 to 1	0.25
2	0.50
3-or more	1.00

* Concrete is defined as properly designed and placed, well-consolidated Portland Cement concrete achieving a normal increase in strength with age.

** Measured at location of concrete, by probe fixed in or on soil surface.

As an option, a scaled distance (distance from blast to concrete/-square root of charge weight) of 130 or more can be used conservatively to design blast events.

B. Unless otherwise required by ordinance or law, each excavation crew shall be provided with two metal boxes equipped with suitable locks. One of these boxes shall be for storing explosives and one for caps. The boxes shall always be locked except when in actual use. They shall be painted a bright color and stenciled with appropriate warning signs. At night, explosives and caps shall be stored in separate magazines.

C. If any possibility exists of rock or any other debris leaving the site during a blast event, the shot shall be covered with rope, heavy timber or rubber mats, to prevent the aforementioned.

D. The Contractor shall keep a blasting log and, for each blast, shall record the date, time of blast, number of holes, type of explosive, number of delays, amount of charge per delay; stemming type, and number of caps; and all other items as required by State laws and regulations.

E. All blasting shall be supervised and performed by qualified personnel and shall be monitored to ensure compliance with the particle velocity requirements. The Contractor shall submit a monitoring plan to the Engineer prior to beginning blasting activities.

F. A pre-blast survey shall be performed by the Contractor. The pre-blast survey shall be accurate and up to date at the time of the blast event. The survey shall be a compilation of the condition, type, and general appearance of all nearby structures. It shall also include a listing of any vibration-sensitive equipment or conditions which exist at adjacent facilities. The owners and occupants of these facilities shall be notified of the intent to blast and the blasting schedule. The survey shall be conducted by a competent engineering firm or other qualified firm and sufficiently documented by photographs, video, measurements, and diagrams. The survey shall include all structures within 200' of the project or any such structure the Contractor feels may be reasonably affected by ground and/or air vibrations from blasting. Pre-blast survey results shall be submitted to the Owner upon request.

G. Shot rock which is excavated shall be disposed of offsite by the Contractor. No rock larger than one-half cubic foot will be permitted in the backfill.

1.14 COMPLIANCE WITH SAFETY REGULATIONS

A. The equipment items furnished shall comply with all governing federal and state laws regarding safety, including all current requirements of the Occupational Safety and Health Act (OSHA). Contractor shall be solely responsible for job safety in accordance with all laws, regulations, methods, etc. of OSHA and the state.

1.15 MAINTENANCE AND OPERATIONS MANUAL

A. Every piece of equipment furnished and installed shall be provided with complete maintenance and operations manuals. These shall be detailed in instructions to the Owner's personnel. They shall be attractively bound for the Owner's records. See Section 01340 and Section 01780 for requirements. The manuals shall be

submitted to the Engineer for review as to adequacy and completeness. Provide four copies each, unless otherwise noted

1.16 OBSTRUCTIONS

A. In cases where storm sewers, sanitary sewers, gas lines, water lines, telephone lines, electric lines or other underground structures are encountered, they shall not be displaced or molested unless necessary, in which case they shall be replaced in as good a condition as found and as quickly as possible.

B. The Contractor is responsible for notifying the appropriate utility companies, and coordinating the protection of the utility. All such lines or underground structures damaged or molested in the construction shall be replaced at the Contractor's expense, unless in the opinion of the Engineer, such damage was caused through no fault of the Contractor.

1.17 STORAGE FACILITIES

A. The Contractor shall be responsible for proper and adequate storage of all materials and equipment used on the site. Any additional off-site space required for construction purposes shall be the Contractor's responsibility to obtain.

B. Upon completion of the work, the Contractor shall remove all storage facilities, surplus materials and equipment and restore the site to its original condition, or to the finished condition as required by the Contract.

1.18 STANDARDS OF WORKMANSHIP

A. Work of all crafts and trades shall be laid out to lines and elevations as established by the Contractor from the Drawings or from instructions by the Engineer. Unless otherwise shown, all work shall be plumb and level, in straight lines and true planes, parallel or square to the established lines and levels. The work shall be accurately measured and fitted to tolerance as established by the best practices of the crafts and trades involved, and shall be as required to fit all parts of the work carefully and neatly together.

1.19 PERFORMANCE AND PAYMENT BONDS

A. Performance and payment bonds, as specified in of the General Conditions, shall run for a period of one (1) year after final acceptance of the work by the Owner. These bonds shall be executed on the forms provided as a part of the Contract Documents.

1.20 INITIAL START-UP AND OPERATION

A. The initial operation period provided for herein is to check and provide the satisfactory mechanical operation of the facilities. These requirements for start-up and operation in no way relieve the Contractor of his responsibility with respect to guaranty of work as specified in the "General Conditions." The manufacturer's representatives shall be present during this period to instruct the

operators in the care, operation and maintenance of the equipment. When the shakedown period is completed, the Owner will assume responsibility for maintenance and operation, provided that all major items of the Work are operating satisfactorily.

B. If any or all of the facilities are not operating satisfactorily at the end of the shakedown period, the Contractor shall continue to maintain those facilities that are incomplete or not operating satisfactorily until they are complete and acceptable to the Owner. Maintenance by the Contractor shall include all mechanical facilities such as pumps and like equipment. Prior to start-up, the Contractor will be required to prepare an operating schedule detailing the proposed start-up and his plans for manpower and auxiliary facilities to be provided.

1.21 GUARANTY

A. Except as otherwise specified herein, the Contractor shall guarantee all work from latent defects in materials, equipment and workmanship for one (1) year from the date of final completion of the Contract. The date of final completion shall be that date upon which the final estimate is approved by the Owner or the date of substantial completion as defined in Section 01770 of the technical Specifications. In case any date but the date of final completion is established to govern the time of the Guaranty, such date shall be duly recorded together with the terms and conditions of such agreement.

B. The Contractor agrees that he will obtain from the manufacturers of equipment and materials furnished under this Contract, guarantees against defective materials and workmanship, and if those guarantees furnished by the manufacturer do not extend for the term of one (1) year from and after the date upon which the final estimate is formally approved by the Owner or other established date as set forth hereinbefore, he shall make the necessary arrangements and assume all cost for extending this guarantee for the required period.

C. The Contractor shall promptly make such repairs or replacement as may be required under the above specified guarantee, and, when the repairs or replacements involve one or more items of installed equipment, shall provide the services of qualified factory-trained servicemen in the employ of the equipment manufacturers to perform or supervise the repairs or replacements.

D. When the Engineer or the Owner deems it necessary, and so orders, such replacements or repairs under this section shall be undertaken by the Contractor within twenty-four (24) hours after service of notice. If the Contractor unnecessarily delays or fails to make the ordered replacements or repairs within the time specified, or if any replacements or repairs are of such nature as not to admit of the delay incident to the service of a notice, then the Owner shall have the right to make such replacements or repairs, and the expense thereof shall be paid by the Contractor or deducted from any moneys due the Contractor.

E. The Performance Bond shall remain in full force and effect throughout the Guaranty period.

F. All warranties and guarantees remaining in effect at and beyond the Guaranty expiration date shall be relinquished and transferred to the Owner. Copies of

such warranty/guaranty shall be submitted to the Engineer prior to date of the start of the guaranty period.

1.22 TRAFFIC CONTROL AND MAINTENANCE

A. Traffic shall be maintained on all highways and streets at all times during construction of pipe lines across or along side said highways and streets. Access to all existing subdivisions and private residences shall also be kept open. Work shall be performed in accordance with applicable City, County, and state Department of Transportation guidelines. Traffic control shall include proper signing and flagging per these guidelines.

B. Traffic shall be maintained in accordance with the Manual on Uniform Traffic Control Devices. Work shall include all labor and materials necessary for construction and maintenance of traffic control devices and markings.

C. Traffic control shall also include all flag persons and traffic control devices such as, but not limited to, flashers, signs, barricades and vertical panels, plastic drums (steel drums will not be permitted) and cones necessary for the control and protection of vehicular and pedestrian traffic as specified by the Manual on Uniform Traffic Control Devices.

D. Any temporary traffic control items, devices, materials, and incidentals shall remain the property of the Contractor when no longer needed.

E. The Contractor shall maintain a two-lane traveled way with a minimum lane width of 10 feet; however, during working hours, one-way traffic may be allowed at the discretion of the Engineer, provided adequate signing and flagpersons are at the location.

F. The Contractor shall fully cover with plywood any signs, either existing, permanent or temporary, which do not properly apply to the current traffic phasing, and shall maintain the covering until the signs are applicable or are removed.

G. In general, all traffic control devices shall be placed starting and proceeding in the direction of the flow of traffic and removed starting and proceeding in the direction opposite to the flow of traffic.

H. The Engineer and Contractor shall review the signing before traffic is allowed to use lane closures, crossovers, or detours, and all signing shall be approved by the Engineer before work can be started by the Contractor.

I. If traffic should be stopped due to construction operations and an emergency vehicle on an official emergency run arrives on the scene, the Contractor shall make provisions for the passage of that vehicle immediately.

1.23 FLOOD INSURANCE

A. Contractor is required to carry flood insurance for projects which are located in designated flood hazard areas unless Federal Flood Insurance is not available.

1.24 CONSTRUCTION ALONG OR ACROSS A STREAM

A. All excavations along or across a stream shall be done in such a manner as to prevent degradation of the waters. Spoil material shall not be allowed to enter the flowing portion of the stream.

B. Effective erosion and sedimentation measures must be employed at all times during the project to prevent degradation of the waters.

C. Site regrading and reseeding shall be accomplished within 14 days after disturbance, regardless of the season.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

SECTION 01205 - LABOR PROVISIONS - KENTUCKY

PART 1 - GENERAL

1.01 HOURS OF WORK

A. The Contractor shall comply in every respect to all provisions of the Kentucky Revised Statutes 337.505 to 337.550.

B. Hours of work shall be as set out in KRS 337.550; that is, not more than eight (8) hours in one calendar day, nor more than forty (40) hours in one week, except in case of emergency caused by fire, flood or damage to life or property.

C. The provisions included under KRS 337.540 concerning a 10-hour workday may be allowed if Owner is in agreement.

D. Any laborer, workman, mechanic, helper, assistant or apprentice working in excess of eight (8) hours per day or forty (40) hours in one week except in case of emergency, shall be paid not less than 1-1/2 times the base rate.

E. Any overtime work (greater than 40 hours in one week) shall require the Contractor to reimburse the Owner for additional resident inspection costs at an hourly rate times 1-1/2 overtime multiplier.

1.02 PREVAILING WAGE REQUIREMENT

A. In accordance with Kentucky Revised Statutes 337.510, Kentucky State Prevailing Wage Rates shall be in effect for all contracts with an estimated value in excess of $250,000.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

Steven L. Beshear
Governor

KENTUCKY LABOR CABINET
DEPARTMENT OF WORKPLACE STANDARDS
DIVISION OF EMPLOYMENT STANDARDS,
APPRENTICESHIP & MEDIATION
1047 US Hwy 127 S - Suite 4
Frankfort, Kentucky 40601
Phone: (502) 564-3534
Fax (502) 696-1897
www.labor.ky.gov

Mark S. Brown
Secretary

Michael L. Dixon
Commissioner

February 21, 2012

JEREMY BUCHANAN
PURCHASE AREA DEV DIST
1002 MEDICAL DR
MAYFIELD KY 42066

Re: SYMSONIA WATER DISTRICT, WATER SYSTEM IMPROVEMENTS PROJ (REVISED)

Advertising Date as Shown on Notification: February 25, 2012

Dear JEREMY BUCHANAN:

This office is in receipt of your written notification on the above project as required by KRS 337.510 (1).

I am enclosing a copy of the current prevailing wage determination number CR 1-001, dated February 3, 2012 for GRAVES County. This schedule of wages shall be attached to and made a part of the specifications for the work, printed on the bidding blanks, and made a part of the contract for the construction of the public works between the public authority and the successful bidder or bidders.

The determination number assigned to this project is based upon the advertising date contained in your notification. There may be modifications to this wage determination prior to the advertising date indicated. In addition, if the contract is not awarded within 90 days of this advertising date or if the advertising date is modified, a different set of prevailing rates of wages may be applicable. It will be the responsibility of the public authority to contact this office and verify the correct schedule of the prevailing rates of wages for use on the project. Your project number is as follows: 042-H-00071-12-1, Heavy/Highway

Sincerely,

Michael L. Dixon
Commissioner

KENTUCKY LABOR CABINET
PREVAILING WAGE DETERMINATION
CURRENT REVISION
LOCALITY NO. 01

CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON & TRIGG COUNTIES

Determination No. CR-1-001 2012

Date of Determination: February 3, 2012

Project No. 042-H-00071-12-1
Type: ____ Bldg _xx___ HH

This schedule of the prevailing rate of wages for Calloway, Carlisle, Fulton, Graves, Hickman, Lyon, &, Trigg Counties has been determined in accordance with the provisions of KRS 337.505 to 337.550. This determination shall be referred to as Prevailing Wage Determination Number CR-1-001 2012.

Apprentices shall be permitted to work as such subject to Administrative Regulations adopted by the Commissioner of Workplace Standards. Copies of these regulations will be furnished upon request to any interested person.

Overtime is to be computed at not less than one and one-half (1 1/2) times the indicated BASE RATE for all hours worked in excess of eight (8) hours per day, and/or in excess of forty (40) hours per week. However, KRS 337.540 permits an employee and employer to agree, in writing, that the employee will be compensated at a straight time base rate for hours worked in excess of eight (8) hours in any one calendar day, but not more than ten (10) hours worked in any one calendar day, if such written agreement is prior to the over eight (8) hours in a calendar day actually being worked, or where provided for in a collective bargaining agreement. The fringe benefit rate is to be paid for each hour worked at a straight time rate for all hours worked. Fringe benefit amounts are applicable for all hours worked except when otherwise noted. Welders will receive rate for craft in which welding is incidental.

NOTE: The type of construction shall be determined by applying the following definitions:

BUILDING CONSTRUCTION
Building construction is the construction of sheltered enclosures with walk-in access for the purpose of housing persons, machinery, equipment, or supplies. It includes all construction of such structures, the installation of utilities and the installation of equipment, both above and below grade level, as well as incidental grading, utilities and paving.

HIGHWAY CONSTRUCTION
Highway construction includes the construction, alteration or repair of roads, streets, highways, runways, taxiways, alleys, trails, paths, parking areas, and other similar projects not incidental to building or heavy construction. It includes all incidental construction in conjunction with the highway construction project.

HEAVY CONSTRUCTION
Heavy projects are those projects that are not properly classified as either "building" or "highway". For example, dredging projects, water and sewer line projects, dams, flood control projects, sewage treatment plants and facilities, and water treatment plants and facilities are considered heavy.

Michael L. Dixon, Commissioner
Department of Workplace Standards
Kentucky Labor Cabinet

ASBESTOS/INSULATION WORKERS: (Including duct (hot/cold), pipe insulator & pipe wrapping):
CALLOWAY& TRIGG COUNTIES:

BASE RATE	$24.05
FRINGE BENEFITS	9.46

ASBESTOS/INSULATION WORKERS: (Including duct (hot/cold), pipe insulator & pipe wrapping):
CARLISLE, FULTON, GRAVES, HICKMAN & LYON COUNTIES:

BASE RATE	$28.56
FRINGE BENEFITS	13.55

CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON & TRIGG COUNTIES:
HAZARDOUS MATERIAL HANDLER: (Includes preparation, wetting, stripping, removal, scrapping, vacuuming, bagging and disposing of all insulation materials, whether they contain asbestos or not, from mechanical systems):

BASE RATE	$24.05
FRINGE BENEFITS	9.46

BOILERMAKERS:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON & TRIGG COUNTIES:

BASE RATE	$35.79
FRINGE BENEFITS	16.71

BRICKLAYERS / BUILDING:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN & LYON COUNTIES:

	BUILDING	BASE RATE	$24.55
		FRINGE BENEFITS	0.00

BRICKLAYERS:

TRIGG COUNTY:	BUILDING	BASE RATE	$23.03
		FRINGE BENEFITS	2.06

TILE FINISHERS

TRIGG COUNTY:	BUILDING	BASE RATE	$15.42
		FRINGE BENEFITS	5.42

TILE SETTERS

TRIGG COUNTY:	BUILDING	BASE RATE	$22.64
		FRINGE BENEFITS	6.10

BRICKLAYERS / HEAVY HIGHWAY:
CARLISLE, FULTON, GRAVES, HICKMAN & LYON COUNTIES:

	HEAVY HIGHWAY	BASE RATE	$28.47
		FRINGE BENEFITS	12.78

BRICKLAYERS / HEAVY HIGHWAY: CONTINUED
CALLOWAY & TRIGG COUNTIES:

	HEAVY HIGHWAY	BASE RATE	$24.52
		FRINGE BENEFITS	1.83

CARPENTERS:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON COUNTIES:
Carpenters: (Including Drywall Hanging, Batt Insulation & Formwork)

	BUILDING	BASE RATE	$20.33
		FRINGE BENEFITS	13.96
	HEAVY & HIGHWAY	BASE RATE	$25.95
		FRINGE BENEFITS	13.22
Piledrivermen:	HEAVY & HIGHWAY	BASE RATE	$26.20
		FRINGE BENEFITS	13.22
Divers:	HEAVY & HIGHWAY	BASE RATE	$39.30
		FRINGE BENEFITS	13.22

CARPENTERS: (Includes drywall finishing/taping)

TRIGG COUNTY:	BUILDING	BASE RATE	$17.50
		FRINGE BENEFITS	0.00
Drywall Hanging:	BUILDING	BASE RATE	$17.00
		FRINGE BENEFITS	0.00

CEMENT MASONS & CONCRETE FINISHERS:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON COUNTIES:

BASE RATE	$22.10
FRINGE BENEFITS	11.65

CEMENT MASONS & CONCRETE FINISHERS:
TRIGG COUNTY:

BASE RATE	$11.00
FRINGE BENEFITS	0.00

ELECTRICIANS:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON & TRIGG COUNTIES:
Electricians:

BASE RATE	$29.47
FRINGE BENEFITS	12.87

Cable Splicers:
CALLOWAY, CARLISLE, GRAVES, HICKMAN, LYON & TRIGG COUNTIES:

BASE RATE	$28.52
FRINGE BENEFITS	12.52

ELECTRICIANS: CONTINUED
Cable Splicers:

FULTON COUNTY:		BASE RATE	$25.00
		FRINGE BENEFITS	10.27

ELEVATOR CONSTRUCTORS:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON & TRIGG COUNTIES:

		BASE RATE	$21.51
		FRINGE BENEFITS	6.12

GLAZIERS:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON & TRIGG COUNTIES:

		BASE RATE	$25.18
		FRINGE BENEFITS	8.65

IRONWORKERS / BUILDING:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, & LYON COUNTIES:
Structural/Ornamental/Reinforcing:

	BUILDING	BASE RATE	$24.66
		FRINGE BENEFITS	16.29

IRONWORKERS / BUILDING:
TRIGG COUNTY:

Reinforcing:	BUILDING	BASE RATE	$14.51
		FRINGE BENEFITS	6.76
Structural:	BUILDING	BASE RATE	$21.78
		FRINGE BENEFITS	8.57
Ornamental:	BUILDING	BASE RATE	24.66
		FRINGE BENEFITS	16.29

IRONWORKERS / HEAVY HIGHWAY:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON & TRIGG COUNTIES:
Projects with a total contract cost of $20,000,000.00 or above:

	HEAVY & HIGHWAY	BASE RATE	$26.00
		FRINGE BENEFITS	17.42
All Other Work:	HEAVY & HIGHWAY	BASE RATE	$24.66
		FRINGE BENEFITS	16.29

LABORERS / BUILDING:
CARLISLE, FULTON, GRAVES, HICKMAN & LYON COUNTIES:

Common or General	BUILDING	BASE RATE	$19.50
		FRINGE BENEFITS	10.60
Grade Checker:	BUILDING	BASE RATE	$19.70
		FRINGE BENEFITS	10.60

LABORERS / BUILDING: CONTINUED
CARLISLE, FULTON, GRAVES, HICKMAN & LYON COUNTIES:

Mason Tender-Brick	BUILDING	BASE RATE	$20.14
		FRINGE BENEFITS	0.00
Mason Tender-Cement/Concrete			
	BUILDING	BASE RATE	$11.46
		FRINGE BENEFITS	0.00

LABORERS / BUILDING:
CALLOWAY COUNTY:

Grade Checker:	BUILDING	BASE RATE	$19.70
		FRINGE BENEFITS	10.60
Common or General:	BUILDING	BASE RATE	$18.29
		FRINGE BENEFITS	4.24
Mason Tender-Brick	BUILDING	BASE RATE	$23.60
		FRINGE BENEFITS	0.00
Mason Tender-Cement/Concrete:			
	BUILDING	BASE RATE	$11.46
		FRINGE BENEFITS	0.00

LABORERS / BUILDING:
TRIGG COUNTY

Grade Checker, Mason Tender-Cement/Concrete, Mason Tender-Brick (Hod), Pipelayer & Screw Operator:	BUILDING	BASE RATE	$20.05
		FRINGE BENEFITS	10.15
Landscape Laborer	BUILDING	BASE RATE	$19.85
		FRINGE BENEFITS	10.15
Common or General	BUILDING	BASE RATE	$11.00
		FRINGE BENEFITS	0.00
Mason Tender-Brick	BUILDING	BASE RATE	$19.65
		FRINGE BENEFITS	0.00

LABORERS / HEAVY HIGHWAY:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN & LYON COUNTIES:

GROUP 1: Aging & Curing of Concrete; Asbestos Abatement Worker; Asphalt Plant; Asphalt; Batch Truck Dump; Carpenter Tender; Cement Mason Tender; Cleaning of Machines; Concrete; Demolition; Dredging; Environmental -- Nuclear, Radiation, Toxic & Hazardous Waste – Level D; Flagperson; Grade Checker; Hand Digging & Hand Back Filling; Highway Marker Placer; Landscaping, Mesh Handler & Placer; Puddler; Railroad; Rip-rap & Grouter; Right-of-Way; Sign, Guard Rail & Fence Installer; Signal Person; Sound Barrier Installer; Storm & Sanitary Sewer; Swamper; Truck Spotter & Dumper; Wrecking of Concrete Form & General Cleanup:

	HEAVY & HIGHWAY	BASE RATE	$20.38
		FRINGE BENEFITS	11.28

LABORERS / HEAVY HIGHWAY: CONTINUED
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN & LYON COUNTIES:

GROUP 2: Batter Board Man (Sanitary & Storm Sewer); Brickmason Tender; Mortar Mixer Operator; Scaffold Builder; Burner & Welder; Bushammer; Chain Saw Operator; Concrete Saw Operator; Deckhand Scow Man; Dry Cement Handler; Environmental – Nuclear, Radiation, Toxic & Hazardous Waste – Level C; Forklift Operator for Masonary; Form Setter; Green Concrete Cutting; Hand Operated Grouter & Grinder Machine Operator; Jackhammer; Pavement Breaker; Paving Joint Machine; Pipelayer; Plastic Pipe Fusion; Power Driven Georgia Buggy & Wheel Barrow; Power Post Hole Digger; Precast Manhole Setter; Walk-Behind Tamper; Walk-Behind Trencher; Sand Blaster; Concrete Chipper; Surface Grinder; Vibrator Operator; & Wagon Driller:

HEAVY & HIGHWAY	BASE RATE	$20.63
	FRINGE BENEFITS	11.28

GROUP 3: Asphalt Luteman & Raker; Gunnite Nozzleman; Gunnite Operator & Mixer; Grout Pump Operator; Side Rail Setter; Rail Paved Ditch; Screw Operator; Tunnel (Free air); & Water Blaster:

HEAVY & HIGHWAY	BASE RATE	$20.68
	FRINGE BENEFITS	11.28

GROUP 4: Caisson Worker (Free Air); Cement Finisher; Environmental - Nuclear, Radiation, Toxic & Hazardous Waste - Levels A & B; Miner & Driller (Free Air); Tunnel Blaster; & Tunnel Mucker (Free Air); Directional & Horizontal Boring; Air Track Drillers (All Types); Powderman & Blasters; Troxler & Concrete Tester if Laborer is Utilitiezed:

HEAVY & HIGHWAY	BASE RATE	$21.28
	FRINGE BENEFITS	11.28

LABORERS / HEAVY HIGHWAY:
TRIGG COUNTY:

GROUP 1: Aging & Curing of Concrete; Asbestos Abatement Worker; Asphalt Plant; Asphalt; Batch Truck Dump; Carpenter Tender; Cement Mason Tender; Cleaning of Machines; Concrete; Demolition; Dredging; Environmental – Nuclear, Radiation, Toxic & Hazardous Waste – Level D; Flagperson; Grade Checker; Hand Digging & Hand Back Filling; Highway Marker Placer; Landscaping, Mesh Handler & Placer; Puddler; Railroad; Rip-rap & Grouter; Right-of-Way; Sign, Guard Rail & Fence Installer; Signal Person; Sound Barrier Installer; Storm & Sanitary Sewer; Swamper; Truck Spotter & Dumper; Wrecking of Concrete Form; & General Cleanup:

HEAVY & HIGHWAY	BASE RATE	$21.51
	FRINGE BENEFITS	10.15

GROUP 2: Batter Board Man (Sanitary & Storm Sewer); Brickmason Tender; Mortar Mixer Operator; Scaffold Builder; Burner & Welder; Bushammer; Chain Saw Operator; Hand Held or Walk Behind Concrete Saw Operator; Deckhand Scow Man; Dry Cement Handler; Environmental – Nuclear, Radiation, Toxic & Hazardous Waste – Level C; Forklift Operator for Masonary; Form Setter; Green Concrete Cutting; Hand Operated Grouter & Grinder Machine Operator; Jackhammer; Pavement Breaker; Paving Joint Machine; Pipelayer; Plastic Pipe Fusion; Power Driven Georgia Buggy & Wheel Barrow; Power Post Hole Digger; Precast Manhole Setter; Walk-Behind Tamper; Walk-Behind Trencher; Sand Blaster; Concrete Chipper; Surface Grinder; Vibrator Operator; & Wagon Driller:

HEAVY & HIGHWAY	BASE RATE	$21.76
	FRINGE BENEFITS	10.15

LABORERS / HEAVY HIGHWAY: CONTINUED
TRIGG COUNTY:

GROUP 3: Asphalt Luteman & Raker; Gunnite Nozzleman; Gunnite Operator & Mixer; Grout Pump Operator; Side Rail Setter; Rail Paved Ditch; Screw Operator; Tunnel (Free air); & Water Blaster:

HEAVY & HIGHWAY	BASE RATE	$21.81
	FRINGE BENEFITS	10.15

GROUP 4: Caisson Worker (Free Air); Cement Finisher; Environmental - Nuclear, Radiation, Toxic & Hazardous Waste - Levels A & B; Miner & Driller (Free Air); Tunnel Blaster; & Tunnel Mucker (Free Air); Directional & Horizontal Boring; Air Track Drillers (All Types); Powderman & Blasters; Troxler & Concrete Tester if Laborer is Utilized:

HEAVY & HIGHWAY	BASE RATE	$22.41
	FRINGE BENEFITS	10.15

MILLWRIGHTS:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON COUNTIES:

	BASE RATE	$23.48
	FRINGE BENEFITS	15.06

MILLWRIGHTS:
TRIGG COUNTY:

	BASE RATE	$23.96
	FRINGE BENEFITS	16.53

OPERATING ENGINEERS / BUILDING:
TRIGG COUNTY:

GROUP 1: Bituminous Paver, all types of loaders, backhoe track, trackhoe, horizontal directional drill, mechanic, roller (bituminous), forklift (regardless of lift height and except when used for masonry construction), telescoping type forklift, core drill, concrete paver, rotary drill, KeCal loader:

BUILDING	BASE RATE	$25.75
	FRINGE BENEFITS	13.00

GROUP 2: Hoist (1 drum), hoisting engine (2 or more drums), hoist:

BUILDING	BASE RATE	$26.75
	FRINGE BENEFITS	13.00

GROUP 3: Roller (rock), tractor (50 HP & over), truck crane, oiler, farm tractor with attachments (except backhoe, highlift & end loader), elevator (when used for hoisting), hoisting engineer (1 drum) or buck hoist), forklift (when used for masonry construction):

BUILDING	BASE RATE	$23.01
	FRINGE BENEFITS	13.00

GROUP 4: Roller (earth), tractor (under 50 HP), oiler:

BUILDING	BASE RATE	$22.24
	FRINGE BENEFITS	13.00

Backhoe/Excavator	BUILDING	BASE RATE	$20.32
		FRINGE BENEFITS	0.00

OPERATING ENGINEERS / BUILDING:
TRIGG COUNTY:

Bulldozer:	BUILDING	BASE RATE	$19.91
		FRINGE BENEFITS	0.00
Compactor	BUILDING	BASE RATE	$24.53
		FRINGE BENEFITS	0.00
Crane:	BUILDING	BASE RATE	$17.28
		FRINGE BENEFITS	6.76
Grade/Blade:	BUILDING	BASE RATE	$22.15
		FRINGE BENEFITS	10.40
Highlift:	BUILDING	BASE RATE	$25.00
		FRINGE BENEFITS	0.00
Scraper:	BUILDING	BASE RATE	$22.15
		FRINGE BENEFITS	9.05

Crane with boom 150 feet and over, including JIB shall receive $.75 above Group 1.

All Cranes with Piling Leads will receive $.50 above Group 1 regardless of boom length.

OPERATING ENGINEERS / BUILDING:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN & LYON COUNTIES:
Backhoe, bobcat/skid loader, bulldozer, cherry picker, crane, forklift, grade/blade, trackhoe:

	BUILDING	BASE RATE	$25.75
		FRINGE BENEFITS	13.00
Oiler	BUILDING	BASE RATE	$22.24
		FRINGE BENEFITS	13.00
Excavator:	BUILDING	BASE RATE	$21.10
		FRINGE BENEFITS	9.15
Loader:	BUILDING	BASE RATE	$21.63
		FRINGE BENEFITS	9.86

Crane with boom 150 feet and over, including JIB shall receive $1.00 above Group 1;
225 feet and over including JIB shall receive $1.50 above rate.

Crane using Piling Leads shall receive $1.00 above rate, regardless of boom length.

HAZARDOUS PAY:
Level A Personal Protective Equipment $1.00 Premium
Level B Personal Protective Equipment $ .75 Premium
Level C Personal Protective Equipment $ .50 Premium
Level D Personal Protective Equipment – No Premium

OPERATING ENGINEERS / HEAVY HIGHWAY
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON & TRIGG COUNTIES:

GROUP 1: A-Frame Winch Truck; Auto Patrol; Backfiller; Batcher Plant; Bituminous Paver; Bituminous Transfer Machine; Boom Cat; Bulldozer; Mechanic; Cableway; Carry-all Scoop; Carry Deck Crane; Central Compressor Plant; Clamshell; Concrete Mixer (21 cu. ft. or Over); Concrete Paver; Truck-Mounted Concrete Pump; Core Drill; Crane; Crusher Plant; Derrick; Derrick Boat; Ditching & Trenching Machine; Dragline; Dredge Operator; Dredge Engineer; Elevating Grader & Loaders; Grade-All; Gurries; Heavy Equipment Robotics Operator/Mechanic; High Lift; Hoe-Type Machine; Hoist (Two or More Drums); Hoisting Engine (Two or More Drums); Horizontal Directional Drill Operator; Hydrocrane; Hyster; KeCal Loader; LeTourneau; Locomotive; Mechanic; Mechanically Operated Laser Screed; Mechanic Welder; Mucking Machine; Motor Scraper; Orangepeel Bucket; Piledriver; Power Blade; Pumpcrete; Push Dozer; Rock Spreader, attached to equipment; Rotary Drill; Roller (Bituminous); Scarifier; Scoopmobile; Shovel; Side Boom; Subgrader; Tailboom; Telescoping Type Forklift; Tow or Push Boat; Tower Crane (French, German & other types); Tractor Shovel; Truck Crane; Tunnel Mining Machines, including Moles, Shields or similar types of Tunnel Mining Equipment:

HEAVY & HIGHWAY	*BASE RATE	$26.50
	FRINGE BENEFITS	13.00

GROUP 2: Air Compressor (Over 900 cu. ft. per min.); Bituminous Mixer; Boom Type Tamping Machine; Bull Float; Concrete Mixer (Under 21 cu. ft); Dredge Engineer; Electric Vibrator; Compactor/Self-Propelled Compactor; Elevator (One Drum or Buck Hoist); Elevator (when used to Hoist Building Material); Finish Machine; Firemen & Hoist (One Drum); Flexplane; Forklift (Regardless of Lift Height); Form Grader; Joint Sealing Machine; Outboard Motor Boat; Power Sweeper (Riding Type); Roller (Rock); Ross Carrier; Skid Mounted or Trailer Mounted Concrete Pump; Skid Steer Machine with all Attachments; Switchman or Brakeman; Throttle Valve Person; Tractair & Road Widening Trencher; Tractor (50 HP or Over); Truck Crane Oiler; Tugger; Welding Machine; Well Points; & Whirley Oiler:

HEAVY & HIGHWAY	*BASE RATE	$24.08
	FRINGE BENEFITS	13.00

GROUP 3: All Off Road Material Handling Equipment, including Articulating Dump Trucks; Greaser on Grease Facilities servicing Heavy Equipment:

HEAVY & HIGHWAY	*BASE RATE	$24.46
	FRINGE BENEFITS	13.00

GROUP 4: Bituminous Distributor; Burlap & Curing Machine; Cement Gun; Concrete Saw; Conveyor; Deckhand Oiler; Grout Pump; Hydraulic Post Driver; Hydro Seeder; Mud Jack; Oiler; Paving Joint Machine; Power Form Handling Equipment; Pump; Roller (Earth); Steersman; Tamping Machine; Tractor (Under 50 HP); & Vibrator:

HEAVY & HIGHWAY	*BASE RATE	$23.82
	FRINGE BENEFITS	13.00

***Cranes with booms 150 ft. & over (including jib) $1.00 premium. Employees assigned to work below ground level are to be paid 10% above basic wage rate. This does not apply to open cut work.**

PAINTERS:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN & LYON COUNTIES

Brush & Roller Only:	BUILDING	BASE RATE	$19.00
		FRINGE BENEFITS	11.55
All other Work:	BUILDING	BASE RATE	13.84
		FRINGE BENEFITS	0.00
Bridges & Dams:	HEAVY & HIGHWAY	*BASE RATE	$25.25
		FRINGE BENEFITS	11.55
All Other Work:	HEAVY & HIGHWAY	*BASE RATE	$19.00
		FRINGE BENEFITS	11.55

Waterblasting units with 3500 PSI and above - $.50 premium; Spray painting and all abrasive blasting - $1.00 premium; Work 40 ft. and above ground level – $1.00 premium.

PAINTERS:
TRIGG COUNTY:

Spray Only:	BUILDING	BASE RATE	$19.00
		FRINGE BENEFITS	11.55
Brush & Roller Only:	BUILDING	BASE RATE	$10.00
		FRINGE BENEFITS	0.00
Bridges & Dams	HEAVY HIGHWAY	BASE RATE	$25.25
		FRINGE BENEFITS	11.55
All other Work:	HEAVY HIGHWAY	BASE RATE	$19.00
		FRINGE BENEFITS	11.55

Waterblasting units with 3500 PSI and above - $.50 premium; Spray painting and all abrasive blasting - $1.00 premium; Work 40 ft. and above ground level – $1.00 premium.

PLASTERERS:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON & TRIGG COUNTIES:

	BUILDING	BASE RATE	$16.63
		FRINGE BENEFITS	0.00

PLUMBERS & PIPEFITTERS: (Including HVAC Pipe)
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON & TRIGG COUNTIES:

		BASE RATE	$31.45
		FRINGE BENEFITS	13.99

ROOFERS:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON COUNTIES:

		BASE RATE	$16.42
		FRINGE BENEFITS	1.50

ROOFERS: CONTINUED
TRIGG COUNTY:

Built up roof, modified bitumen roof, rubber roof & single ply roof:		BASE RATE	$26.87
		FRINGE BENEFITS	12.07
Shake & Shingle Roof:		BASE RATE	$19.31
		FRINGE BENEFITS	6.25
All Other Work:		BASE RATE	$15.94
		FRINGE BENEFITS	0.00

SHEETMETAL WORKERS: (Including HVAC Duct and metal roofs)
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON & TRIGG COUNTIES:

		BASE RATE	$28.15
		FRINGE BENEFITS	15.72

SPRINKLER FITTERS:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON & TRIGG COUNTIES:

		BASE RATE	$29.00
		FRINGE BENEFITS	16.50

TRUCK DRIVERS / BUILDING:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON COUNTIES:

Single-Axle:	BUILDING	BASE RATE	$18.78
		FRINGE BENEFITS	8.27
Semi-Axle & Tandem:	BUILDING	BASE RATE	$19.50
		FRINGE BENEFITS	8.27

TRUCK DRIVERS / BUILDING:
TRIGG COUNTY:

10 Yard Truck:	BUILDING	BASE RATE	$16.19
		FRINGE BENEFITS	.52
Dump Truck:	BUILDING	BASE RATE	$17.57
		FRINGE BENEFITS	0.00
Truck Driver:	BUILDING	BASE RATE	$12.70
		FRINGE BENEFITS	0.00

TRUCK DRIVERS / HEAVY HIGHWAY:
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON & TRIGG COUNTIES:

Greaser, Tire Changer:	HEAVY & HIGHWAY	BASE RATE	$23.89
		FRINGE BENEFITS	4.15
Truck Mechanic:	HEAVY & HIGHWAY	BASE RATE	$24.12
		FRINGE BENEFITS	4.15

TRUCK DRIVERS / HEAVY HIGHWAY: CONTINUED
CALLOWAY, CARLISLE, FULTON, GRAVES, HICKMAN, LYON & TRIGG COUNTIES:

Single Axle Dump & Flatbed; All Terrain Vehicle when used to haul materials; Semi-Trailer or Pole Trailer when used to pull building materials & equipment; Tandem Axle Dump; Distributor; & Mixer (All Types):

HEAVY & HIGHWAY	BASE RATE	$24.19
	FRINGE BENEFITS	4.15

Euclid, Other Heavy Earthmoving Equipment & Lowboy; Articulator Cat; 5 Axle Vehicle; Winch & A-Frame when used in transporting materials; Ross Carrier; Fork Lift Truck when used to transport building materials; & Drivers on Pavement Breaker:

HEAVY & HIGHWAY	BASE RATE	$24.20
	FRINGE BENEFITS	4.15

End of Document
CR-1-001 2012
February 3, 2012

SECTION 01271 - BASIS OF MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. The Contractor shall furnish all necessary labor, machinery, tools, apparatus, equipment, materials, service and other necessary supplies and perform all Work shown on the Drawings and/or described in the Specifications and Contract Documents at the unit prices as indicated by the Bidder in the Bid.

B. The Bidder declares that he has examined the site of the Work and informed himself fully in regard to all conditions pertaining to the place where the Work is to be done; that he has examined the Plans, Specification and Contract Documents for the Work, and has read all special provisions furnished prior to the opening of bids; and that he has further satisfied himself relative to the Work to be performed. The Bidder further declares that he understands that unit quantities shown in the Proposal are approximate only, are subject to increase or decrease, and that, should the quantities of any of the items be decreased, the Bidder will make no claim for the anticipated profits. In addition, the Owner also reserves the right to adjust quantities, either by addition or deletion and as-BID unit price shall remain in effect for these quantity adjustments.

C. All excavation required of the work shall be done as part of the total price for the complete project. All excavation shall be unclassified. Except where bores were done. See appendix for bore results at the tank location

1.02 PAY ITEMS

A. The items listed hereinafter refer to and are the same items listed in the PROPOSAL hereinbefore and constitute all of the pay items in this Contract. Any other items of Work listed in the Specifications or shown on the Drawings shall be considered incidental to the above items.

1.03 WATER MAIN

A. Payment for furnishing and installing the water main will be made at the contract unit price per linear foot, complete in place, which price shall include compensation for furnishing, hauling, excavation (including rock), bedding, poly-wrapping where required, laying, installation of pipe location tape and tracer wire, jointing, fittings, testing, backfilling, surface restoration (except pavement replacement), disinfection and cleanup. The quantity of water main to be paid for shall be the length of the complete water main measured along the centerline without any deduction for lengths of fittings, valves or other appurtenances.

1.04 GATE VALVES AND BOXES

A. Payment for furnishing and installing gate valves, and boxes will be made at the contract unit price each, complete in place, which price shall include compensation for furnishing, hauling, excavation, installation, blocking and backfilling.

1.05 FIRE HYDRANT AND VALVE

A. Payment for furnishing and installing 6" pipe hydrant lead, 6" hydrant lead gate valve and box, and the fire hydrant, including thrust blocks, crushed stone drain, and anchorage will be made at the contract unit price each, complete in place. Type of hydrant lead pipe shall be as noted on the Drawings.

1.06 CONNECTION TO EXISTING WATER MAINS (Wet Tap)

A. Payment for connection to existing water mains will be made at the contract unit price each, complete in place, which price shall include compensation for furnishing and installing the tapping sleeve and valve, hauling, excavating (including rock), labor, backfilling, and all other installation requirements for connection to existing mains. Valve boxes and valve markers, where applicable, shall be furnished and installed with each tapping valve.

1.07 RAW WATER SAMPLE POINT

A. Payment for this item is to include the manhole, lid, frame, dga bottom, corporation stop and tap. Price shall include all materials and labor required for complete in-place

1.08 HIGHWAY ROAD BORES

A. The steel cover pipe required to be bored and/or jacked in place will be measured from end to end of the completed cover pipe in place, and will be paid for per bore at the contract unit price per lump sum complete in place, which price shall include the cover pipe, water main laid therein, material and work for blocking the ends, and all other items necessary for its construction as shown on the Drawings and/or described in the Specifications.

1.09 UNPAVED SHOULDERS AND GRAVEL DRIVEWAY REPLACEMENT

A. Payment for replacing unpaved highways, roads, gravel driveways, and shoulders will be made at the contract unit price per linear foot, complete in place, which price shall include compensation for Method "C" backfill from the top of the pipe bedding to six (6) inches below the grade line and then the 6" dense graded aggregate course to the top of the trench.

1.10 CREEK CROSSINGS

A. Payment for creek crossings will be made at the contract unit price per linear foot, complete in place, which shall include compensation for the pipe, trenching (including rock excavation), backfill and all materials and labor necessary to complete the work.

1.11 SERVICE PIPING (NOT CROSSING A PAVED ROAD)

A. Payment for service piping of the various sizes and types, installed by open cut, will be made a the contract price per linear foot, complete in place, which shall include compensation for furnishing, hauling, trenching (including rock excavation), laying, jointing, testing and backfilling. The quantity of service piping to be paid for shall be the length of the completed service line measured along its centerline

1.12 TREATMENT PLANT SITE WORK

A. Payment for treatment plant site work shall be made at the contract lump sum price complete in place, which shall include grading (including rock excavation), DGA, concrete work, and all other items shown on the plans and required for a complete functioning site that are not listed elsewhere on the bid tab.

1.13 VINYL COATED FENCE WITH GATES

A. Payment for vinyl coated fence with gates shall be made at the contract price per linear foot, complete in place, which shall include compensation for labor and materials.

1.14 BUILDING

A. Payment for the building shall be made at the contract lump sum price, complete in place, which shall include compensation for all items shown on the Building Details sheet and as described in the specifications including but not limited to doors, fans, HVAC wall units, louvers, hardware, the storage room items, and all other items required that are not listed elsewhere in the bid tab.

1.15 BOOSTER PUMP ROOM

A. Payment for the booster pump room shall be made at the contract lump sum price, complete in place, which shall include compensation for the pumps, valves, piping, master meter, and all other items required that are not listed elsewhere in the bid tab.

1.16 CHEMICAL ROOMS

A. Payment for the chemical rooms shall be made at the contract lump sum price, complete in place, which shall include compensation for the pumps, valves, piping, meters, and all other items required that are not listed elsewhere in the bid tab.

1.17 CHEMICAL FEED VAULT & ASSOCIATED PIPING

A. Payment for the chemical feed vault and associated piping shall be made at the contract lump sum price, complete in place, which shall include compensation all items shown on the details and as described in the specifications including but not limited to piping, corporation stops, valves, gaskets, sleeves, and all other items required that are not listed elsewhere in the bid tab.

1.18 WELL PUMPS AND ASSEMBLY

A. Payment for the well pumps and assembly shall be made at the contract price per item, complete in place, which shall include compensation all items shown on the Well Details sheet and as described in the specifications including but not limited

to pump assembly, piping, heat trace, insulation, fittings, valves, and all other items required that are not listed elsewhere in the bid tab.

1.19 WATER STORAGE TANK FOUNDATION

A. Payment for the water storage tank foundation shall be made at the contract lump sum price, complete in place, which shall include compensation for grading, excavation (including rock), reinforced concrete, any site stabilization required, testing, and all other items required that are not listed elsewhere in the bid tab. See the Boring Report in the Appendix of the specifications for existing conditions.

1.20 GROUND STORAGE TANK

A. Payment for the ground storage tank shall be made at the contract lump sum price, complete in place, which shall include compensation all items shown on the Tank Details sheet and as described in the specifications including tank design, materials, labor, and all other items required that are not listed elsewhere in the bid tab.

1.21 ELECTRICAL CONTROLS

A. Payment for the electrical controls shall be made at the contract lump sum price, complete in place, which shall include compensation for all electrical items shown in the plans and as described in the specifications including but not limited to SCADA, transfer switch, pump controls, tank controls, well controls, electrical service, and all other items required that are not listed elsewhere in the bid tab.

1.22 CONCRETE DRIVE PUSH BORE

A. Payment for concrete drive pusher bore shall be made at contract unit price per Linear foot, complete in place.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

SECTION 01310 - PROJECT COORDINATION

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

Minimum administrative and supervisory requirements necessary for coordination of work on the project include but are not necessarily limited to the following:

A. Coordination and meetings.

B. Limitations for use of site.

C. Coordination of crafts, trades and subcontractors.

D. General installation provisions.

E. Cleaning and protection.

F. Conservation and salvage.

1.03 COORDINATION AND MEETINGS

A. Monthly general project coordination meetings will be held at regularly scheduled times convenient for all parties involved. These meetings are in addition to specific meetings held for other purposes, such as regular project meetings and special pre-installation meetings. Representation at each meeting by every party currently involved in coordination or planning for the work of the entire project is required including the prime contractor's project manager and field superintendant. Meetings shall be conducted in a manner which will resolve coordination problems. Results of the meeting shall be recorded and copies distributed to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

1.04 LIMITATIONS ON USE OF THE SITE

A. Limitations on site usage as well as specific requirements that impact site utilization are indicated on the drawings and by other contract documents. In addition to these limitations and requirements, allocation of available space shall be administered equitably among entities needing both access and space so as to produce the best overall efficiency in performance of the total work of the project. Schedule deliveries so as to minimize space and time requirements for storage of materials and equipment on site.

1.05 COORDINATION OF CRAFTS, TRADES AND SUBCONTRACTORS

A. The Contractor shall coordinate the work of all the crafts, trades and subcontractors engaged on the work, and he shall have final responsibility as regards the schedule, workmanship and completeness of each and all parts of the work.

B. All crafts, trades and subcontractors shall be made to cooperate with each other and with others as they may be involved in the installation of work which adjoins, incorporates, precedes or follows the work of another. It shall be the Contractor's responsibility to point out areas of cooperation prior to the execution of subcontractor agreements and the assignment of the parts of the work. Each craft, trade and subcontractor shall be made responsible to the Owner, for furnishing embedded items and giving directions, for doing all cutting and fitting and making all provisions for accommodating the work, and for protecting, patching, repairing and cleaning as required to satisfactorily perform the work.

C. The Contractor shall be responsible for all cutting, digging and other action of his subcontractors and workmen. Where such action impairs the safety or function of any structure or component of the project, the Contractor shall make such repairs, alterations and additions as will, in the opinion of the Engineer, bring said structure or component back to its original design condition at no additional cost to the Owner.

D. Each subcontractor is expected to be familiar with the General Requirements and all sections of the detailed Specifications for all other trades and to study all Drawings applicable to his work including Architectural and Structural Drawings, to the end that complete coordination between trades will be effected. Consult with the Engineer if conflicts exist on the Drawings.

E. Special attention shall be given to points where ducts or piping must cross other ducts or piping, where lighting fixtures must be recessed in ceilings and where ducts, piping and conduits must fit into walls and columns. It shall be the responsibility of such subcontractor to leave the necessary room for other trades.

F. No extra compensation will be allowed to cover the cost of removing piping, conduit, ducts, etc., or equipment found encroaching on space required by others.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

SECTION 01320 - PROGRESS SCHEDULES

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. Scheduling Responsibilities:

1. In order to provide a definitive basis for determining job progress, a construction schedule of a type approved by the engineer will be used to monitor the project.

2. The Contractor shall be responsible for preparing the schedule and updating on a monthly basis. It shall at all times remain the Contractor's responsibility to schedule and direct his forces including subcontractors in a manner that will allow for the completion of the work within the contractual period. The contractor shall provide two (2) copies of updated schedule at the monthly progress meeting

B. Construction Hours:

1. No work shall be done between 6:00 p.m. and 7:00 a.m. nor on Saturdays, Sundays or legal holidays without the prior written permission of the Owner. However, emergency work may be done without prior written permission.

2. If the Contractor, for his convenience and at his own expense, should desire to carry on his work at night or outside the regular hours, he shall submit a written request to the Engineer and shall allow nine (9) days for satisfactory arrangements to be made for inspecting the work in progress. If permission is granted, the Contractor shall light the different parts of the project as required to comply with all applicable federal, state, and local regulations. The Contractor shall also revise his schedule as appropriate at the next monthly schedule update meeting to reflect the changes in working hours.

C. Progress of the Work:

1. The work shall be started within ten (10) days following the Notice to Proceed and shall be executed with such progress as may be required to prevent delay to other Contractors or to the general completion of the project. The work shall be executed at such times and in or on such parts of the project, and with such forces, material and equipment, to assure completion of the work in the time established by the Contract.

2. The Contractor agrees that whenever it becomes apparent from the current monthly schedule update that delays have resulted and, hence, that the Contract completion date will not be met or when so directed by the Owner, he will take some or all of the following actions at no additional cost to the Owner:

a. Increase construction manpower in such quantities and crafts as will substantially eliminate the backlog of work.

b. Increase the number of working hours per shift, shifts per working day or days per week, the amount of construction equipment, or any combination of the foregoing to substantially eliminate the backlog of work.

c. Reschedule activities to achieve maximum practical concurrency of accomplishment of activities, and comply with the revised schedule.

d. The Contractor shall submit to the Engineer for review a written statement of the steps he intends to take to remove or arrest the delay to the critical path in the accepted schedule. If the Contractor should fail to submit a written statement of the steps he intends to take or should fail to take such steps as required by the Contract, the Owner may direct the level of effort in manpower (trades), equipment, and work schedule (overtime, weekend and holiday work, etc.), to be employed by the Contractor in order to remove or arrest the delay to the critical path in the accepted schedule, and Contractor shall promptly provide such level of effort at no additional cost to the Owner.

1.02 CONSTRUCTION SCHEDULE

A. Within ten (10) calendar days of the Notice to Proceed, the Contractor shall submit to the Engineer three (3) copies of his proposed schedule. The schedule will be the subject of a schedule review meeting with the Contractor, the Engineer and the Owner or the Owner's representative within one (1) week of its submission. The Contractor will revise and resubmit the schedule until it is acceptable and accepted by the Owner or the Owner's representative.

1.03 SUBMITTAL SCHEDULE

A. In addition to the above scheduling requirements, the Contractor will be required to submit a complete and detailed listing of anticipated submittals during the course of the Contract. The Contractor will coordinate his submittals with those of his Subcontractors and Suppliers and will identify each submittal by Contract drawing number and specification number. The anticipated submission date for each submittal must be indicated along with the date on which its return is anticipated. For planning purposes, the Engineer will usually return shop drawings fourteen (14) days after receipt. However, longer durations for review will not be considered a basis for a claim.

B. The Submittal Schedule must be submitted within ten (10) working days of the Notice to Proceed and will be the subject of a special meeting with the Engineer and the Owner or the Owner's representative within one (1) week of the schedule's submission. At that meeting, the Submittal Schedule will be reviewed for comprehensiveness and feasibility. The Engineer will adjust the projected return dates based on the need for more or less time for each submittal's review. The Submittal Schedule will then be accepted or revised as required.

1.04 SCHEDULE UPDATES

A. Monthly Meetings:

A monthly Schedule Update Meeting will be held in conjunction with the applicable progress meeting at the construction site to review and update the Schedule. The Schedule Update Meetings will be chaired by the Engineer and attended by the Contractor and the Engineer. Actual progress of the previous month will be recorded and future activities will be reviewed. The duration of activities and their logical connections may be revised as needed. Decisions made at these meetings and agreed to by all parties are binding with the exception that no contractual completion dates will be modified without formal written requests and acceptance as specified herein.

B. Revisions to Schedule:

The Schedule shall be formally revised if any of the following conditions are encountered:

1. When a delay in completion of any work item or sequence of work items results in an indicated extension of the project completion.

2. When delays in submittals or deliveries or work stoppages are encountered which make replanning or rescheduling of the work necessary.

3. When the schedule does not represent the actual prosecution and progress of the project.

1.05 CONTRACT COMPLETION TIME

A. Causes for Extensions:

The Contract completion time will be adjusted only for causes specified in this Contract. In the event the Contractor requests an extension of any Contract completion date, he shall furnish such justification and supporting evidence as the Owner or the Engineer may deem necessary for a determination as to whether the Contractor is entitled to an extension of time under the provisions of this Contract. The Owner, with the assistance of the Engineer, will, after receipt of such justification and supporting evidence, make findings of fact and will advise the Contractor in writing thereof.

B. Requests for Time Extension:

Each request for change in any Contract completion date shall be initially submitted to the Engineer within the ten (10) days of cause for request. All information known to the Contractor at that time concerning the nature and extent of the delay shall be transmitted to the Engineer at that time. No time extension will be granted for requests which are not submitted within the foregoing time limits

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

SECTION 01340 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. General: This section specifies procedural requirements for non- administrative submittals including shop drawings, product data, samples (when samples are specifically requested) and other miscellaneous work-related submittals. Shop drawings, product data, samples and other work-related submittals are required to amplify, expand and coordinate the information contained in the Contract Documents.

B. Refer to other Division-1 sections and other Contract Documents for Specifications on administrative, non-work-related submittals. Such submittals include, but are not limited to the following items:

1. Permits.
2. Payment applications.
3. Performance and payment bonds.
4. Insurance certificates.
5. Inspection and test reports.
6. Schedule of values.
7. Progress reports.
8. Listing of subcontractors.
9. Operating and Maintenance Manuals

C. All submittals shall be furnished in at least four (4) copies and shall be checked and reviewed by the Contractor before submission to the Engineer. The review of the submittals by the Engineer shall not be construed as a complete check but will indicate only that the general method of construction and detailing is satisfactory. Review of such submittals will not relieve the Contractor of the responsibility for any errors which may exist as the Contractor shall be responsible for the dimensions and design of adequate connections, details, and satisfactory construction of all work.

1.02 DEFINITIONS

A. Shop drawings are technical drawings and data that have been specially prepared for this project, including but not limited to the following items:

1. Fabrication and installation drawings.
2. Setting diagrams.

3. Shopwork manufacturing instructions.

4. Templates.

5. Patterns.

6. Coordination drawings (for use on-site).

7. Schedules.

8. Design mix formulas.

9. Contractor's engineering calculations.

Standard information prepared without specific reference to a project is not considered to be shop drawings.

B. Product data includes standard printed information on manufactured products that has not been specially-prepared for this project, including but not limited to the following items:

1. Manufacturer's product specifications and installation instructions.

2. Standard color charts.

3. Catalog cuts.

4. Roughing-in diagram and templates.

5. Standard wiring diagrams.

6. Printed performance curves.

7. Operational range diagrams.

8. Mill reports.

9. Standard product operating and maintenance manuals.

C. Samples, where specifically required, are physical examples of work, including but not limited to the following items:

1. Partial sections of manufactured or fabricated work.

2. Small cuts or containers of materials.

3. Complete units of repetitively-used materials.

4. Swatches showing color, texture and pattern.

5. Color range sets.

6. Units of work to be used for independent inspection and testing.

D. Miscellaneous submittals are work-related, nonadministrative submittals that do not fit in the three previous categories, including, but not limited to the following:

1. Specially-prepared and standard printed warranties.

2. Maintenance agreements.

3. Workmanship bonds.

4. Survey data and reports.

5. Testing and certification reports.

6. Record drawings.

7. Field measurement data.

1.03 SUBMITTAL PROCEDURES

A. General: Refer to the General Conditions and Paragraph 1.02A hereinbefore for basic procedures for submittal handling:

B. Coordination: Coordinate the preparation and processing of submittals with the performance of the work. Coordinate each separate submittal with other submittals and related activities such as testing, purchasing, fabrication, delivery and similar activities that require sequential activity.

Coordinate the submittal of different units of interrelated work so that one submittal will not be delayed by the Architect/Engineer's need to review a related submittal. The Architect/Engineer reserves the right to withhold action on any submittal requiring coordination with other submittals until related submittals are forthcoming.

C. Coordination of Submittal Times: Prepare and transmit each submittal to the Architect/Engineer sufficiently in advance of the scheduled performance of related work and other applicable activities. Transmit different kinds of submittals for the same unit of work so that processing will not be delayed by the Architect/Engineer's need to review submittals concurrently for coordination.

D. Review Time: Allow sufficient time so that the installation will not be delayed as a result of the time required to properly process submittals, including time for resubmittal, if necessary. Advise the Architect/Engineer on each submittal, as to whether processing time is critical to the progress of the work and if the work would be expedited if processing time could be shortened.

1. Allow a longer time period where processing must be delayed for coordination with subsequent submittals. The Architect/Engineer will advise the Contractor promptly when it is determined that a submittal being processed must be delayed for coordination.

2. No extension of time will be authorized because of the Contractor's failure to transmit submittals to the Architect/Engineer sufficiently in advance of the work.

E. Submittal Preparation: Mark each submittal with a permanent label for identification. Provide the following information on the label for proper processing and recording of action taken.

1. Project name.

2. Date.

3. Name and address of Architect/Engineer.

4. Name and address of Contractor.

5. Name and address of subcontractor.

6. Name and address of supplier.

7. Name of manufacturer.

8. Number and title of appropriate specification section.

9. Drawing number and detail references, as appropriate.

10. Similar definitive information as necessary.

F. Submittal Transmittal: Package each submittal appropriately for transmittal and handling. Transmit each submittal from the Contractor to the Architect/Engineer, and to other destinations as indicated, by use of a transmittal form. Submittals received from sources other than the Contractor will be returned to the sender "without action".

1.04 SPECIFIC SUBMITTAL REQUIREMENTS

A. Shop drawings shall be prepared by a qualified detailer. Details shall be identified by reference to sheet and detail numbers shown on Contract Drawings. Where applicable, show fabrication, layout, setting and erection details.

Shop drawings are defined as original drawings prepared by the Contractor, subcontractors, suppliers, or distributors performing work under this Contract. Shop drawings illustrate some portion of the work and show fabrication, layout, setting or erection details of equipment, materials and components. The Contractor shall, except as otherwise noted, have prepared the number of reviewed copies required for his distribution plus two (2) which will be retained by the Engineer. Shop drawings shall be folded to an approximate size of 8-1/2" x 11" and in such manner that the title block will be located in the lower right-hand corner of the exposed surface.

B. Project data shall include manufacturer's standard schematic drawings modified to delete information which is not applicable to the project, and shall be supplemented to provide additional information applicable to the project. Each copy of descriptive literature shall be clearly marked to identify pertinent information as it applies to the project.

C. Where samples are required, they shall be adequate to illustrate materials, equipment or workmanship, and to establish standards by which completed work

is judged. Provide sufficient size and quantity to clearly illustrate functional characteristics of product and material, with integrally related parts and attachment devices, along with a full range of color samples.

D. All submittals shall be referenced to the applicable item, section and division of the Specifications, and to the applicable drawing(s) or drawing schedule(s).

E. The Contractor shall review and check submittals, and shall indicate his review by initials and date.

F. If the submittals deviate from the Contract Drawings and/or Specifications, the Contractor shall advise the Engineer, in writing of the deviation and the reasons therefore.

G. In the event the Engineer does not specifically reject the use of material or equipment at variance to that which is shown on the Drawings or specified, the Contractor shall, at no additional expense to the Owner, and using methods reviewed by the Engineer, make any changes to structures, piping, controls, electrical work, mechanical work, etc., that may be necessary to accommodate this equipment or material. Should equipment other than that on which design drawings are based be accepted by the Engineer, shop drawings shall be submitted detailing all modification work and equipment changes made necessary by the substituted item.

H. Additional information on particular items, such as special drawings, schedules, calculations, performance curves, and material details, shall be provided when specifically requested in the technical Specifications.

I. Submittals for all electrically operated items (including instrumentation and controls) shall include complete size, color coding, all terminations and connections, and coordination with related equipment.

J. Equipment shop drawings shall indicate all factory or shop paint coatings applied by suppliers, manufacturers and fabricators; the Contractor shall be responsible for insuring the compatibility of such coatings with the field-applied paint products and systems.

K. Fastener specifications of manufacturer shall be indicated on equipment shop drawings.

L. Where manufacturers brand names are given in the Specifications for building and construction materials and products, such as grout, bonding compounds, curing compounds, masonry cleaners, waterproofing solutions and similar products, the Contractor shall submit names and descriptive literature of such materials and products he proposes to use in this Contract.

M. No material shall be fabricated or shipped unless the applicable drawings or submittals have been reviewed by the Engineer and returned to the Contractor.

N. All bulletins, brochures, instructions, parts lists, and warranties package with and accompanying materials and products delivered to and installed in the project shall be saved and transmitted to the Owner through the Engineer.

1.06 CONTRACTOR RESPONSIBILITIES

A. Verify field measurements, field construction criteria, catalog numbers, and similar data.

B. Coordinate each submittal with requirements of work and of Contract Documents.

C. Notify Engineer, in writing at time of submission, of deviations in submittals from requirements of Contract Documents.

D. Begin no work, and have no material or products fabricated or shipped which requires submittals until return of submittals with Engineer's stamp and initials or signature indicating review.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

SECTION 01450 - QUALITY CONTROL SERVICES

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. Required inspection and testing services are intended to assist in the determination of probable compliance of the Work with requirements specified or indicated. These required services do not relieve the Contractor of responsibility for compliance with these requirements or for compliance with requirements of the Contract Documents.

B. Tests, inspections and certifications of materials, equipment, subcontractors or completed Work, as required by the various sections of the Specifications shall be obtained by the Contractor and all costs shall be included in the Contract Price.

C. The Contractor shall submit to the Engineer the name of any testing laboratory to be used.

D. Contractor shall deliver written notice to the Engineer at least 10 days in advance of any inspections or tests to be made at the project site. All inspections or tests to be conducted at the field shall be done in the presence of the Engineer or his representative.

E. Certifications by independent testing laboratories may be by copy of the attest and shall give scientific procedures and results of tests. Certifications by persons having interest in the matter shall be by original attest properly sworn to and notarized.

F. Inspections, tests and related actions specified in this section and elsewhere in the Contract Documents are not intended to limit the Contractor's own quality control procedures which facilitate overall compliance with requirements of the Contract Documents.

1.02 SUBMITTALS

A. General: Refer to Section 01340 for the general requirements on submittals. Submit a certified written report of each inspection, test or similar service, directly to the Architect/Engineer.

B. Report Data: Written reports of each inspection, test or similar service shall include, but not be limited to the following:

1. Name of testing agency or test laboratory.

2. Dates and locations of samples and tests or inspections.

3. Names of individuals making the inspection or test.

4. Designation of the work and test method.

5. Complete inspection or test data.

6. Test results.

7. Interpretations of test results.

8. Notation of significant ambient conditions at the time of sample-taking and testing.

9. Comments or professional opinion as to whether inspected or tested work complies with requirements of the Contract Documents.

10. Recommendations on retesting, if applicable.

1.03 RESPONSIBILITIES

A. Contractor Responsibilities: Except where they are specifically indicated as being the Owner's responsibility, or where they are to be provided by another identified entity, inspections, tests and similar quality control services are the Contractor's responsibility; these services also include those specified to be performed by an independent agency and not directly by the Contractor. Costs for these services shall be included in the Contract Sum. The Contractor shall employ and pay an independent agency, testing laboratory or other qualified firm to perform quality control services specified.

B. Retest Responsibility: Where results of required inspections, tests or similar services prove unsatisfactory and do not indicate compliance of related Work with the requirements of the Contract Documents, or where contractor is unable to perform test, then retests are the responsibility of the Contractor, regardless of whether the original test was the Contractor's responsibility. Retesting of work revised or replaced by the Contractor is the Contractor's responsibility, where required tests were performed on original Work. Contractor will also be responsible for additional compensation for the Engineer and all other required parties for retest.

C. Responsibility for Associated Services: The Contractor is required to cooperate with the independent performing required inspections, tests and similar services. Provide such auxiliary services as are reasonably requested. Notify the testing agency sufficiently in advance of operations to permit assignment of personnel. These auxiliary services include but are not necessarily limited to the following:

Providing access to the work.
Taking samples or assistance with taking samples.
Delivery of Samples to test laboratories.
Delivery and protection of samples and test equipment at the project site.

D. Coordination: The Contractor and each independent agency engaged to perform inspections, tests and similar services for the project shall coordinate the sequence of their activities so as to accommodate required services with a minimum of delay in the progress of the Work. In addition, the Contractor and each independent testing agency shall coordinate their Work so as to avoid the necessity of removing and replacing Work to accommodate inspections and tests. The Contractor is responsible for scheduling times for inspections, tests, taking of samples and similar activities.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 REPAIR AND PROTECTION

A. Upon completion of inspection, testing, sample taking and similar services performed on the Work, repair damaged work and restore substrates and finishes to eliminate deficiencies, including deficiencies in the visual qualities of exposed finishes. Comply with the Contract Document requirements for "Cutting and Patching". Protect Work exposed by or for quality control service activities, and protect repaired work. Repair and protection is the Contractor's responsibility, regardless of the assignment of responsibility for inspection, testing or similar services.

SECTION 01500 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

This section specifies administrative and procedural requirements for temporary services and facilities, including such items as temporary utility services, temporary construction and support facilities, and project security and protection.

A. Use Charges: No cost or usage charges for temporary services or facilities are chargeable to the Owner or Engineer. Cost or use charges for temporary services or facilities will not be accepted as a basis of claims for a change-order extra.

B. Temporary utility services required for use at the project site may include but are not limited to the following:

1. Water service and distribution.

2. Temporary electric power and light.

3. Telephone service.

4. Storm and sanitary sewer.

5. Provide adequate utility capacity at each stage of construction. Prior to availability of temporary utilities at the site, provide trucked-in services for start-up of construction operations.

C. Temporary construction and support facilities required for the project include but are not limited to the following:

1. Field offices and storage sheds.

2. Temporary roads and paving.

3. Sanitary facilities, including drinking water.

4. Dewatering facilities and drains.

5. Temporary enclosures.

6. Project identification, bulletin boards and signs.

7. Waste disposal services.

8. Construction aids and miscellaneous general services and facilities.

9. Alternate temporary services and facilities, equivalent to those specified, may be used, subject to acceptance by the Engineer.

D. Security and protection facilities and services required for the project include but are not limited to the following:

1. Environmental protection.

2. Alternate security and protection methods or facilities, equivalent to those specified, may be used, subject to acceptance by the Engineer.

1.02 PROPERTY PROTECTION

A. Care is to be exercised by the Contractor in all phases of construction, to prevent damage and/or injury to the Owner's and/or other property. Payments for the repair and restoration are limited as set forth in the "Conflict With or Damage to Existing Utilities Facilities" of the Supplementary General Conditions.

B. All exposed existing piping must be immediately supported to prevent damage. Prior to completion of each day's work, such piping must be adequately covered by the Contractor and approved by the Owner's representative.

C. The Contractor shall avoid unnecessary injury to trees and shall remove only those authorized to be removed by written consent of the Owner. Fences, gates, and terrain damaged or disarranged by the Contractor's forces shall be immediately restored in their original condition or better.

1.03 CONSTRUCTION WARNING SIGNS

A. The Contractor shall provide construction warning signs for each location where he is working in the state highway right-of-way or in City or County streets. He will further provide flagmen as required and shall abide by all Department of Highways safety rules, including size, type and placement of construction signs. All signs shall be of professional quality.

1.04 ACCESS ROADWAYS

A. The Contractor shall construct all access roadways needed during construction, and the planned access roadways for the completed project. The Contractor shall maintain access roadways continuously during the construction period.

B. The Contractor shall maintain all existing roadways within the project site which are used for any purpose by his construction operations. The degree and frequency of maintenance shall be adequate to keep existing roadways in a condition at least equal to their condition prior to construction. Road maintenance shall include daily dust control and grading as necessary on all roads and sweeping of paved roads every other day.

1.05 RESPONSIBILITY FOR TRENCH SETTLEMENT

A. The Contractor shall be responsible for any settlement caused by the construction, that occurs within one (1) year after the final acceptance of this Contract by the Owner. Repair of any damage caused by settlement shall meet the approval of the Owner.

1.06 WASTE DISPOSAL

A. The Contractor shall dispose of waste, including hazardous waste, off-site in accordance with all applicable laws and regulations.

1.07 CONTRACTOR'S TRAILERS AND MATERIAL STORAGE

A. The location of the Contractor's and Subcontractor's office and work trailers and parking areas on the project site shall be subject to the Owner's approval.

B. The location of the Contractor's and Subcontractor's material storage yards on the project site shall be subject to the Owner's approval.

1.08 QUALITY ASSURANCE

A. Regulations: Comply with requirements of local laws and regulations governing construction and local industry standards, in the installation and maintenance of temporary services and facilities, including but not limited to the following:

1. Obtain all permits as required by governing authorities.

2. Obtain and pay for temporary easements required across property other than that of Owner.

3. Comply with applicable codes.

In addition, comply with "Environmental Impact" commitments the Owner or previous Owners of the site may have made to secure approval to proceed with construction of the project.

B. Inspections: Inspect and test each service before placing temporary utilities in use. Arrange for required inspections and tests by governing authorities, and obtain required certifications and permits for use.

1.09 JOB CONDITIONS

A. General: Provide each temporary service and facility ready for use at each location when the service or facility is first needed to avoid delay in performance of the Work. Maintain, expand as required, and modify temporary services and facilities as needed throughout the progress of the Work. Do not remove until services or facilities are no longer needed, or are replaced by the authorized use of completed permanent facilities.

With the establishment of the job progress schedule, establish a schedule for the implementation and termination of service for each temporary utility. At the earliest feasible time, and when acceptable to the Owner and Engineer, change over from the use of temporary utility service to the use of the permanent service, to enable removal of the temporary utility and to eliminate possible interference with completion of the Work.

B. Conditions of Use: Operate temporary services and facilities in a safe and efficient manner. Do not overload temporary services or facilities, and do not permit them to interfere with the progress of the Work. Do not allow unsanitary conditions, public nuisances or hazardous conditions to develop or persist on the site.

1. Temporary Utilities: Do not permit the freezing of pipes, flooding or the contamination of water sources.

2. Temporary Construction and Support Facilities: Maintain temporary facilities in such a manner as to prevent discomfort to users. Take necessary fire prevention measures. Maintain temporary support facilities in a sanitary manner so as to avoid health problems and other deleterious effects.

3. Security and Protection: Maintain site security and protection facilities in a safe, lawful and publicly acceptable manner. Take necessary measures to prevent erosion of the site.

PART 2 - PRODUCTS

2.01 MATERIALS, EQUIPMENT AND SERVICES

A. General: Provide new materials and equipment for temporary services and facilities; used materials and equipment that are undamaged and in serviceable condition may be used, if acceptable to the Engineer. Provide only materials and equipment that are recognized as being suitable for the intended use, by compliance with appropriate standards.

B. Temporary Electricity:

1. Provide temporary electrical service for construction needs, power to all construction trailers, and for lighting and heating facilities, throughout construction period.

2. Service shall be adequate for construction use by all trades during construction period.

3. Contractor shall make all necessary arrangements with the power company to obtain this service. He shall furnish, erect, and maintain the service pole, wires, main switch, panelboards, outlets, lights and metering facilities as required by the power company and as necessary to provide electrical service throughout the construction site.

4. Contractor shall be responsible for payment of all monthly billing charges for temporary electric power. Contractor shall pay costs of equipment, materials, furnishing, installing, maintenance and removal of temporary electric service facilities.

5. Contractor shall pay costs of equipment, furnishing, installing, maintenance and removal of temporary service facilities.

6. Maintenance of temporary electric service shall be the sole responsibility of the General Contractor.

C. Temporary Lighting:

1. Furnish and install temporary lighting required for :

   a. Construction needs.

   b. Safe and adequate working conditions.

   c. Public Safety.

   d. Security lighting.

   e. Temporary office and storage area lighting.

2. Costs of installation and operation: Contractor shall pay all installation, maintenance and removal costs of temporary lighting.

3. Maintenance of temporary lighting service (replacement of bulbs, etc.) shall be the sole responsibility of the General Contractor.

D. Temporary Heating and Ventilating

1. Furnish and install temporary heat and ventilation in enclosed areas throughout construction period required to:

   a. Facilitate progress of work.

   b. Protect work and products against dampness and cold.

   c. Prevent moisture condensation on surfaces.

   d. Provide suitable ambient temperatures and humidity levels for installation and curing of materials.

   e. Provide adequate ventilation to meet health regulations for safe working environment.

   f. Heat and ventilate temporary field offices for Contractor and for Engineer, and other storage and construction buildings.

   g. Allow beneficial occupancy of project, or portion of project, prior to final completion, including air conditioning.

2. Temperatures required in buildings:

   a. Generally, 24 hours a day: Minimum 40 degrees F. (4.5 degrees C.).

   b. 24 hours a day during placing, setting and curing of cementitious materials: As required by specification section for each product.

c. 24 hours a day, seven (7) days prior to, and during, placing of interior finishes; woodwork, flooring, painting and finishing: As required by specification section for each product.

d. 24 hours a day after application of finishes, and until Substantial Completion: Minimum 70 degrees F. (21 degrees C.).

e. Storage areas: As required by Specification Section for each product.

3. Ventilation Required:

a. General: Prevent hazardous accumulations of dusts, fumes, mists, vapors or gases in areas occupied during construction.

b. Provide local exhaust ventilation to prevent harmful dispersal of hazardous substances into atmosphere of occupied areas.

c. Dispose of exhaust materials in a manner that will not result in harmful exposure to persons.

d. Ventilate storage spaces containing hazardous or volatile materials.

e. Provide adequate ventilation for:

(1) Curing installed materials.

(2) Dispersal of humidity.

(3) Ventilation of temporary sanitary facilities.

f. Duration of operation:

(1) At all times personnel occupies an area subject to hazardous accumulations of harmful elements.

(2) Continue operation of ventilation and exhaust system for time after cessation of work process to assure removal of harmful elements.

(3) For curing installed materials: As required by specification section for respective materials.

(4) For humidity dispersal: As needed to provide suitable ambient conditions for work.

4. Contractor shall pay costs of installation, operation, maintenance and removal of temporary heat and ventilation.

E. Temporary Water:

1. Contractor shall make his own arrangements at his own expense for obtaining the water supply necessary for construction purposes.

2. Contractor shall pay costs of the furnishing, maintaining and removing all temporary water service equipment, fixtures, hose, piping, etc.

F. Protection and Security:

1. Provide barricades, lanterns and other such signs and signals as may be necessary to warn of the dangers in connection with open excavation and obstructions.

2. Provide an adequate and approved system to secure the project area at all times, especially during non-construction periods; General Contractor shall be solely responsible for taking proper security measures.

3. Contractor shall pay all costs for protection and security systems.

G. Sanitary Facilities:

The Contractor shall furnish, install and maintain ample sanitary facilities for the workmen. As the needs arise, enclosed temporary toilets, in sufficient number, shall be placed as directed by the Engineer. Permanent toilets installed under this Contract shall not be used during construction. Drinking water shall be provided from a proven safe source so piped or transported as to be kept clean and fresh and served from single service containers of satisfactory types.

H. Temporary Protection:

1. Temporary Enclosures:

Furnish and install temporary enclosures at doorways, windows and other openings in exterior walls, as necessitated by weather and other conditions, and when required for the progress of the Work. Temporary doors shall be substantially built and hung, equipped with proper hinges, locks and other necessary hardware and shall be removed and reset whenever required to accommodate the work of other trades requiring their removal. All enclosures shall be maintained in good repair and removed when no longer needed. Door and window frames and sills shall be protected as necessary to prevent damage to items during construction.

2. Temporary Covering:

Provide substantial temporary wood covering over all floor openings for ducts, shafts, equipment, etc., using rough planking at least two (2) inches thick, cleated together and made sufficiently strong and put in place wherever required.

3. Temporary Railing:

Temporary railing shall be provided on stairs and around wells, pits and other locations where needed, to prevent accidents or injury to persons.

I. Contractor's Field Office:

Each Contractor shall establish and maintain a field office on his project and have available at the office a responsible representative who can officially receive instructions from the Engineer. The Contractor's Field Office shall be provided in accordance with Section 01520.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Use qualified tradesmen for installation of temporary services and facilities. Locate temporary services and facilities where they will serve the entire project adequately and result in minimum interference with the performance of the Work.

B. Relocate, modify and extend services and facilities as required during the course of work so as to accommodate the entire work of the Project.

3.02 REMOVAL

A. Completely remove temporary materials, equipment, and offices upon completion of construction.

B. Repair damage caused by installation, and restore to specified or original condition.

SECTION 01520 - FIELD OFFICES

PART 1 - GENERAL

1.01 CONTRACTOR'S FIELD OFFICE

A. The Contractor shall establish and maintain a field office on this project and have available at the office a responsible representative who can officially receive communications from the Owner and the Engineer. The Contractor shall have one complete, up-to-date set of Drawings, Specifications and Contract Documents (including all Addenda and Change Orders) in this office at all times, available for reference at any time. Notices, instructions, orders, directions or other communications from the Engineer, left at this office, shall be considered as received by the Contractor.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

SECTION 01631 - PRODUCTS AND SUBSTITUTIONS

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. Definitions: Definitions used in this paragraph are not intended to negate the meaning of other terms used in the Contract Documents including such terms as "specialties", "systems", "structure", "finishes", "accessories", "furnishings", "special construction" and similar terms. Such terms are self-explanatory and have recognized meanings in the construction industry.

1. "Products" are items purchased for incorporation in the Work, regardless of whether they were specifically purchased for the project or taken from the Contractor's previously purchased stock. The term "product" as used herein includes the terms "material", "equipment", "system" and other terms of similar intent.

2. "Named Products" are products identified by use of the manufacturer's name for a product, including such items as a make or model designation, as recorded in published product literature, of the latest issue as of the date of the Contract Documents.

3. "Materials" are products that must be substantially cut, shaped, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form units of work.

4. "Equipment" is defined as a product with operational parts, regardless of whether motorized or manually operated, and in particular, a product that requires service connections such as wiring or piping.

B. Substitutions: The Contractor's requests for changes in the products, materials, equipment and methods of construction required by the Contract Documents are considered requests for "substitutions", and are subject to the requirements specified herein. The following are not considered as substitutions:

1. Revisions to the Contract Documents, where requested by the Owner, Engineer are considered as "changes" not substitutions.

2. Substitutions requested during the bidding period, which have been accepted prior to the Contract Date, are included in the Contract Documents and are not subject to the requirements for substitutions as herein specified.

3. Specified Contractor options on products and construction methods included in the Contract Documents are choices available to the Contractor and are not subject to the requirements for substitutions as herein specified.

4. Except as otherwise provided in the Contract Documents, the Contractor's determination of and compliance with governing regulations and orders as issued by governing authorities do not constitute "substitutions" and do not constitute a basis for change orders.

1.02 SUBMITTALS

The information required to be furnished for evaluation of product substitution will be as follows:

A. Performance capabilities, and materials and construction details will be evaluated based upon conformance with the Specifications. Products that do not conform with the Specification shall not be accepted.

B. Manufacturer's production and service capabilities, and evidence of proven reliability will be acceptable if the following is furnished.

1. Written evidence that the manufacturer has not less than (3) years experience in the design and manufacture of the substitute product.

2. Written evidence of at least one application, of a type and size similar to the proposed substitute product, in successful operation for a period of at least one year.

3. In lieu of furnishing evidence of a manufacturer's Experience and successful operation of an application of the product to be substituted, the Contractor has the option of furnishing a cash deposit or bond which will guarantee replacement if the product the furnished does not satisfy the other requirements specified in this section. The amount of each deposit or bond will be subject to the approval.

C. Specific reference to characteristics either superior or inferior to specified requirements will be evaluated based on their net effect on the project. Products with any characteristics inferior to those specified will not be acceptable unless offset by characteristics that, in the opinion of the Engineer, will cause the overall effect of the product on the project to be at least equal to that of those specified.

1.03 QUALITY ASSURANCE

A. Source Limitations: To the fullest extent possible, provide products of the same generic kind, from a single source, for each unit of work.

B. Compatibility of Options: Compatibility of products is a basic requirement of product selection. When the Contractor is given the option of selecting between two or more products for use on the project, the product selected must be compatible with other products previously selected, even if the products previously selected were also Contractor options. The complete compatibility between the various choices available to the Contractor is not assured by the various requirements of the Contract Documents, but must be provided by the Contractor.

C. The detailed estimate of operating and maintenance costs will be evaluated based on comparison with similar data on the specified products. Proposed

substitute products which have an operating and maintenance cost that, in the opinion of the Engineer, exceeds that of the specified products will not be considered equal and will not be acceptable.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

General: Deliver, store, and handle products in accordance with manufacturer's recommendations, using means and methods that will prevent damage, deterioration and loss, including theft. Control delivery schedules to minimize long-term storage at the site and to prevent overcrowding of construction spaces. In particular coordinate delivery and installation to ensure minimum holding or storage times for items known or recognized to be flammable, hazardous, easily damaged, or sensitive to deterioration, theft and other sources of loss.

A. Deliver products to the site in the manufacturer's sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting and installing.

B. Store products at the site in a manner that will facilitate inspection and measurement of quantity or counting of units.

C. Store heavy materials away from the project structure in a manner that will not endanger the supporting construction.

D. Contractor is responsible for any and all damages or theft of materials or equipment till which time they entire project is complete and accepted by the owner.

PART 2 - PRODUCTS

2.01 GENERAL PRODUCT COMPLIANCE

A. General: Requirements for individual products are indicated in the Contract Documents; compliance with these requirements is in itself a Contract Requirement. These requirements may be specified in any one of several different specifying methods, or in any combination of these methods. These methods include the following:

1. Proprietary.

2. Descriptive.

3. Performance.

4. Compliance with Reference Standards.

Compliance with codes, compliance with graphic details, allowances, and similar provisions of the Contract Documents also have a bearing on the selection process.

B. Procedures for Selecting Products: Contractor's options in selecting products are limited by requirements of the Contract Documents and governing regulations.

They are not controlled by industry traditions or procedures experienced by the Contractor on previous construction projects.

2.02 SUBSTITUTIONS

A. Conditions: Contractor's request for substitution will be received and considered when extensive revisions to the Contract Documents are not required, when the proposed changes are in keeping with the general intent of the Contract Documents, when the request are timely, fully documented and properly submitted, and when one or more of the following conditions is satisfied, all as judged by the Engineer; otherwise the requests will be returned without action except to record non-compliance with these requirements.

1. The Engineer will consider a request for substitution where the request is directly related to an "or equal" clause or similar language in the Contract Documents.

2. The Engineer will consider a request for substitution where the specified product or method cannot be provided within the Contract Time. However, the request will not be considered if the product or method cannot be provided as a result of the Contractor's failure to pursue the work promptly or to coordinate the various activities properly.

3. The Engineer will consider a request for substitution where the specified product or method cannot receive necessary approval by a governing authority, and the requested substitution can be approved.

4. The Engineer will consider a request for a substitution where a substantial advantage is offered the Owner, in terms of cost, time, energy conservation or other considerations of merit, after deducting offsetting responsibilities the Owner may be required to bear. These additional responsibilities may include such considerations as additional compensation to the Engineer for redesign and evaluation services, the increased cost of other work by the Owner or separate contractors, and similar considerations.

5. The Engineer will consider a request for substitution when the specified product or method cannot be provided in a manner which is compatible with other materials of the work, and where the Contractor certifies that the substitution will overcome the incompatibility.

6. The Engineer will consider a request for substitution when the specified product or method cannot be properly coordinated with other materials in the work, and where the Contractor certifies that the proposed substitution can be properly coordinated.

7. The Engineer will consider a request for substitution when the specified product or method cannot receive a warranty as required by the Contract Documents and where the Contractor certifies that the proposed substitution receive the required warranty.

8. The Contractor shall reimburse the Owner any costs for review by the Engineer of proposed product substitutions which require major design

changes, as determined by the Owner, to related of adjacent work made necessary by the proposed substitutions.

B. Work-Related Submittals: Contractor's submittal of and the Engineer's acceptance of shop drawings, product data or samples which relate to work not complying with requirements of the Contract Documents, does not constitute an acceptable or valid request for a substitution, nor approval thereof.

2.03 GENERAL PRODUCT REQUIREMENTS

A. General: Provide products that comply with the requirements of the Contract Documents and that are undamaged and, unless otherwise indicated, unused at the time of installation. Provide products that are complete with all accessories, trim, finish, safety guards and other devices and details needed for a complete installation and for the intended use and effect.

1. Standard Products: Where they are available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

2. Continued Availability: Where, because of the nature of its application, the Owner is likely to need replacement parts or additional amounts of a product at a later date, either for maintenance and repair or replacement, provide standard, domestically produced products for which the manufacturer has published assurances that the products and its parts are likely to be available to the Owner at a later date.

B. Nameplates: Except as otherwise indicated for required labels and operating data, do not permanently attach or imprint manufacturer's or producer's nameplates or trademarks on exposed surfaces of products which will be exposed to view either in occupied spaces or on the exterior of the completed project.

1. Labels: Locate required product labels and stamps on a concealed surface or, where required for observation after installation, on an accessible surface which, in occupied spaces, is not conspicuous.

PART 3 - EXECUTION

3.01 INSTALLATION OF PRODUCTS

A. General: Except as otherwise indicated in individual sections of these Specifications, comply with the manufacturer's instructions and recommendations for installation of the products in the applications indicated. Anchor each product securely in place, accurately located and aligned with other work. Clean exposed surfaces and protect surfaces as necessary to ensure freedom from damage and deterioration at Time of Acceptance.

SECTION 01740 - CLEANING

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. Maintain premises free from accumulations of waste, debris, and rubbish.

B. At completion of work, remove waste materials, rubbish, tools, equipment, machinery and surplus materials, and clean all exposed surfaces. Leave project clean and ready for occupancy.

1.02 SAFETY REQUIREMENTS

A. Hazards Control:

1. Store volatile wastes in covered metal containers, and remove from premises daily.

2. Prevent accumulation of wastes which create hazardous conditions.

3. Provide adequate ventilation during use of violative noxious substances.

B. Conduct cleaning and disposal operations to comply with local ordinances and anti-pollution laws.

1. Do not burn or bury rubbish and waste materials on project site.

2. Do not dispose of volatile wastes such as mineral spirits, oil, or paint thinner in storm or sanitary drains.

3. Do not dispose of wastes into streams or waterways.

PART 2 - PRODUCTS

2.01 MATERIALS

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

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 - EXECUTION

3.01 DURING CONSTRUCTION

A. Execute cleaning to ensure that building, grounds, and public properties are maintained free from accumulations of waste materials and rubbish.

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

C. At reasonable intervals during progress of work, clean site and public properties, and dispose of waste materials, debris and rubbish.

D. Provide on-site containers for collection of waste materials, debris and rubbish.

E. Remove waste materials, debris and rubbish from site and legally dispose of at public or private dumping areas off Owner's property.

F. Handle materials in a controlled manner with as few handlings as possible; do not drop or throw materials from heights.

G. Schedule cleaning operations so that dust and other contaminants resulting from cleaning process will not fall on wet, newly painted surfaces.

3.02 FINAL CLEANING

A. Employ experienced workmen, or professional cleaners, for final cleaning.

B. In preparation for substantial completion or occupancy, conduct final inspection of sight-exposed interior and exterior surfaces, and of concealed spaces.

C. Remove grease, dust, dirt, stains, labels, fingerprints, and other foreign materials, from sight-exposed interior or exterior finished surfaces; polish surfaces so designated to shine finish.

D. Repair, patch and touch up marred surfaces to specified finish, to match adjacent surfaces.

E. Broom clean paved surfaces; rake clean other surfaces of grounds.

F. Maintain cleaning until project, or portion thereof, is occupied by Owner.

SECTION 01770 - PROJECT CLOSEOUT

PART 1 - GENERAL

1.01 SUBSTANTIAL COMPLETION

A. In order to initiate project closeout procedures, the Contractor shall submit the following:

1. Written certification to Engineer that project is Substantially Complete.

2. List of major items to be completed or corrected.

B. Engineer will make an inspection within seven (7) days after receipt of certification, together with Owner's Representative.

C. Should Engineer consider that work is Substantially Complete:

1. Contractor shall prepare, and submit to Engineer, a list of items to be completed or corrected, as determined by the inspection.

2. Engineer will prepare and issue a Certificate of Substantial Completion, containing:

a. Date of Substantial Completion.

b. Contractor's list of items to be completed or corrected, verified and amended by Engineer.

c. The time within which Contractor shall complete or correct work of listed items.

d. Time and date Owner will assume possession of work or designated portion thereof.

e. Responsibilities of Owner and Contractor for:

(1) Insurance

(2) Utilities

(3) Operation of Mechanical, Electrical, and Other Systems.

(4) Maintenance and Cleaning.

(5) Security.

f. Signatures of:

(1) Engineer

(2) Contractor

(3) Owner

3. Owner occupancy of Project or Designated Portion of Project:

a. Contractor shall:

(1) Obtain certificate of occupancy.

(2) Perform final cleaning in accordance with Section 01740.

b. Owner will occupy Project, under provisions stated in Certificates of Substantial Completion.

4. Contractor: Complete work listed for completion or correction, within designated time.

D. Should Engineer consider that work is not Substantially Complete:

1. He shall immediately notify Contractor, in writing, stating reasons.

2. Contractor: Complete work, and send second written Engineer, certifying that Project, or designated portion of Project is substantially complete.

3. Engineer will reinspect work.

E. Should Engineer consider that work is still not finally complete:

1. He shall notify Contractor, in writing, stating reasons.

2. Contractor shall take immediate steps to remedy the stated deficiencies, and send third written notice to the Engineer certifying that the work is complete.

3. Engineer and Owner will reinspect work at Contractor's expense.

1.02 FINAL INSPECTION

A. Contractor shall submit written certification that:

1. Contract Documents have been reviewed.

2. Project has been inspected for compliance with Contract Documents.

3. Work has been completed in accordance with Contract Documents.

4. Equipment and systems have been tested in presence of Owner's Representative and are operational.

5. Project is completed, and ready for final inspection.

B. Engineer will make final inspection within seven (7) days after receipt of certification.

C. Should Engineer consider that work is finally complete in accordance with

requirements of Contract Documents, he shall request Contractor to make Project Closeout submittals.

D. Should Engineer consider that work is not finally complete:

1. He shall notify Contractor in writing, stating reasons.

2. Contractor shall take immediate steps to remedy the stated deficiencies, and send second written notice to Engineer certifying that work is complete.
3. Engineer will reinspect work.

1.03 CLOSEOUT SUBMITTALS

A. Project Record Documents: To requirements of Section 01785.

B. Guarantees, Warranties and Bonds: To requirements of particular technical Specifications and Section 01782.

1.04 INSTRUCTION

A. Instruct Owner's personnel in operation of all systems, mechanical, electrical, and other equipment.

1.05 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit final applications in accordance with requirements of General Conditions.

1.06 FINAL CERTIFICATE FOR PAYMENT

A. Engineer will issue final certificate in accordance with provisions of general conditions.

B. Should final completion be materially delayed through no fault of Contractor, Engineer may issue a Semi-Final Certificate for Payment.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

SECTION 01780 – OPERATIONS AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Compile product data and related information appropriate for Owner's maintenance and operation of equipment furnished under the Contract. Prepare operating and maintenance data as specified.

B. In addition to maintenance and operations data, the manufacturer's printed recommended installation practice shall also be included. If not part of the operations and maintenance manual, separate written installation instructions shall be provided, serving to assist the Contractor in equipment installation.

1.02 FORM OF SUBMITTALS

A. Prepare data in the form of an instructional manual for use by Owner's personnel.

B. Format:

1. Size: 8-1/2 in. x 11 in.

2. Paper: 20 pound minimum, white, for typed pages.

3. Text: Manufacturer's printed data, or neatly typewritten.

4. Photo copies must be clear and legible.

5. Drawings:

   a. Provide reinforced punched binder tab, bind in with text.

   b. Fold large drawings to the size of the text pages where feasible.

   c. For flow or piping diagrams that cannot be detailed on the standard size drawings, a larger, appropriate size drawing may be submitted and supplied in a properly marked map packet.

6. Provide fly-leaf for each separate product, or each piece of operating Equipment.

   a. Provide typed description of product, and major component parts of equipment.

   b. Provide indexed tabs.

7. Cover: Identify each volume with types or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:

   a. Title of Project.

b. Identity of separate structure as applicable.

c. Identity of general subject matter covered in the manual.

C. Binders:

1. Commercial quality, durable and cleanable, 3-hole, 3" or 4" D-ring binders, with oil and moisture resistant hard covers.

2. When multiple binders are used, correlate the data into related consistent grouping.

3. Imprinted on the front cover and side of each binder shall be the name of the Plant, the Contract Number and Volume Number.

4. Binders shall be new and not recycled form a prior data manual.

1.03 SUBMITTAL SCHEDULE

A. Provide three (3) copies and two (2) digital copies of approved completed O & M Manual in final form ten (10) days prior to final inspection or acceptance to the Owner.

1.04 QUALITY ASSURANCE

A. Preparation of data shall be done by personnel:

1. Trained and experienced in maintenance and operation of the described products.

2. Completely familiar with requirements of this Section.

3. Skilled as a technical writer to the extent required to communicate essential data.

4. Skilled as a draftsman competent to prepare required drawings.

1.05 CONTENTS OF MANUAL

A. Each item of equipment shall be placed in a logical sequential order, as listed or ordered in the Contract Documents.

B. Content, for each unit of equipment and system, as appropriate:

1. Detailed description of the process and operation procedures as applicable.

2. Instructions for all components of the equipment whether manufactured by the supplier or not, including valves, controllers and other miscellaneous components.

3. Description of unit and component parts.

   a. Function, normal operating characteristics, and limiting conditions.

   b. Performance curves, engineering data and tests.

   c. Complete nomenclature and commercial number of all replaceable parts.

   d. Exploded and/or sectional drawing views.

   e. Equipment model number.

4. Operating procedures:

   a. Start-up, break-in, routine and normal operating instructions.

   b. Regulation, control, stopping, shutdown and emergency instructions.

   c. Summer and winter operating instructions.

   d. Special operating instructions.

5. Maintenance Procedures:

   a. Routine operations.

   b. Guide to "trouble-shooting".

   c. Disassembly, repair and reassembly.

   d. Alignment, adjusting and checking.

   e. Preventative maintenance schedule.

   f. Recommended spare parts list and quantities.

   g. Equipment parts list.

   h. Local service center.

6. Servicing and Lubrication schedule.

   a. List of lubricants required.

   b. Lubrication procedures.

   c. Lubrication schedule.

7. Internal and external wiring and piping diagrams numbered to correspond to the installation.

8. Description of sequence of operation by control supplier.

9. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.

    a. Predicted life of parts subject to wear.

10. As-installed control diagrams by controls supplier.

11. Each Contractor's coordination drawings.

    a. As-installed color coded piping diagrams.

12. Charts of valve tag numbers, with the location and function of each valve.

13. Other data as required under pertinent sections of Specifications.

C. Content, for each electrical system, as appropriate:

1. Description of system and component parts.

    a. Function, normal operating characteristics, and limiting conditions.

    b. Performance curves, engineering data and tests.

    c. Complete nomenclature and commercial number of replacement parts.

2. Circuit directories of panel boards.

    a. Electrical service.

    b. Controls.

    c. Communications.

3. As-installed color-coded wiring diagrams.

4. Operating procedures:

   a. Routine and normal operating instructions.

   b. Sequences required.

   c. Special operating instructions.

5. Maintenance procedures:

   a. Routine operations.

   b. Guide to "trouble-shooting".

   c. Disassembly, repair and reassembly.

   d. Adjustment and checking.

6. Manufacturer's printed operating and maintenance instructions.

7. List of original manufacturer's recommended spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.

8. Other data as required under pertinent sections of Specifications.

D. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.

E. Additional requirements for operating and maintenance data: The respective section of Specifications.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

SECTION 01782 - WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. Compile specified warranties and bonds.

B. Compile specified service and maintenance contracts.

C. Co-execute submittals when so specified.

D. Review submittals to verify compliance with Contract Documents.

E. Submit to Engineer for review and transmittal to Owner.

1.02 SUBMITTALS REQUIREMENTS

A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.

B. Furnish two (2) original signed copies.

C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

1. Product, equipment or work item.

2. Firm name, address and telephone number.

3. Scope

4. Date of beginning of warranty, bond or service and maintenance contract.

5. Duration of warranty, bond or service and maintenance contract.

6. Provide information for Owner's personnel:

   a. Proper procedure in case of failure.

   b. Instances which might affect the validity of warranty or bond.

7. Contractor name, address and telephone number.

1.03 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size 8-1/2 in. x 11 in., punch sheets for 3-ring binder.

a. Fold larger sheets to fit into binders.

2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS." List:

a. Title of Project

b. Name of Contractor

C. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.

1.04 TIME OF SUBMITTALS

A. For equipment or component parts of equipment put into service during progress of construction:

1. Submit documents within 10 days after inspection and acceptance.

B. Otherwise make submittals within 10 days after date of substantial completion, prior to final request for payment.

C. For items of work, where acceptance is delayed materially beyond the Date of Substantial Completion, provide updated submittal within 10 days after acceptance, listing the date of acceptance as the start of the warranty period.

1.05 SUBMITTALS REQUIRED

A. Submit warranties, bonds, service and maintenance contracts as specified in the respective sections of the Specifications.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

SECTION 01785 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.01 MAINTENANCE OF DOCUMENTS

A. Maintain at job site, one copy of:

1. Contract Drawings
2. Specifications
3. Addenda
4. Reviewed Shop Drawings
5. Change Orders
6. Other Modifications to Contract

B. Store documents in approved location, apart from documents used for construction.

C. Provide files and racks for storage of documents.

D. Maintain documents in clean, dry, legible condition.

E. Do not use record documents for construction purposes.

F. Make documents available at all times for inspection by Engineer and Owner.

1.02 MARKING DEVICES

A. Provide colored pencil or felt-tip marking pen for all marking.

1.03 RECORDING

A. Label each document "PROJECT RECORD" in 2-inch high printed letters.

B. Keep record documents current.

C. Do not permanently conceal any work until required information has been recorded.

D. Contract Drawings: Legibly mark to record actual construction:

1. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
2. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.

3. Field changes of dimension and detail.

4. Changes made by Change Order or Field Order.

5. Details not on original Contract Drawings.

E. Specifications and Addenda: Legibly mark up each section to record:

1. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.

2. Changes made by Change Order or Field Order.

3. Other matters not originally specified.

F. Shop Drawings: Maintain as record documents; legibly annotate shop drawings to record changes made after review.

1.05 SUBMITTALS

A. At completion of project, deliver record documents to Engineer.

B. Accompany submittal with transmittal letter, in duplicate, containing:

1. Date.

2. Project Title and Number.

3. Contractor's Name and Address.

4. Title and Number of each Record Document.

5. Certification that each Document as Submitted is Complete and Accurate.

6. Signature of Contractor, or His Authorized Representative.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

SECTION 02

SECTION 02220 - DEMOLITION & SALVAGE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required for demolition as shown on the Drawings and specified herein.

1.02 PROCEDURE

A. The procedures proposed for the accomplishment of salvage and demolition work shall be submitted for review. The procedures shall provide for safe conduct of the work, careful removal and disposition of materials specified to be salvaged, protection of property which is to remain undisturbed, coordination with other work in progress and timely disconnection of utility services. The procedures shall include a detailed description of the methods and equipment to be used for each operation, and the sequence of operations.

B. It is the responsibility of the Contractor to visit the site to familiarize himself with the amount of Work that is included under this Section.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 DUST CONTROL

A. The amount of dust resulting from the demolition shall be controlled to prevent the spread of dust to occupied portions of the plant and to avoid creation of a nuisance in the surrounding area. Use of water will not be permitted when it will result in, or create, hazardous or objectionable conditions such as ice, flooding and pollution.

3.02 DISCONNECTION OF UTILITY SERVICES

A. Utilities shall be disconnected at the points indicated by the Owner or Engineer and left in a safe condition.

3.03 BURNING

A. The use of burning at the project site for the disposal of refuse and debris will not be permitted, unless authorized in writing by the Owner and permit from regulatory agency has be acquired by the contractor.

3.04 PROTECTION OF EXISTING WORK

A. Existing work to remain shall be protected from damage. Work damaged by the Contractor shall be repaired to match existing work.

3.05 BACKFILL OF STRUCTURES

A. The portion of the demolished structures remaining below grade shall be backfilled with concrete, masonry, etc., from the demolition or any backfill material which is acceptable to the Engineer. The top two (2) feet of the backfill shall be made up of topsoil and graded to match the existing ground. It shall be free of any of the demolition material. The entire backfill shall be compacted in such a manner as to prevent settlement.

B. It is the responsibility of the Contractor to dispose of all excess demolition material from the site as soon as practicable.

3.06 SALVAGE MATERIAL

A. All equipment, pumps, controls, valves, piping, etc., is the property of the Owner and care shall be taken in its removal so not to damage it in any way. Such salvage material shall be removed and delivered to the Owner to a site designated by him. The Owner has the right to refuse any salvage material, and in such cases it is the responsibility of the Contractor to dispose of the unwanted material.

SECTION 02240 - DEWATERING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor and equipment required to dewater all excavations.

B. Dewatering of all excavations shall be the responsibility of the Contractor, and no additional compensation will be allowed for same unless specifically included as a bid item.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION

3.01 GENERAL

A. Dewatering equipment shall be of adequate size and quantity to assure maintaining proper conditions for installing pipe, concrete, backfill or other material or structure in the excavation.

B. Dewatering shall include proper removal of any and all liquid, regardless of its source, from the excavation and the use of all practical means available to prevent surface runoff from entering any excavation.

C. The site shall be kept free of surface water at all times. The Contractor shall install drainage ditches, dikes and shall perform all pumping and other work necessary to divert or remove rainfall and all other accumulations of surface water from the excavations. The diversion and removal of surface water shall be performed in a manner that will prevent flooding and/or damage to other locations within the construction area where it may be detrimental. The Contractor shall provide, install and operate sufficient trenches, sumps, pumps, hose piping, well points, deep wells, etc., necessary to depress and maintain the ground water level at least two (2) feet below the base of the excavation during all stages of construction operations. The ground water table shall be lowered in advance of excavation and maintained a minimum of two (2) feet below the lowest excavation subgrade made until the structure has sufficient strength and weight to withstand horizontal and vertical soil and water pressures from natural ground water.

D. No liquid from the excavated area shall be discharged into the sanitary sewer system.

SECTION 02260 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section includes, but is not limited to, the following:

1. Shoring and bracing necessary to protect existing buildings, streets, walkways, utilities, and other improvements and excavation against loss of ground or caving embankments.

2. Maintenance of shoring and bracing.

3. Removal of shoring and bracing, as required.

B. Types of shoring and bracing systems include, but are not limited to, the following:

1. Steel H-section (soldier) piles.

2. Timber lagging.

3. Steel sheet piles.

4. Portable Steel Trench Box.

C. Building excavation is specified in another Division 2 Section.

1.02 SUBMITTALS

A. Layout drawings for excavation support system and other data prepared by, or under the supervision of, a qualified professional engineer. System design and calculations must be acceptable to local authorities having jurisdiction.

1.03 JOB CONDITIONS

A. Before starting work, verify governing dimensions and elevations. Verify condition of adjoining properties. Take photographs to record any existing settlement or cracking of structures, pavements, and other improvements. Prepare a list of such damages, verified by dated photographs, and signed by Contractor and others conducting investigation.

B. Survey adjacent structures and improvements, employing qualified professional engineer, establishing exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

C. During excavation, resurvey benchmarks weekly, maintaining 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.

1.04 EXISTING UTILITIES

A. Protect existing active sewer, water, gas, electricity and other utility services and structures.

B. Notify municipal agencies and service utility companies having jurisdiction. Comply with requirements of governing authorities and agencies for protection, relocation, removal, and discontinuing of services.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General: Provide adequate shoring and bracing materials which will support loads imposed. Materials need not be new, but should be in serviceable condition.

B. Structural Steel: ASTM A 36.

C. Steel Sheet Piles: ASTM A 328.

D. Timber Lagging: Any species, rough-cut, mixed hardwood, nominal 3 inches thick, unless otherwise indicated.

E. Portable Steel Trench Box shall be OSHA approved.

PART 3 - EXECUTION

3.01 SHORING

A. Wherever shoring is required, locate the system to clear permanent construction and to permit forming and finishing of concrete surfaces. Provide shoring system adequately anchored and braced to resist earth and hydrostatic pressures.

B. Shoring systems retaining earth on which the support or stability of existing structures is dependent must be left in place at completion of work.

3.02 BRACING

A. Locate bracing to clear columns, floor framing construction, and other permanent work. If necessary to move a brace, install new bracing prior to removal of original brace.

B. Do not place bracing where it will be cast into or included in permanent concrete work, except as otherwise acceptable to Engineer.

C. Install internal bracing, if required, to prevent spreading or distortion of braced

frames.

D. Maintain bracing until structural elements are supported by other bracing or until permanent construction is able to withstand lateral earth and hydrostatic pressures.

E. Remove sheeting, shoring, and bracing in stages to avoid disturbance to underlying soils and damage to structures, pavements, facilities, and utilities.

F. Repair or replace, as acceptable to Engineer, adjacent work damaged or displaced through installation or removal of shoring and bracing work.

SECTION 02300 - EARTHWORK

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all materials, labor, equipment and services necessary to do all clearing and grubbing, excavation, backfilling, providing of additional fill material and topsoil, control of surface drainage and ground water, finished site grading and erosion control required to construct the work as shown.

1.02 JOB CONDITIONS

A. Weather: Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained on account of rain, snow, ice, drought or other adverse weather conditions.

B. Existing Utilities: Prior to commencement of work, the Contractor shall locate existing underground utilities in areas of the work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.

C. Use of Explosives: The Contractor (or any of his Subcontractors) shall not bring explosives onto site or use in work without prior written permission from the Owner. All activities involving explosives shall be in compliance with the rules and regulations of the State Department of Mines, and Minerals, Division of Explosives and Blasting. Contractor is solely responsible for handling, storage, and use of explosive materials when their use is permitted.

D. Protection of Persons and Property:

1. Barricade open excavations occurring as part of this work and post with warning lights.

   a. Operate warning lights as recommended by authorities having jurisdiction.

   b. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

E. Dust Control: Use all means necessary to control dust on or near the project site where such dust is caused by the Contractor's operations or directly results from conditions left by the Contractor.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

A. Definitions:

1. Satisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups GW, GP, GM, SM, SW, SP, GC, SC, ML, and CL.

2. Unsatisfactory soil materials are defined as those complying with ASTM D2487 soil classification groups MH, CH, OL, OH and PT. The Contractor shall notify the Engineer if these soil materials are encountered.

3. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, crushed slag, natural or crushed sand.

4. Drainage Fill: Washed, evenly graded mixture of crushed stone, or uncrushed gravel, with 100 percent passing a 1 - 2 inch sieve and not more than 5 percent passing a no. 4 sieve.

5. Backfill and Fill Materials: Satisfactory soil materials free of debris, waste, frozen materials, vegetable, and other deleterious matter.

PART 3 - EXECUTION

3.01 CLEARING AND GRUBBING

A. Work shall consist of cutting and removing designated trees, stumps, brush, logs, removal of fences, or other loose and projecting material. Unless otherwise specified, it shall also include the grubbing of stumps, roots, and other natural obstructions which, in the opinion of the Engineer, must be removed to execute properly the construction work and operate properly the facility upon the completion of construction.

B. Trees, bushes, and all natural vegetation shall only be removed with the approval of the Engineer. No cleared or grubbed materials shall be used in backfills or embankment fills. All stumps, roots, and other objectionable material shall be grubbed up so that no roots larger than 3 inches in diameter remain less than 18 inches below the ground surface. All holes and depressions left by grubbing operations shall be filled with suitable material and compacted to grade, as recommended in Paragraph 3.06.

C. Disposal shall be by burning or other methods satisfactory to the Engineer; however, burning will be permitted only when the Contractor has obtained written permission from the local regulatory agency.

D. The Contractor shall also remove from the site and satisfactorily dispose of all miscellaneous rubbish including, but not limited to, masonry, scrap metal, rock, pavement, etc., that is under the fill or to be removed as shown on the Drawings, specified herein, or directed by the Engineer.

E. Existing improvements, adjacent property, utility and other facilities, and trees, plants, and brush that are not to be removed shall be protected from injury or damage resulting from the Contractor's operations.

F. Trees and shrubs, designated to remain or that are beyond the clearing and grubbing limit, which are injured or damaged during construction operations shall be treated or replaced at the Contractor's expense by experienced tree surgery personnel.

3.02 EROSION CONTROL

A. Temporary measures shall be applied throughout the construction period to control and to minimize siltation to adjacent properties and waterways. Such measures shall include, but not be limited to, the use of berms, silt barriers, gravel or crushed stone, mulch, slope drains and other methods.

B. These temporary measures shall be applied to erodible material exposed by any activity associated with the construction of this project.

C. Refer to Section 02371, Erosion and Sedimentation Control for requirements.

3.03 EXCAVATION

A. Excavation of every description and of whatever substances encountered within the grading limits of the project shall be performed to the lines and grades indicated on the Drawings. All excavation shall be performed in the manner and sequence as required for the work.

B. All excavated materials that meet the requirements for fill, subgrades or backfill shall be stockpiled within the site for use as fill or backfill, or for providing the final site grades. Where practicable, suitable excavated material shall be transported directly to any place in the fill areas within the limits of the work. All excavated materials that are not suitable for fill, and any surplus of excavated material that is not required for fill shall be disposed of by the Contractor.

C. The site shall be kept free of surface water at all times. The Contractor shall install drainage ditches, dikes and shall perform all pumping and other work necessary to divert or remove rainfall and all other accumulations of surface water from the excavations. The diversion and removal of surface water shall be performed in a manner that will prevent flooding and/or damage to other locations within the construction area where it may be detrimental. The Contractor shall provide, install and operate sufficient trenches, sumps, pumps, hose piping, well points, deep wells, etc., necessary to depress and maintain the ground water level at least two (2) feet below the base of the excavation during all stages of construction operations. The ground water table shall be lowered in advance of excavation and maintained a minimum of two (2) feet below the lowest excavation subgrade made until the excavation is backfilled or the structure has sufficient strength and weight to withstand horizontal and vertical soil and water pressures from natural ground water.

D. Excavations for concrete structural slabs and footings on grade shall extend two (2) feet below the indicated bottom of slabs and footings. The over-excavation shall be backfilled with 18 inches, compacted thickness, of over lot fill material or suitable material as herein specified. The remaining six (6) inches of over-excavation shall be backfilled with porous fill material. The porous fill layer shall extend beyond the limits of the concrete slab a minimum of two (2) feet on

all sides as indicated on the Drawings. The porous fill shall be crushed stone or gravel and shall have the following U.S. Standard Sieve gradation:

Sieve	1-1/2	1	3/4	1/2	3/8
% Passing	Min 100	95±5	58±17	Max15	Max 5

E. Excavations for the construction shall be carefully made to the depths required. Bottoms for footings and grade beams shall be level, clean and clear of loose material, the lower sections true to size. Bottoms of footings and grade beams, in all locations, shall be at a minimum depth of 30 inches below adjacent exterior finished grade or 30 inches below adjacent existing grade, whichever is lower, whether so indicated or not. Footings and grade beam bottoms shall be inspected by the Engineer before any concrete is placed thereon.

F. In excavations for structures where, in the opinion of the Engineer, the ground is spongy or otherwise unsuitable for the contemplated foundation, the Contractor shall remove such unsuitable material and replace it with suitable material properly compacted.

G. Sheeting and shoring shall be provided as necessary for the protection of the work and for the safety of the personnel. The clearances and types of the temporary structures, insofar as they affect the character of the finished work, will be subject to the review of the Engineer, but the Contractor shall be responsible for the adequacy of all sheeting, bracing and cofferdamming. All shoring, bracing and sheeting shall be removed as the excavations are backfilled in a manner such as to prevent injurious caving; or, if so directed by the Engineer, shall be left in place. Sheeting left in place shall be cut off 18 inches below the surface.

H. Excavation for structures which have been carried below the depths indicated without specific instructions shall be refilled to the proper grade with suitable material properly compacted, except that in excavation for columns, walls or footings, the concrete footings shall extend to this lower depth. All work of this nature shall be at the Contractor's expense.

3.04 FILL

A. All existing fill below structures and paved areas must be stripped. The upper six (6) inches of the natural subgrade below shall be scarified and recompacted at optimum moisture to at least ninety-five percent (95%) of Standard Proctor Density ASTM D 698 (latest revision).

B. All vegetation, such as roots, brush, heavy sods, heavy growth of grass and all decayed vegetable matter, rubbish and other unsuitable material within the area upon which fill is to be placed shall be stripped or otherwise removed before the fill is started. In no case will such objectionable material be allowed to remain in or under the fill area. Existing fill from excavated areas on site shall be used as fill for open and/or planted areas. Additional fill stockpiled at the site can be used for structural fill if approved by the Engineer. Any additional material necessary for establishing the indicated grades shall be furnished by the Contractor and approved by the Engineer. All fill material shall be free from trash, roots and other organic material. The best material to be used in fills shall be reserved for backfilling pipe lines and for finishing and dressing the surface. Material larger than 3 inches maximum dimension shall not be permitted in the upper 6 inches of the fill area. Fill material shall be placed in successive layers and thoroughly

tamped or rolled in a manner approved by the Engineer, each layer being moistened or dried such that the specified degree of compaction shall be obtained. No fill shall be placed or compacted in a frozen condition or on top of frozen material. No fill material shall be placed when free water is standing on the surface of the area where the fill is to be placed and no compaction of fill will be permitted with free water on any point of the surface of the fill to be compacted.

C. Where concrete slabs are placed on earth, all loam and organic or other unsuitable material shall be removed. Where fill is required to raise the subgrade for concrete slabs to the elevations as indicated on the Drawings or as required by the Engineer, such fill shall consist of suitable material and shall be placed in layers. Each layer shall be moistened or dried such that the specified degree of compaction shall be obtained. All compaction shall be accomplished in a manner and with equipment as approved by the Engineer. When the subgrade is part fill and part excavation or natural ground, the excavated or natural ground portion shall be scarified to a depth of 12 inches and compacted as specified for adjacent fill.

3.05 BACKFILLING

A. After completion of footings, grade beams and other construction below the elevation of the final grades and prior to backfilling, all forms shall be removed and the excavation shall be cleaned of all trash and debris. Material for backfilling shall be as specified for suitable material, placed and compacted as specified hereinafter. Backfill shall be placed in horizontal layers of the thickness specified and shall have a moisture content such that the required degree of compaction is obtained. Each layer shall be compacted by mechanical tampers or by other suitable equipment approved by the Engineer to the specified density. Special care shall be taken to prevent wedging action or eccentric loading upon or against the structure. Trucks and machinery used for grading shall not be allowed within 45 degrees above the bottom of the footings or grade beams.

B. The trenches shall be backfilled following visual inspection by the Engineer and prior to pressure testing. The trenches shall be carefully backfilled with the excavated materials approved for backfilling, or other suitable materials, free from large clods of earth or stones. Each layer shall be compacted to a density at least equal to that of the surrounding earth and in such a manner as to permit the rolling and compaction of the filled trench with the adjoining earth to provide the required bearing value, so that paving, if required, can proceed immediately after backfilling is completed.

3.06 COMPACTION

A. Suitable material as hereinbefore specified shall be placed in maximum 8" horizontal layers. Compaction shall be performed by rolling with approved tamping rollers, pneumatic-tired rollers, three wheel power rollers or other approved equipment. The degree of compaction required is expressed as a percentage of the maximum dry density obtained by the test procedure presented in ASTM D-698. Laboratory moisture density tests shall be performed on all fill material. Material shall be moistened or aerated as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction. Compaction requirements shall be as specified below:

Fill Utilized For	Required Density (%)	Maximum Permissible Lift Thickness As Compacted, Inches
Backfill & Utility Trenches Under Foundations & Pavements	95-100	8
Backfill Around Structures	95-100	8
Field and Utility Trench Backfill Under Sidewalks and Open Areas	90-100	8

B. Field density tests shall be performed in sufficient number to insure that the specified density is being obtained. Tests shall be in accordance with ASTM Standards D 1556 or D 2922/D 3017 and shall be performed as authorized by the Engineer. Payment for field density tests shall be by the Owner. Contractor shall provide suitable notification for coordination of testing. Delays due to the lack of adequate advance notification shall be the responsibility of the Contractor.

3.07 SITE GRADING

A. Where indicated or directed, topsoil shall be removed without contamination with subsoil and spread on areas already graded and prepared for topsoil, or transported and stockpiled convenient to areas for later application, or at locations specified. Topsoil shall be stripped to full depth and, when stored, shall be kept separate from other excavated materials and piled free of roots, stones, and other undesirable materials.

B. Following stripping, fill areas shall be scarified to a minimum depth of six (6) inches to provide bond between existing ground and the fill material. Material should be placed in successive horizontal layers not exceeding twelve (12) inches uncompacted thickness. In general, layers shall be placed approximately parallel to the finished grade line.

C. In general and unless otherwise specified, the Contractor may use any type of earth moving equipment he has at his disposal, provided such equipment is in satisfactory condition and of such type and capacity that the work may be accomplished properly and the grading schedule maintained. During construction, the Contractor shall route equipment at all times, both when loaded and empty, over the layers as they are placed, and shall distribute the travel evenly over the entire area.

D. The material in the layers shall be of the proper moisture content before rolling or tamping to obtain the prescribed compaction. Wetting or drying throughout the layer shall be required. Should the material be too wet to permit proper compaction or rolling, all work on the fill thus affected shall be delayed until the material has dried to the required moisture content. If the material is too dry, it shall be sprinkled with water and manipulated to obtain the uniform moisture content required throughout a layer before it is compacted.

E. Each layer of the fill shall be compacted by rolling or tamping to the standard specified in Paragraph 3.06 and not less than 90% maximum density at optimum

moisture content as determined by field density tests made by the Standard Proctor method in accordance with ASTM D 698. In general and unless otherwise specified, the Contractor may use any type of compaction equipment such as sheepsfoot rollers, pneumatic rollers, smooth rollers and other such equipment he has at his disposal, provided such equipment is in satisfactory condition and is of such design, type, size, weight, and quantity to obtain the required density in the embankment. If at any time the required density is not being obtained with the equipment then in use by the Contractor, the Engineer may require that different and/or additional compaction equipment be obtained and placed in use at once to obtain the required compaction.

F. Samples of all fill and embankment materials, both before and after placement and compaction, will be taken by the Engineer, and from the tests made on such samples, certain corrections, adjustments, and modifications of methods, materials, and moisture content will be directed to obtain uniformity with the governing specifications for compaction and construct properly the fill and embankment.

G. The Contractor shall be responsible for the stability of all embankments and shall replace any portion which, in the opinion of the Engineer, has become displaced due to carelessness or negligence on the part of the Contractor.

3.08 TOPSOIL

A. Provide all labor, materials, equipment and services required for furnishing and placing topsoil. Samples of topsoil shall be submitted to the Engineer for review before topsoil is placed. The material shall be good quality loam and shall be fertile, friable, mellow; free from stones larger than one (1) inch, excessive gravel, junk metal, glass, wood, plastic articles, roots and shall have a liberal amount of organic matter. Light sand loam or heavy clay loam will not be acceptable.

B. The topsoil shall be 3 inches thick in all areas to be seeded. No topsoil shall be placed until the area to be covered is excavated or filled to the required grade. Imported backfill material will be stockpiled on site for structure backfilling and top soiling.

SECTION 02371 - EROSION AND SEDIMENTATION CONTROL-KY NPDES REQUIREMENTS (for disturbed areas of one acre or more)

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, and equipment required for erecting, maintaining and removing temporary erosion and sedimentation controls as specified herein and as recommended by state and local regulatory agencies.

B. Temporary erosion controls include, but are not limited to grassing, mulching, seeding, providing erosion control and turf reinforcement mats on all disturbed surfaces including waste area surfaces and stockpile and borrow area surfaces; scheduling work to minimize erosion and providing interceptor ditches at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits.

C. Temporary sedimentation controls include, but are not limited to, silt dams, traps, barriers, and appurtenances on sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits.

D. Contractor is responsible for providing and maintaining effective temporary erosion and sediment control measures prior to and during construction or until final controls become effective.

E. The Contractor shall be responsible for placement of erosion and sedimentation controls. Prior to construction, the Contractor shall develop an erosion control plan and submit to the Engineer for review. Prior to excavation, fill or grade work, the Contractor shall place controls in locations required by the erosion control plan. If during the course of construction, the Engineer determines additional controls are required, the Contractor shall furnish, install and maintain additional mulching, blankets and/or sediment barriers to control erosion and sedimentation to the satisfaction of the Engineer.

F. The Contractor shall notify the appropriate state agency before beginning construction, and shall implement erosion control measures as may be required by state and federal agencies. Contractor shall submit a signed Notice of Intent form to the Division of Water at least 48 hours prior to beginning of construction activity.

G. The Contractor shall inspect and repair all erosion and sedimentation controls every seven (7) days and after each rainfall of 0.5 inch or greater.

H. Bare soil areas must be seeded, mulched, or covered after 14 days if no work will be done in the area within the next 7 days.

PART 2 – PRODUCTS

2.01 SEED

A. The seed mixture to be sown shall be in the following proportions:

Common Name	Proportion By Weight	% of Purity	% of Germination
Kentucky 31 Tall Fescue	75	90	85
Italian Rye Grass	10	90	85
Red Top	10	90	85
White Clover	5	95	90

B. All seed shall be fresh and clean and shall be delivered mixed, in unopened packages, bearing a guaranteed analysis of the seed mixture.

2.02 FERTILIZER

A. Just prior to the planting of turf, evenly broadcast 15 pounds per thousand square feet of fertilizer, 10-10-10 (nitrogen, phosphorus, potassium). Disc or harrow fertilizer 2 to 4 inches into the soil.

B. Fertilizer shall be delivered to the site in the original unopened container bearing the manufacturer's guarantee analysis. Any fertilizer that becomes caked or damaged making it unsuitable for use, will not be accepted.

2.03 SOD

A. Sod shall be at least 70% Bluegrass, strongly rooted and free of weeds.

B. It shall be mowed to a height not to exceed 3" before lifting, and shall be of uniform thickness with not over 1-1/2" of soil.

2.04 MULCH

A. Mulch for seeded areas shall be Conwed Hydro Mulch, Silva-Fiber, or equal. It shall be suitable for use in a water slurry or for application with hydraulic equipment.

B. Clean straw is acceptable as mulch. It shall be spread at the rate of one (1) bale per 1,000 feet (approximately 2" loose depth).

C. Mulch on slopes greater the 4:1 shall be held in place with erosion control netting.

D. Mulch on areas subject to surface water run-off or in drainage ditches shall be held in place with erosion control netting.

2.05 EROSION CONTROL BLANKETS

A. Erosion Control Blanket shall be made up of biodegradable and/or photodegradable products such as jute, wood fiber, coconut fiber, straw and degradable plastic netting. They shall degrade at a rate of approximately 6 months to 24 months.

B. Erosion Control Blanket shall be installed on slopes greater than 4:1 and in all ditches and drainage channels, and where otherwise directed by regulatory agencies.

2.06 TURF REINFORCEMENT MAT

A. As described in the Specifications, Turf Reinforcement Mat shall be installed for permanent erosion control.

B. Turf Reinforcement Mat shall consist of top and bottom heavy weight netting and biodegradable matrix such as coconut fiber or aspen curled wood excelsior.

C. Where slope and hydraulic conditions are severe, a synthetic matrix may be used, based on manufacturer's recommendations.

2.07 SILT FENCE

A. Temporary Silt Fence shall consist of woven geotextile fabric attached to 2" X 2" X 48" tall hardwood stakes.

1. Fabric shall be 48" tall, with top being even with top of stakes. Bottom 12" shall be buried in trench.

2. Stakes shall be at 6' centers.

B. Temporary Reinforced Silt Fence

1. For areas of steep slopes and high flows, as directed by state or local regulations, Reinforced Silt Fence shall be installed.

2. Fabric shall be woven monofilament geotextile attached to 11 gauge steel fencing of 2" X 4" grid.

3. Stakes shall be 5" tall steel and shall be installed on 4' centers.

4. Fabric and fencing shall be buried in trench.

C. Spacing of Silt Fences on slopes shall be according to the following table, or as directed by state or local regulatory agencies:

		Soil Type	
Slope Angle	Silty	Clays	Sandy
Very Steep (1:1)	50 ft.	75 ft.	100 ft.
Steep (2:1)	75 ft.	100 ft.	125 ft.
Moderate (4:1)	100 ft.	125 ft.	150 ft.
Slight (10:1)	125 ft.	150 ft.	200 ft.

D. If runoff flows along the uphill side of the silt fence, Contractor shall install "J-hooks" every 40 to 80 feet. These are curved sections of silt fence above the continuous fence that serve as small dams to stop and hold the flow to allow sediment to settle.

2.08 FIBER ROLLS

A. On long slopes less than 10:1, and where recommended by the regulatory agency, Fiber Rolls shall be installed.

B. Fiber Rolls shall be made of wood shavings, coconut fiber or other similar material encased in heavy duty netting.

C. Wooden stakes at 4'-0" on center shall be used to anchor the Fiber Rolls along the contours of the slope.

2.09 AGGREGATE SILT CHECKS

A. Where needed to slow flow velocity, to cause ponding or to protect storm water inlet structures, Aggregate Silt Checks shall be installed.

B. Aggregate Silt Checks shall consist of rock of various sizes ranging from 2" to 6" contained in or placed on geotextile filter fabric. Pea-stone or gravel-filled bags are acceptable for temporary silt checks in low-flow conditions.

2.10 RIP RAP

A. Rip Rap shall be installed at the outlets of storm drains and on channel banks as recommended by state and local regulatory agencies.

B. Rip Rap shall have no less than 80%, by volume, of individual stones that range in size from 0.0247 to 1.483 cubic feet.

2.11 CONSTRUCTION ENTRANCE PAD

A. Contractor shall construct entrance pads at all locations where vehicles will enter or exit the site.

B. Pad shall be a minimum of 20 feet wide, 50 feet long and 6" thick, and consist of No. 2 stone laid on top of filter fabric.

PART 3 - EXECUTION

3.01 GENERAL

A. Erosion and sediment control practices shall be consistent with the requirements of the state and local regulatory agencies and in any case shall be adequate to prevent erosion of disturbed and/or regraded areas.

B. Contractor is responsible for notifying the state regulatory agency concerning inclusion under the NPDES General Permit for Storm Water Discharges From Construction Activities.

C. Contractor is responsible for constructing, maintaining, logging, and all reporting as related to erosion control issues.

3.02 SEEDING

A. The areas to be seeded shall be thoroughly tilled to a depth of at least 4" by discing, harrowing, or other approved methods until the condition of the soil is acceptable to the Engineer. After harrowing or discing, the seed bed shall be dragged and/or hand raked to finish grade.

B. The incorporation of the fertilizer and the agricultural lime may be a part of the tillage operation and shall be applied no less than 24 hours nor more than 48 hours before the seed is to be sown.

C. Seed shall be broadcast either by hand or approved sowing equipment at the rate of ninety (90) pounds per acre (two pounds per 1,000 square feet), uniformly distributed over the area. Broadcasting seeding during high winds will not be permitted. The seed shall be drilled or raked into a depth of approximately 2 inch and the seeded areas shall be lightly raked to cover the seed and rolled. Drilling seeding shall be done with approved equipment with drills not more than 3 inches apart. All ridges shall be smoothed out, and all furrows and wheel tracks likely to develop into washes, shall be removed.

D. After the seed has been sown, the areas so seeded shall be mulched with clean straw at the rate of one (1) bale per 1,000 feet (approximately 2 inch loose depth). Mulch on slopes and in all ditches and drainage channels shall be held in place with erosion control blankets.

E. Areas seeded shall be watered and protected until a uniform stand develops, and then inspected periodically and maintained appropriately. Displaced mulch shall be replaced or any damage to the seeded area shall be repaired promptly, both in a manner to cause minimum disturbance to the existing stand of grass. If necessary to obtain a uniform stand, the Contractor shall refertilize, reseed and remulch as needed. Scattered bare spots up to one (1) square yard in size will be allowed up to a maximum of 10 percent of any area.

F. Payment for seeding and mulching shall be included in the Contractor's bid.

3.02 SOD

A. To install, bring soil to final grade and clear of trash, wood, rock, and other debris. Apply topsoil, fertilizer at approximately 1000 lbs per acre.

B. Use sod within 36 hours of cutting. Lay sod in straight lines. Butt joints tightly, but do not overlap joints or stretch sod. Stagger joints in adjacent rows in a brickwork type pattern. Use torn or uneven pieces on the end of the row.

C. Notch into existing grass. Anchor sod with pins or stakes if placed on slopes greater than 3:1. Roll or tamp sod after installation and water immediately. Soak to a depth of 4 to 6 inches. Replace sod that grows poorly. Do not cut or lay sod in extremely wet or cold weather. Do not mow regularly until sod is well established.

3.04 INSTALLATION OF EROSION AND SEDIMENT CONTROL DEVICES

A. All erosion and sediment control products and materials shall be installed per manufacturer's recommendations and in accordance with the Kentucky Erosion Prevention and Sediment Control Field Guide.

C. Contractor shall pay special attention to the trenching-in of the bottoms of silt fence, the staking of sediment barriers, and the stapling of erosion control blankets.

3.05 MAINTENANCE OF EROSION AND SEDIMENT CONTROL DEVICES

A. Erosion and sedimentation controls shall be inspected weekly and after rain events of 0.5 inch or greater. Replace silt fencing as needed, filter stone which is dislodged, erosion control blanket which is damaged, and make other necessary repairs.

B. Remove sediment from fences and barriers when it accumulates to half the height of the barrier, or more often as needed.

3.06 CLEAN UP

A. Upon completion of the project and/or establishment of satisfactory turf, vegetation or permanent erosion control structures, Contractor shall remove all temporary devices and properly dispose of such.

3.07 NPDES GENERAL PERMIT FOR STORM WATER DISCHARGES FROM CONSTRUCTION ACTIVITIES

A. The Contractor is responsible for filing the appropriate Notice of Intent (NOI) letter at least 48 hours prior to start of construction activity. The Notice of Intent (NOI) is a Kentucky Pollution Discharge Elimination System (KPDES) permit application as provided by the Kentucky Revised Statutes, Chapter 224. This application is required to be submitted for construction projects that disturb one or more acres of land. A permit application form is included at the end of this section.

B. The NOI is filed under the General Permit for Storm Water (issued 9/30/92, effective 10/01/92) and labeled as KYR100000 - General Permit for construction sites. The Notice of Intent (NOI) letter requirements are stated along with the mailing address below.

3.08 NOTICE OF INTENT LETTER REQUIREMENTS

A. Concerning storm water permitting, you will be required to submit a letter of Notice of Intent to be covered under the storm water general permit. The following are to be contained in the Notice of Intent letter:

1. Name, mailing address, and location of the facility for which the notification is submitted;

2. Up to four (4) 4-digit SIC codes that best represent the principal products or activities provided by the facility. The following are the typical construction SIC codes utilized:

   1542 - Building Construction, nonresidential, except industrial and warehouses
   1623 - Water Main Construction, Sewer Construction
   1629 - Water and Wastewater Treatment Plant Construction
   1711 - Water Pump Installation
   1781 - Drilling Water Wells

3. The operator's name, address, telephone number, ownership status and status as federal, state, private public or other entity. On construction sites, the facility operator is the Contractor.

4. The name of the receiving water(s), or if the discharge is through a municipal separate storm sewer, the name of the municipal operator of the storm sewer and the ultimate receiving water(s); and

5. Existing quantitative data describing the concentration of pollutants in the storm water discharge. If there is no existing quantitative data, report "no existing quantitative data."

6. Additional requirements for construction activities. The Notice of Intent for a storm water discharge associated with industrial activity from a construction site shall, in addition to the information required above, include a brief description of the project, estimated timetable for major activities, estimates of the number of acres of the site on which soil will be disturbed, and a certification that the storm water pollution prevention plan for the facility provides compliance with state or locally approved sediment and erosion plans, state or locally approved storm water management plan, state or local sewer use ordinances, and state or local septic system requirements.

3.09 WHERE TO SUBMIT

Section Supervisor, Inventory and Data Management Section, KPDES Branch, Kentucky Division of Water, 14 Reilly Road, Frankfort Office Park, Frankfort, Kentucky 40601.

3.10 REQUIRED FOR THIS CONTRACT

A. The Contractor shall prepare the NOI for both the Contractor and the Owner's signature.

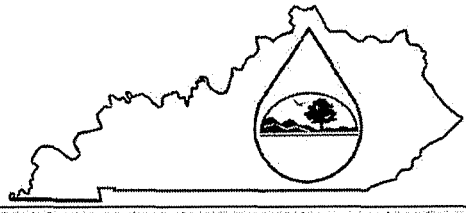
B. The Contractor shall submit the NOI to the Kentucky Division of Water (address noted above) at least forty-eight (48) hours prior to the start of work activities. There is no need to wait on a response from the regulatory agency.

C. This shall occur at or before the Order to Commence Work date given by the Owner.

D. The Contractor shall file a Notice of Termination (NOT) when General Permit coverage is no longer needed (General Permits describe how this is done). An example copy shall be on file as noted in Item 5 above.

E. Contractor is responsible for the construction, maintenance, and removal of all erosion and sedimentation control measures to be in accordance with the state and local regulations.

KPDES FORM NOI-SW



Kentucky Pollutant Discharge Elimination System (KPDES)

Notice of Intent (NOI) for Storm Water Discharges Associated with Industrial Activity Under the KPDES General Permit

Submission of this Notice of Intent constitutes notice that the party identified in Section I of this form intends to be authorized by a KPDES permit issued for storm water discharges associated with industrial activity. Becoming a permittee obligates such discharger to comply with the terms and conditions of the permit.

ALL NECESSARY INFORMATION MUST BE PROVIDED ON THIS FORM (See Instructions on back)

I. Facility Operator Information

Name:		**Phone:**	
Address:		**Status of Owner/Operator:**	
City, State, Zip Code:			

II. Facility/Site Location Information

Name:			
Address:			
City, State, Zip Code:			
County:			
Site Latitude: (degrees/minutes/seconds)		**Site Longitude: (degrees/minutes/seconds)**	

III. Site Activity Information

MS4 Operator Name:							
Receiving Water Body:							
Are there existing quantitative data?	**Yes** ☐ **No** ☐ **If Yes, submit with this form.**						
SIC or Designated Activity Code Primary		**2nd**		**3rd**		**4th**	

If this facility is a member of a Group Application, enter Group Application Number:

If you have other existing KPDES Permits, enter Permit Numbers:

IV. Additional Information Required FOR CONSTRUCTION ACTIVITIES ONLY

Project Start Date:		**Completion Date:**	
Estimated Area to be disturbed (in acres):			
Is the Storm Water Pollution Prevention Plan in Compliance with State and/or Local Sediment and Erosion Plans?	**Yes** ☐ **No** ☐		

V. Certification: I certify under penalty of law that this document and all attachments 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.

Printed or Typed Name:			
Signature:		**Date:**	

Kentucky Pollutant Discharge Elimination System (KPDES)
Instructions
Notice of Intent (NOI) for Storm Water Discharges Associated with Industrial Activity
To Be Covered Under The KPDES General Permit

WHO MUST FILE A NOTICE OF INTENT (NOI) FORM
Federal law at 40 CFR Part 122 prohibits point source discharges of stormwater associated with industrial activity to a water body of the Commonwealth of Kentucky without a Kentucky Pollutant Discharge Elimination System (KPDES) permit. The operator of an industrial activity that has such a storm water discharge must submit a NOI to obtain coverage under the KPDES Storm Water General Permit. If you have questions about whether you need a permit under the KPDES Storm Water program, or if you need information as to whether a particular program is administered by the state agency, call the **Storm Water Contact, Industrial Section, Kentucky Division of Water at (502) 564-3410.**

WHERE TO FILE NOI FORM
NOIs must be sent to the following address:

Section Supervisor
Inventory & Data Management Section
KPDES Branch, Division of Water
Frankfort Office Park
14 Reilly Road
Frankfort, KY 40601

COMPLETING THE FORM
Type or print legibly in the appropriate areas only. If you have any questions regarding the completion of this form call the **Storm Water Contact, Industrial Section, at (502) 564-3410.**

SECTION I - FACILITY OPERATOR INFORMATION
Give the legal name of the person, firm, public organization, or any other entity that operates the facility or site described in this application. The name of the operator may or may not be the same as the name of the facility. The responsible party is the legal entity that controls the facility's operation, rather than the plant or site manager. Do not use a colloquial name. Enter the complete address and telephone number of the operator.

Enter the appropriate letter to indicate the legal status of the operator of the facility.

F = Federal	M = Public (other than federal or state)
S = State	P = Private

SECTION II - FACILITY/SITE LOCATION INFORMATION
Enter the facility's or site's official or legal name and complete street address, including city, state, and ZIP code.

SECTION III - SITE ACTIVITY INFORMATION
If the storm water discharges to a municipal separate storm sewer system (MS4), enter the name of the operator of the MS4 (e.g., municipality name, county name) and the receiving water of the discharge from the MS4. (A MS4 is defined as a conveyance or system of conveyances (including roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, man-made channels, or storm drains) that is owned or operated by a state, city, town, borough, county, parish, district, association, or other public body which is designed or used for collecting or conveying storm water.)

If the facility discharges storm water directly to receiving water(s), enter the name of the receiving water.

Indicate whether or not the owner or operator of the facility has existing quantitative data that represent the characteristics and concentration of pollutants in storm water discharges. If data is available submit with this form.

List, in descending order of significance, up to four 4-digit standard industrial classification (SIC) codes that best describe the principal products or services provided at the facility or site identified in Section II of this application.

If the facility listed in Section II has participated in Part 1 of an approved storm water group application and a group number has been assigned, enter the group application number in the space provided.

If there are other KPDES permits presently issued for the facility or site listed in Section II, list the permit numbers.

SECTION IV - ADDITIONAL INFORMATION REQUIRED FOR CONSTRUCTION ACTIVITIES ONLY
Construction activities must complete Section IV in addition of Sections I through III. Only construction activities need to complete Section IV.

Enter the project start date and the estimated completion date for the entire development plan.

Provide an estimate of the total number of acres of the site on which soil will be disturbed (round to the nearest acre).

Indicate whether the storm water pollution prevention plan for the site is in compliance with approved state and/or local sediment and erosion plans, permits, or storm water management plans.

SECTION V - CERTIFICATION
Federal statutes provide for severe penalties for submitting false information on this application form. Federal regulations require this application to be signed as follows:

For a corporation: by a responsible corporate officer, which means: (i) president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy or decision making functions, or (ii) the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or having gross annual sales or expenditures exceeding $25 million (in second-quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures;

For a partnership or sole proprietorship: by a general partner or the proprietor, or

For a municipality, state, Federal, or other public facility: by either a principal executive officer or ranking elected official.

Revised June 1999

SECTION 02400 - BORING AND JACKING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install all bored and jacked carrier pipes in encasement pipes under railroad and highway crossings as shown on the Drawings and/or specified herein.

1.03 SUBMITTALS

A. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Engineer for review before ordering.

B. At the time of submission, the Contractor shall, in writing, call the Engineer's attention to any deviations that the submittals may have from the requirements of the Contract Drawings and Specifications.

C. Comply with all requirements of Section 01340.

PART 2 - PRODUCTS

2.01 CARRIER PIPE

A. Carrier pipe shall be as specified in the applicable Division 2 section unless otherwise noted.

2.02 CASING PIPE

A. Casing pipe shall be steel, plain end, have a minimum yield point strength of 35,000 psi and conform to ASTM A 252 Grade 2 or ASTM A 139 Grade B without hydrostatic tests. The steel pipe shall have welded joints and be in at least 18 foot lengths. The casing pipe shall be coal tar epoxy coated.

B. The diameter of the casing pipe shall be as follows:

Carrier Pipe Nominal Diameter (inches)	4	6	8	10	12	16	18	24	27	30	36
Casing Pipe Nominal Diameter (inches)	10	12	16	18	20	28	30	36	40	44	50

For carrier pipe sizes greater than 36-inches nominal diameter, the casing pipe diameter size shall be determined by the Engineer or as shown on the Contract Drawings.

C. The wall thickness of the casing pipe shall be as follows:

Casing Pipe Nominal Diameter (inches)	Under 20	20	24	30	33	36	42	48
Casing Pipe Nominal Thickness (inches)	0.250	0.281	0.312	0.406	0.438	0.469	0.562	0.625

However, should casing pipe thickness be specified or required on Highway or Railroad permit approval sheets, said permit thickness requirement shall govern. Permit approval sheets will be made available to the Contractor.

2.03 CASING SPACERS

A. Stainless Steel Casing Spacers: Stainless steel casing spacers shall be bolt-on style with a shell made in two (2) sections of heavy T-304 stainless steel. Connecting flanges shall be ribbed for extra strength. The shell shall be lined with a PVC liner .090" thick with 85-90 durometer. All nuts and bolts are to be 18-8 stainless steel. Runners shall be made of ultra high molecular weight polymer with inherent high abrasion resistance and a low coefficient of friction. Runners shall be supported by risers made of heavy T-304 stainless steel. The supports shall be mig welded to the shell and all welds shall be fully passivated. Stainless steel casing spacers shall be made by Cascade Waterworks Mfg. Co., or equal.

B. Solid Polyethylene Casing Spacers (to be used with PVC pipe only): Solid polyethylene casing spacers shall be bolt-on style with a shell made in two (2) sections. Carrier pipe shall be wrapped with rubber strap inside casing space to prevent slippage. All nuts and bolts are to be 18-8 stainless steel. Solid polyethylene casing spacers shall be made by Calpico Inc., Advance Products & Systems, Inc., or equal.

2.04 CASING END SEALS

A. Wrap-around end seals - Wrap-around end seals shall be made of a waterproof flexible coal tar membrane reinforced with fiberglass, or synthetic rubber. The two exposed edges of the wrap-around seal shall be adhesively bonded forming a watertight seal. The ends of the wrap shall be sealed on the casing and carrier pipe by stainless steel bands. Wrap-around end seals shall be made by Calpico Inc., Advance Products & Systems, Inc., or equal.

PART 3 - EXECUTION

3.01 CROSSINGS - GENERAL

A. Where designated on the drawings, crossings beneath state maintained roads, not to be disturbed shall be accomplished by boring and jacking a casing pipe.

B. Steel casing pipe for crossings shall be bored and/or jacked (or open cut installed where indicated on the Drawings) into place to the elevations shown on the drawings. All joints between lengths shall be solidly butt-welded with a smooth non-obstructing joint inside. The casing pipe shall be installed without bends. The carrier pipe shall be installed after the casing pipe is in place, and shall extend a minimum of two (2) feet beyond each end of the casing to facilitate making joint connections. The carrier shall be braced and centered with casing spacers within the casing pipe to preclude possible flotation. Casing spacers shall be installed a maximum of eight (8) feet apart along the length of the carrier pipe within the casing pipe, within two (2) feet of each side of a pipe joint, and the rest evenly spaced. The height of the supports and runners combined shall be sufficient to keep the carrier pipe at least 0.75" from the casing pipe wall at all times. Manufacturer's recommendations may govern these requirements.

C. At each end of the casing pipe, the carrier pipe shall be sealed with casing end seals. The end seals shall extend a minimum of 12 inches in each direction from the end of the casing pipe.

D. Wood skids are not an acceptable method of supporting the carrier pipe.

E.

3.02 BORING AND JACKING

A. The Contractor shall excavate his own pits, as he may deem necessary, and will set his own line and grade stakes which shall be checked by the Engineer. Permits, as required, will be furnished or obtained by the Owner, but shall be in the Contractor's hands before any excavating is commenced.

B. The boring method shall consist of pushing the pipe into the earth with a boring auger rotating within the pipe to remove the spoil.

1. The boring operation shall be progressed on a 24-hour basis without stoppage (except for adding lengths of pipe) until the leading edge of the pipe has reached the receiving pit.

2. The front of the pipe shall be provided with mechanical arrangements or devices that will positively prevent the auger from leading the pipe so that there will be no unsupported excavation ahead of the pipe.

3. The auger and cutting head arrangement shall be removable from within the pipe in the event an obstruction is encountered. If the obstruction cannot be removed without excavation in advance of the pipe, the pipe shall be abandoned in place and immediately filled with grout.

4. The over-cut by the cutting head shall not exceed the outside diameter of the pipe by more than 2 inch. If voids should develop or if the bored hole diameter is greater than the outside diameter of the pipe by more than approximately 1 inch, grouting or other approved methods must be used to fill such voids.

5. The face of the cutting head shall be arranged to provide a reasonable obstruction to the free flow of soft or poor material.

6. Any method which does not have this boring arrangement will not be permitted. Contractor's boring arrangement plans and methods must be submitted to, and approved by, the Engineer.

C. In the event an obstruction is encountered in boring which cannot be removed and it becomes necessary to withdraw the casing and commence elsewhere, the hole from which the casing is withdrawn shall be completely backfilled with coarse sand rammed in.

D. Insurance to be furnished by the Contractor to cover this type of work shall be adequate to meet the requirements of the Railroad and/or State or County Highway Departments. Insurance shall consist of comprehensive general liability and automobile liability insurance.

E. Before award of the contract, the Contractor shall furnish a statement of his experience of such work, or if inexperienced, shall advise the Owner as to whom he will sublet the work and give a statement of the experience of the subcontractor, which shall be satisfactory to the Owner.

3.03 CONTRACTOR'S RESPONSIBILITIES

A. Attend a preconstruction meeting at the construction site with the City Inspector, Railroad Inspector, Highway Inspector Engineer, and Contractor being present.

SECTION 02508 – HORIZONTAL DIRECTIONAL DRILLING

PART 1-GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to utilize the trenchless technology of horizontal directional drilling (HDD) for the installation of below grade piping and appurtenances as specified herein.

1.02 EXISTING CONDITIONS

A. The existing piping & other utilities shown on the Contract Drawings is based on the best available information. The Engineer makes no guarantee as to the accuracy of the locations or type of piping or utility depicted. All new piping which ties into existing lines must be made compatible with that piping.

B. So that piping conflicts may be avoided, Contractor shall locate the utility (vertically & horizontally) well ahead of the pipe laying operation to confirm exact locations of existing piping before installing any new piping.

C. Contractor shall provide all fittings and adapters necessary to complete all connections to existing piping.

1.04 SUBMITTALS

A. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Engineer for review before ordering. Comply with provisions of Section 01340.

B. At the time of submission, the Contractor shall, in writing, call Engineer's attention to any deviations that the submittals may have from the requirements of the Engineer's Contract Drawings and Specifications.

C. Work Plan - Prior to beginning work, the Contractor must submit to the Engineer a general work plan outlining the procedure and schedule to be used to execute the project. Work Plan should be realistic and document the thoughtful planning required to successfully complete the project.

D. Bore Plan – Prior to beginning the work, the Contractor shall submit a drawing indicating the pilot bore plan.

E. Equipment - Contractor shall submit specifications on directional drilling equipment to be used to ensure that the equipment will be adequate to

complete the project. Specifications for any drilling fluid additives that the Contractor intends to use shall be submitted for review by the Engineer.

1.05 QUALITY ASSURANCE

A. The requirements set forth in this document specify a wide range of procedural precautions necessary to insure that the very 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. Adherence to the specifications contained herein, or the Engineer's approval of any aspect of any directional bore operation covered by this specification, shall in no way relieve the Contractor of their ultimate responsibility for the satisfactory completion of the work authorized under the Contract.

B. Use of horizontal directional drilling for installation piping specified in Division 2 hereinafter shall be in accordance with the most latest revision of ASTM F-1962.

PART 2 – PRODUCTS

2.01 EQUIPMENT

A. The directional drilling equipment shall consist of a directional drilling rig of sufficient capacity to perform the bore and pullback the pipe, a mixing and delivery system for drilling fluid of sufficient capacity to successfully complete the installation, a guidance system to accurately guide boring operations, control and containment of drilling fluid, along with trained and competent personnel to operate the system. All equipment shall be in good, safe operating condition with sufficient supplies, materials and spare parts on hand to maintain the system in good working order for the duration of the project.

2.02 DRILLING SYSTEM

A. Drilling Rig - The directional drilling machine shall consist of a hydraulically powered system to rotate, push and pull hollow drill pipe into the ground at a variable angle while delivering a pressurized fluid mixture to a guidable drill (bore) head. The machine shall be anchored to the ground to withstand the pulling, pushing and rotating pressure required to complete the installation. The hydraulic power system shall be self-contained with sufficient pressure and volume to power drilling operations. Hydraulic system shall be free of leaks. Rig shall have a system to monitor and record maximum pull-back pressure during pull-back operations.

B. Drill Head - The drill head shall be steerable by changing it's rotation and shall provide the necessary cutting surfaces and drilling fluid jets.

C. Mud Motors (if required) - Mud motors shall be of adequate power to turn the required drilling tools.

D. Drill Pipe - Shall be constructed of high quality 4130 seamless tubing, grade D or better, with threaded box and pins. Tool joints should be hardened to 32-36 RC.

2.03 GUIDANCE SYSTEM

A. The Guidance System shall be of a proven type and shall be used to provide a continuous and accurate determination of the location of the drill head during the drilling operation. The guidance system shall be capable of tracking all required depths in any soil condition and rock encountered along the proposed installation route.

B. The guidance system shall be setup and operated by personnel trained and experienced with this system. The Operator shall be aware of any magnetic anomalies and shall consider such influences in the operation of the guidance system if using a magnetic system.

2.04 DRILLING FLUID (MUD) SYSTEM

A. Mixing System - A self-contained, closed, drilling fluid mixing system shall be of sufficient size to mix and deliver drilling fluid composed of bentonite clay, potable water and appropriate additives. Mixing system shall be able to molecularly shear individual bentonite particles from the dry powder to avoid clumping and ensure thorough mixing. The drilling fluid reservoir tank shall be sized for adequate storage of the mud mixture. Mixing system shall continually agitate the drilling fluid during drilling operations.

B. Drilling Fluids - Drilling fluid shall be composed of clean water and an appropriate additive. Water shall be from a clean source with a pH of 8.5 – 10 and/or as per mixing requirements of the Manufacturer. Water of a lower pH or with excessive calcium shall be treated with the appropriate amount of sodium carbonate or equal. The water and additives shall be mixed thoroughly and be absent of any clumps or clods. No hazardous additives may be used. Drilling fluid shall be maintained at a viscosity sufficient to suspend cuttings and maintain the integrity of bore wall.

C. Delivery System - The mud pumping system shall have a minimum capacity to supply mud in accordance with the drilling equipment pull-back rating at a constant required pressure. The delivery system shall have filters in-line to prevent solids from being pumped into the drill pipe. Connections between the pump and drill pipe shall be relatively leak-free. Used drilling fluid and drilling fluid spilled during drilling operations shall be contained and properly disposed of. A berm, minimum of 12" high,

shall be maintained around drill rigs, drilling fluid mixing system, entry and exit pits and drilling fluid recycling system (if used) to prevent spills into the surrounding environment. Pumps and or vacuum truck(s) of sufficient size shall be in place to convey excess drilling fluid from containment areas to storage facilities.

2.05 OTHER EQUIPMENT

A. Pipe Rollers - Pipe rollers, if required, shall be of sufficient size to fully support the weight of the pipe while being hydro-tested and during pull-back operations. Sufficient number of rollers shall used to prevent excess sagging of pipe.

B. Pipe Rammers - Hydraulic or pneumatic pipe rammers may only be used if necessary and with the authorization of Engineer.

C. 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 the Engineer prior to commencement of the work. Consideration for approval will be made on an individual basis for each specified location. The proposed device or system will be evaluated prior to approval or rejection on its potential ability to complete the utility placement satisfactorily without undue stoppage and to maintain line and grade within the tolerances prescribed by the particular conditions of the project.

PART 3 -EXECUTION

3.01 GENERAL

A. The Engineer must be notified 48 hours in advance of starting work. The Engineer's approval for beginning the installation shall in no way relieve the Contractor 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 inspection personnel at such times as appropriate.

B. The Contractor shall be fully responsible for all damages resulting from his failure to comply with all applicable state, federal and local regulations, and requirements of these specifications.

3.03 DRILLING PROCEDURE

A. Site Preparation - Prior to any alterations to work-site, contractor shall photograph or video tape entire work area, including entry and exit points. One copy shall be given to the Engineer and one copy to remain with contractor for a period of one year following the completion of the project. Work site as indicated on drawings, within right-of-way, shall be graded or

filled to provide a level working area. No alterations beyond what is required for operations are to be made. Contractor shall confine all activities to designated work areas.

B. Drill Path Survey - Entire drill path shall be accurately surveyed with entry and exit stakes placed in the appropriate locations within the areas indicated on drawings. If contractor is using a magnetic guidance system, drill path will be surveyed for any surface geomagnetic variations or anomalies.

C. Environmental Protection -- Contractor shall have in place silt fence between all drilling operations and any drainage, wetland, waterway or other area designated for such protection by contract documents, state, federal and local regulations. Additional environmental protection necessary to contain any hydraulic or drilling fluid spills shall be put in place, including berms, liners, turbidity curtains and other measures. Contractor shall adhere to all applicable environmental regulations. Also, all erosion control facilities shall be in accordance with Specification Section 02371, hereinafter, and the standard detail drawing for erosion control included in the contract drawings.

D. Safety - Contractor shall adhere to all applicable state, federal and local safety regulations and all operations shall be conducted in a safe manner. Safety meetings shall be conducted at least weekly with a written record of attendance and topic submitted to Engineer.

E. Pipe Joining shall be as required in the Division 2 piping specification, hereinafter. Pipe will be placed on pipe rollers before pulling into bore hole with rollers spaced close enough to prevent excessive sagging of pipe.

F. Pilot Hole - Pilot hole shall be drilled on bore path with no deviations greater than 5% of depth over a length of 100'. In the event that pilot does deviate from bore path more than 5% of depth in 100', contractor will notify Engineer and Engineer may require contractor to pull-back and re-drill from the location along bore path before the deviation. In the event that a drilling fluid fracture, inadvertent returns or returns loss occurs during pilot hole drilling operations, contractor shall cease drilling, wait at least 30 minutes, inject a quantity of drilling fluid with a viscosity exceeding 120 seconds as measured by a March funnel and then wait another 30 minutes. If mud fracture or returns loss continues, contractor will cease operations and notify Engineer. Engineer and contractor will discuss additional options and work will then proceed accordingly.

G. Reaming - Upon successful completion of pilot hole, contractor will ream bore hole to a minimum of 25% greater than outside diameter of pipe using the appropriate tools. Contractor will not attempt to ream at one time more than the drilling equipment and mud system are designed to safely handle.

H. Pull-Back - After successfully reaming bore hole to the required diameter, contractor will pull the pipe through the bore hole. In front of the pipe will be a swivel. Once pullback operations have commenced, operations must continue without interruption until pipe is completely pulled into bore hole. During pull-back operations contractor will not apply more than the maximum safe pipe pull pressure at any time. In the event that pipe becomes stuck, contractor will cease pulling operations to allow any potential hydro-lock to subside and will commence pulling operations. If pipe remains stuck, contractor will notify Engineer. Engineer and contractor will discuss options and then work will proceed accordingly.

3.04 PIPE TESTING

A. All pipe testing shall be as required in the Division 2 piping specification, hereinafter.

3.05 SITE RESTORATION

A. Following drilling operations, contractor will de-mobilize equipment and restore the worksite to original condition. All excavations will be backfilled and compacted to 95% of original density. Landscaping will be restored to original. All mud shall be disposed of by the CONTRACTOR.

SECTION 02510 - WATER DISTRIBUTION PIPING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required for furnishing and installing all piping and appurtenances specified herein.

1.02 SUBMITTALS

A. A notarized certification shall be furnished for all pipe and fittings that verifies compliance with all applicable specifications.

B. The requirement for this certification does not eliminate the need for shop drawings submittals in compliance with Section 01340.

1.03 EXISTING CONDITIONS

A. The existing piping shown on the Contract Drawings is based on the best available information. The Engineer makes no guarantee as to the accuracy of the locations or type of piping depicted. All new piping which ties into existing lines must be made compatible with that piping.

B. So that piping conflicts may be avoided, Contractor shall open up his trench well ahead of the pipe laying operation to confirm exact locations of existing piping before installing any new piping.

C. Contractor shall provide all fittings and adapters necessary to complete all connections to existing piping.

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE AND FITTINGS

A. Ductile iron pipe shall conform to ANSI/AWWA C151/A21.51, latest revision, pressure class 350, with push-on joints unless otherwise noted on Drawings.

B. The interior of the pipe shall be cement-mortar lined with bituminous seal coat in accordance with ANSI/AWWA C104/A21.4, latest revision. Thickness of the lining shall be as set forth in the ANSI/AWWA C104/A21.4 specification unless otherwise directed by the Engineer. The exterior of all pipe, unless otherwise specified, shall receive either coal tar or asphalt base coating a minimum of 1 mil thick.

C. Each piece of pipe shall bear the manufacturer's name or trademark, the year in which it was produced and the letters "DI" or the word "DUCTILE". Pipe manufacturer shall furnish notarized certificate of compliance to the above AWWA or ANSI specifications.

D. Fittings shall be pressure class 350 ductile iron and have mechanical-joints or push-on joints in accordance with ANSI/AWWA C110/A21.10, latest revision and shall conform to the details and dimensions shown therein. Fittings shall have interior cement-mortar lining as specified hereinbefore for the pipe. Compact ductile iron fittings meeting the requirements of ANSI/AWWA C153/A21.53, latest revision, will also be acceptable.

E. Joints for ductile iron pipe and fittings, as described hereinbefore, shall be rubber-gasket joints and be in accordance with ANSI/AWWA C111/A21.11, latest revision. Joints shall have the same pressure rating as the pipe or fitting of which they are a part. Joints shall be installed per the manufacturer's recommendations.

F. Provide ANSI/AWWA C110/A21.10 mechanical joint plugs and locked or restrained pipe joints where indicated on Drawings. Fittings under structures shall be mechanical joint with retainer glands.

2.02 RESTRAINED JOINT DUCTILE IRON PIPE

A. Restrained joint ductile iron pipe shall conform to ANSI/AWWA C151/A21.51, latest revision, pressure class 350, with restrained push-on joints unless otherwise noted on Drawings.

B. The interior of the pipe shall be cement-mortar lined with bituminous seal coat in accordance with ANSI/AWWA C104/A21.4, latest revision. Thickness of the lining shall be set forth in the aforementioned specification unless otherwise directed by the Engineer. The exterior of all pipe, unless otherwise specified, shall receive either coal tar or asphalt base coating a minimum of 1 mil thick.

C. Each piece of pipe shall bear the manufacturer's name or trademark, the year in which it was produced and the letters "DI" or the word "DUCTILE". Pipe manufacturer shall furnish notarized certificate of compliance to the above AWWA or ANSI specifications.

D. Fittings shall be pressure class 350 ductile iron and have restrained push-on joints in accordance with ANSI/AWWA C110/A21.10, latest revision with the exception of the manufacturer's proprietary design dimensions. Fittings shall have interior cement-mortar lining as specified hereinbefore for the pipe. Compact ductile iron fittings meeting the requirements of ANSI/AWWA C153/A21.53, latest revision, will also be acceptable.

E. The use of restrained joints utilizing a friction type connection shall **not** be accepted.

F. Joints for ductile iron pipe and fittings, as described hereinbefore, shall be rubber-gasket joints and be in accordance with ANSI/AWWA C111/A21.11, latest revision. Joints shall have the same pressure rating as the pipe of fitting of which they are a part. Joints shall be installed per the manufacturers recommendations.

G. All pipe in the vicinity of a series of bends shall have restrained push-on joints, with lengths as recommended by the Engineer or pipe manufacturer. Pipe at ends left for future connections shall also have restrained push-on joints. All other tees, bends, and dead-ends shall have concrete thrust blocking.

H. Restrained joint pipe and fittings shall be FLEX-RING Restrained Joint by American Ductile Iron Pipe, TR FLEX Restrained Joint by U.S. Pipe, SUPER-LOCK Restrained Joint by Clow Water Systems, SNAP-LOCK Restrained Joint by Griffin Pipe, or approved equal.

I. Restrained push-on joint pipe and fittings shall be capable of being deflected after assembly.

J. All restrained joint pipe and fittings shall be fabricated by the same pipe manufacturer.

K. Where spigot end of restrained joint pipe connect with valves or other items that have mechanical-joint ends, connection shall be made with a restrained mechanical-joint gland. Restrained mechanical-joint connection shall be Mechanical- Joint Coupled-Joint by American Ductile Iron Pipe, MECH-LOK Restrained Joint by Griffin Pipe, or approved equal.

2.03 POLYVINYL CHLORIDE PLASTIC (PVC) PIPE

A. AWWA C-900 and C905 (Outside Diameter compatible with Cast Iron O.D.)

1. 4-inch through 12-inch - PVC plastic pipe shall conform to ANSI/AWWA C-900, Class 200. PVC pipe shall have a maximum laying length of 20 feet, with bell end and elastomeric gasket, and with plain end for cast-iron or ductile-iron fittings. Elastomeric gasket shall conform with the requirements of ASTM F-477. The seal of the National Sanitation Foundation Testing Laboratory must appear on each pipe.

B. ASTM D2241 (Outside Diameter compatible with Iron Pipe O.D.)

1. 1-inch through 36-inch - PVC plastic pipe shall conform to ASTM Specification - D2241 (latest edition); Product Standards PS-22-70 NBS; Standard Dimension Ratio SDR 21 (200 psi); Maximum Length - 20 feet; Pressure Rating - 200 psi at 73.4° F. (SDR-21). Elastomeric gasket shall conform with the requirements of ASTM F-477. The seal of the National Sanitation Foundation Testing Laboratory must appear on each pipe.

a. Fittings, adaptors or specials shall be furnished, as required, to connect the plastic pipe to the cast or ductile iron mechanical joint valves, fittings, and pipe.

b. Joints shall be push-on joints conforming to ASTM D-3139.

C. Fittings shall be pressure class 350 ductile iron and have mechanical-joints or push-on joints in accordance with ANSI/AWWA C110/A21.10, latest revision, and shall conform to the details and dimensions shown therein. Fittings shall have interior cement-mortar lining as specified hereinbefore for the pipe. Compact ductile iron fittings meeting the requirements of ANSI/AWWA C153/A21.53, latest revision, will also be acceptable. All fittings shall be assembled using "Mega Lug" type Positive Restraint Devices.

D. The basis of acceptance of PVC plastic water main pipe will be a written, notarized certification, accompanied by a copy of test results, that the pipe and pipe material has been sampled, tested and inspected in accordance with the designated standard specifications. These certifications shall be obtained from the manufacturer and delivered to the Engineer's or Owner's representative on the project site. A sufficient number of tests and certifications shall be made so as to be representative of the complete project. Copies of the test results shall be kept on file by the manufacturer and shall be available for review by the Engineer or Owner upon request.

E. Pipe shall be visually inspected on the project site for proper markings which shall include manufacturer's name or trademark, nominal pipe size, pressure rating for water at 73.4 degrees F., plastic pipe material designation code (e.g. PVC 1120), dimension ratio, AWWA or ASTM designation and pressure class with which the pipe complies, and the National Sanitation Foundation NSF 14 Seal of Approval for drinking water.

F. Pipe Jointing:

1. Pipe to be joined by leakproof , thermal, butt fusion joints. All fusion must be done by personnel trained by the pipe supplier using tools approved by the pipe supplier.

2. The fusion machine shall have hydraulic pressure control for fusing 2 pipe ends together; it shall include pressure fusion indicating gauges to correctly monitor fusion pressures. The machines correctly monitor fusion pressures. The machines shall be equipped with an electric or gasoline engine powered facing unit to trim irregularities from the pipe ends. The heating plate on the fusion machine shall be electrically heated and thermostatically controlled and shall contain a temperature gauge for monitoring temperature.

3. Joint strength must be equal to that of adjacent pipe as demonstrated by tensile test. In addition, results of tensile impact testing of joint should indicate a ductile rather than a brittle fracture. External appearance of fusion bead should be smooth without significant juncture groove.

4. Threaded or solvent cement joints and connections are not permitted.

G. Joining, Terminating or Adapting by Mechanical Means:

1. The polyethylene pipe shall be connected to systems or fittings of other materials by means of an assembly consisting of a polyethylene flange adapter butt-fused to the pipe, a backup ring of either cast iron, steel, or high silica aluminum alloy made to ANSI B-16.1 dimensional standards (with modified pressure ratings), bolts of compatible material (insulated from the fittings where necessary) and a gasket of reinforced black rubber, or other material approved by the Engineer, cut to fit the joint. In all cases, the bolts shall be drawing up evenly and in line.

2. Termination of valves, or fittings such as tees, bonds, etc., made of other materials shall be by the flange assemblies specified hereinbefore. The pipe adjacent to these joints and to joints themselves must be rigidly supported for a distance of one pipe diameter or 1 foot, whichever is greater, beyond the flange assembly.

3. Appurtenances must be placed on their own foundations, unsupported by the pipe, in accordance with the detail plans.

H. Tools and Procedures:

1. Fusion jointing and other procedures necessary for correct assembly of the polyethylene pipe and fittings will be done only by personnel trained in those skills by the pipe supplier.

2. Only those tools designed for aforementioned procedures and approved by the pipe supplier shall be used for assembly of pipe and fittings to insure proper installation.

2.05 COUPLING AND ADAPTORS

A. Flexible couplings shall be of the sleeve type with a middle ring, two wedge shaped resilient gaskets at each end, two follower rings, and a set of steel trackhead bolts. The middle ring shall be flared at each end to receive the wedge portion of the gaskets. The follower rings shall confine the outer ends of the gaskets, and tightening of the bolts shall cause the follower rings to compress the gaskets against the pipe surface, forming a leak-proof seal. Flexible couplings shall be steel with minimum wall thickness of the middle ring or sleeve installed on pipe being 5/16-inch for pipe smaller than 10 inches, 3/8-inch for pipe 10 inches or larger. The minimum length of the middle ring shall be 5-inches for pipe sizes up to 10 inches and 7 inches for pipe 10 inches to 30 inches. The pipe stop shall be removed. Gaskets shall be suitable for 250 psi pressure rating or at rated working pressure of the connecting pipe. Couplings shall be harnessed and be designed for 250 psi.

B. Flanged adapters shall have one end suitable for bolting to a pipe flange and the other end of flexible coupling similar to that described hereinbefore. All pressure piping with couplings or adapters shall be harnessed with full threaded rods spanning across the couplings or adapters. The adapters shall be furnished with bolts of an approved corrosion resistant steel alloy, extending to the adjacent pipe flanges. Flanges on flanged adapter (unless otherwise indicated or required) shall be faced and drilled ANSI B16.1 Class 125.

C. Flexible couplings and flanged adapters shall be as manufactured by Dresser, Rockwell, or equal, per the following, unless otherwise specified and/or noted on the Drawings:

D. Steel couplings for joining same size, plain-end, steel, cast iron, and PVC plastic pipe -

Dresser	Rockwell
Style 138	4ll

E. Transition couplings for joining pipe of different outside diameters-

Dresser	Rockwell
Style 162 (4"-12")	413 steel (2"-24")
Style 62 (2"-24")	415 steel (6"-48")
	433 cast (2"-16")

435 cast (2"-12")

F. Flanged adapters for joining plain-end pipe to flanged pipe, fittings, valves and equipment.

Dresser	Rockwell
Style 127 cast (3"-12")	912 cast (3"-12")
Style 128 steel (3"-48" C.I. Pipe)	913 steel (3" and larger)
Style 128 steel (2"-96" steel pipe)	

2.06 DETECTABLE UNDERGROUND WIRE

A. Detectable underground wire which can be located from the surface by a pipe detector shall be installed directly below all pipe.

B. The wire shall be 12 gage.

C. The wire shall be brought to the surface and connected to a ground rod installed in each concrete pad at each valve location.

D. Payment for the wire shall be included in the linear foot price bid of the appropriate bid item(s).

2.07 CONCRETE PIPE ANCHORS, THRUST BLOCKS, CRADLE OR ENCASEMENT

A. Where indicated on the Drawings, required by the Specifications or as directed by the Engineer, concrete pipe anchors, thrust blocks, cradles or encasements shall be installed.

B. Concrete shall be 3000 psi, and reinforcing bars shall be as installed as indicated on the details.

2.08 PRE-FABRICATED TRENCH BAFFLES

A. Where indicated on the Drawings, required by the Specifications, or as directed by the Engineer, Contractor shall install pre-fabricated trench baffles in the pipeline trench.

B. The baffle shall be self-supporting, made of ABS (Acryonitrile Butadiene Styrene) or comparable material, and shall provide a watertight seal around the pipe by use of an elastomeric PVC flexible coupling. The purpose of the baffle is to stop the flow of groundwater along the trench, and around the pipe. The trench baffle shall be ARipley=s Dam@ as manufactured by EJP, or equal.

2.09 CONNECTION OF NEW WATER MAINS TO EXISTING SYSTEM

A. The Contractor shall connect the new water main to existing water main where shown on the Drawings or directed by the Engineer, and shall furnish all necessary equipment and materials required to complete the connection. **No new connections shall be made until after new lines have passed all required testing.**

PART 3 - EXECUTION

3.01 EXCAVATION FOR PIPELINE TRENCHES

A. Unless otherwise directed by the Engineer, trenches in which pipes are to be laid shall be excavated in open cut to the depths required by field conditions or as specified by the Engineer. In general this shall be interpreted to mean that machine excavation in earth shall not extend below an elevation permitting the pipe to be properly bedded. Installation shall be in accordance with ANSI/AWWA C600 for ductile iron and Cast Iron O.D. (AWWA) PVC pipe or ASTM F-645 for Iron Pipe O.D. (ASTM) PVC pipe except as modified herein.

B. If the foundation is good firm earth and the machine excavation has been accomplished as set out hereinbefore, the remainder of the material shall be excavated by hand, then the earth pared or molded to give full support to the lower quadrant of the barrel of each pipe. Where bell and spigot is involved, bell holes shall be excavated during this latter operation to prevent the bells from being supported on undisturbed earth. If for any reason the machine excavation in earth is carried below an excavation that will permit the type of bedding specified above, then a layer of granular material shall be placed so that the lower quadrant of the pipe will be securely bedded in compact granular fill.

C. Excavation may be undercut to a depth below the required invert elevation that will permit laying the pipe in a bed of granular material to provide continuous support for the bottom quadrant of the pipe. When this method is used, the bedding shall be as set out in Paragraph 3.02 hereinafter.

D. Trenches shall be of sufficient width to provide free working space on each side of the pipe and to permit proper backfilling around the pipe, but unless specifically authorized by the Engineer, trenches shall in no case be excavated or permitted to become wider then 2'-0" plus the nominal diameter of the pipe at the level of or below the top of the pipe. If the trench does become wider than 2'-0" at the level of or below the top of the pipe, special precaution may be necessary, such as providing compacted, granular fill up to top of the pipe or providing pipe with additional crushing strength as determined by the Engineer after taking into account the actual trench loads that may result and the strength of the pipe being used. The Contractor shall bear the cost of such special precautions as are necessary.

E. All excavated materials shall be placed a minimum of two feet (2') back from the edge of the trench.

F. Before laying the pipe, the trench shall be opened far enough ahead to reveal obstructions that may necessitate changing the line or grade of the pipeline.

G. The trench shall be straight and uniform so as to permit laying pipe to lines and grades given by the Engineer. It shall be kept free of water during the laying of the pipe and until the pipeline has been backfilled. Removal of trench water shall be at the Contractor's expense. Dry conditions shall be maintained in the excavations until the backfill has been placed. During the excavation, the grade shall be maintained so that it will freely drain and prevent surface water from entering the excavation at all times. When directed by Owner, temporary

drainage ditches shall be installed to intercept or direct surface water which may affect work. All water shall be pumped or drained from the excavation and disposed of in a suitable manner without damage to adjacent property or to other work.

H. Minimum cover of 30" shall be provided for all pipelines. Measurement is from top of pipe to ground surface.

3.02 PIPE BEDDING

A. All pipe shall be supported on a bed of granular material, unless the trench has been prepared in accordance with Paragraph 3.01B. In no case shall pipe be supported directly on rock. Bedding shall not be a separate pay item unless otherwise set out in the Detailed Specifications. Bedding shall be provided in earth bottom trenches, as well as rock bottom trenches where an improved surface is anticipated. Bedding material shall be free from large rock, foreign material, frozen earth, and shall be acceptable to the Engineer. Bedding shall be a minimum of 6" below pipe barrel.

B. In all cases the foundation for pipes shall be prepared so that the entire load of the backfill on top of the pipe will be carried on the barrel of the pipe so that none of the load will be carried on the bells.

C. Where flexible pipe is used, the bedding shall be placed up to at least the spring line (horizontal center line) of the pipe. The bedding material and procedures shall conform to ASTM D 2321 and any Technical Specifications set out hereinafter. If conditions warrant, the Engineer may require the bedding to be placed above the springline of the pipe. Granular bedding shall be Size #9-m or ASTM C 33, Size #7 crushed stone, fine gravel, or sand, and is not a separate pay item.

D. Where undercutting and granular bedding is involved it shall be of such depth that the bottom of the bells of the pipe will be at least three inches above the bottom of the trench as excavated. Undercutting is not a separate pay item.

E. In wet, yielding mucky locations where pipe is in danger of sinking below grade or floating out of line or grade, or where backfill materials are of such a fluid nature that such movements of the pipe might take place during the placing of the backfill, the pipe must be weighted or secured permanently in place by such means as will prove effective. When ordered by the Engineer, yielding and mucky materials in subgrades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe.

F. Installation shall be in accordance with ASTM D 2321 except as modified hereinafter.

3.03 LAYING PIPE

A. The laying of pipe in finished trenches shall be commenced at the lowest point so the spigot ends point in the direction of flow.

B. All pipes shall be laid with ends abutting and true to line and grade as given by the Engineer. Supporting of pipes shall be as set out hereinbefore under "Pipe Bedding" and in no case shall the supporting of pipes on blocks be permitted.

C. Before each piece of pipe is lowered into the trench, it shall be thoroughly inspected to insure that it is clean. Each piece of pipe shall be lowered separately unless special permission is given otherwise by the Engineer. No piece of pipe or fitting which is known to be defective shall be laid or placed in the lines. If any defective pipe or fitting shall be discovered after the pipe is laid, it shall be removed and replaced with a satisfactory pipe or fitting without additional charge. In case a length of pipe is cut to fit in a line it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe.

D. Pipe shall not be laid on solid rock. A pad of granular material (#9 crushed stone) shall be used as a pipe bedding. Pipe bedding is not a separate pay item. Irregularities in subgrade in an earth trench shall be corrected by use of granular material.

E. When ordered by the Engineer, unsuitable materials in subgrades shall be removed below ordinary trench depth in order to prepare a proper bed for the pipe.

F. When laying of pipe is stopped for any reason, the exposed end of such pipe shall be closed with a plywood or fabricated plug fitted into the pipe bell, so as to exclude earth or other material, and precautions taken to prevent flotation of pipe by runoff into trench.

G. No backfilling (except for securing pipe in place) over pipe will be allowed until the Resident Engineer has had an opportunity to make an inspection of the joints, alignment and grade, in the section laid.

3.04 BACKFILLING PIPELINE TRENCHES

A. Backfilling of pipeline trenches shall be accomplished as shown on the Drawings and with details set forth hereinafter. Before final acceptance, the Contractor will be required to level off all trenches or to bring the trench up to grade. The Contractor shall also remove from roadways, rights-of-way and/or private property all excess earth or other materials resulting from construction. In the event that pavement is not placed immediately following trench backfilling in paved areas, the Contractor shall be responsible for maintaining the trench surface in a level condition at proper pavement grade at all times. Under pavement or gravel drives, all trench backfill shall be in accordance with Method B as shown on the Detail Drawings. All other trench backfill shall be in accordance with Method A.

B. Method "A" - Backfilling in Open Terrain in Soil (Unimproved Surfaces):

Backfilling of pipeline trenches in open terrain shall be accomplished in the following manner:

1. The lower portion of the trench, from the bottom of the pipe to a point 12" above the top of the pipe, shall be backfilled with material free from rock

and/or material acceptable to the Engineer. This material shall be placed in a manner approved by the Engineer, and shall be carefully compacted to avoid displacement of the pipe. Compaction shall be accomplished by hand-tamping or by approved mechanical methods.

2. The upper portion of the trench above the compacted portion shall be backfilled with material which is free from large rock. Incorporation of rock having a volume exceeding one-half cubic foot is prohibited. Backfilling this portion of the trench may be accomplished by any means approved by the Engineer. The trench backfill shall be heaped over or leveled as directed by the Engineer.

C. Method "B" - Backfilling Under Streets, Roads, Sidewalks, Paved and Unpaved Driveways (Improved Surfaces):

Backfilling of pipeline trenches under streets, roads and paved driveways shall be accomplished in the following manner:

1. The lower portion of the trench from the pipe bedding to a point 6" below the bottom of the pavement or concrete sub-slab, shall be backfilled with # 9 crushed stone.

2. The upper portion of the trench, from a point 8" below the bottom of the pavement or concrete sub-slab to grade, shall be backfilled with a base course of dense graded aggregate. At such time that pavement replacement is accomplished, the excess base course shall be removed as required.

D. Trenches outside existing sidewalks, driveways, streets, and highways shall be backfilled in accordance with Method "A". Trenches within the limits of sidewalk and unpaved driveways shall be backfilled in accordance with Method "B". Trenches within the paving limits of existing streets, highways and driveways shall be backfilled in accordance with Method "B". Both methods are shown on the Detail Drawings. When directed by the Engineer, the Contractor shall wet backfill material to assure maximum compaction.

Before final acceptance, the Contractor will be required to level off all trenches or to bring the trench up to grade. The Contractor shall also remove from roadways, rights-of-ways and/or private property all excess earth or other materials resulting from construction.

In the event that pavement is not placed immediately following trench backfilling in streets and highways, the Contractor shall be responsible for maintaining the trench surface in a level condition at proper pavement grade at all times.

3.05 SETTLEMENT OF TRENCHES

A. Whenever lines are in, or cross, driveways and streets, the Contractor shall be responsible for any trench settlement which occurs within these rights-of-way within one (1) year from the time of final acceptance of the work. If paving shall require replacement because of trench settlement within this time, it shall be replaced by the Contractor at no extra cost to the Owner. Repair of settlement damage shall meet the approval of the Owner.

3.06 CONCRETE THRUST BLOCKS, CRADLE, ANCHORS OR ENCASEMENT

A. Concrete thrust blocks, cradle, anchors or encasement shall be placed where shown on the Drawings, required by the Specifications, or as directed by the Engineer.

B. For cradle and encasement, concrete shall be 3000 psi and shall be mixed sufficiently wet to permit it to flow under the pipe to form a continuous bed.

C. For thrust blocks and anchors, concrete shall be 3000 psi, and shall be formed or be sufficiently stiff to maintain the forms indicated on the Details.

D. In tamping concrete, care shall be taken not to disturb the grade or line of the pipe or injure the joints. Concrete placed outside the specified limits or without authorization from the Engineer will not be subject to payment.

E. Water mains shall have concrete thrust or Akicker blocks at all pipe intersections and changes of direction to resist forces acting on the pipeline. All reducers (increasers) shall be anchored.

3.07 BITUMINOUS CONCRETE HIGHWAY, STREET AND DRIVEWAY REPLACEMENT

A. The Contractor shall replace those sections of existing roads, streets and driveways required to be removed to install the pipe lines under this contract. He shall construct same to the original lines and grades and in such manner as to leave all such surfaces in fully as good or better condition than that which existed prior to the operations.

B. Prior to trenching, the pavement shall be scored or cut to straight edges at least twelve (12) inches outside each edge of the proposed trench to avoid unnecessary damage to the remainder of the paving. Edges of the existing pavement shall be re-cut and trimmed to square, straight edges after the pipeline has been installed and prior to placing the new base and pavement.

C. Backfilling of the trench shall be in accordance with Method "B" as described hereinbefore. Base course for the paving shall be dense graded crushed limestone furnished and placed in accordance with the current requirements of the Standard Specifications for Road and Bridge Construction of the Department of Transportation, to a depth of six (6) inches in roads and streets and four (4) inches in driveways.

D. A subslab of reinforced concrete shall be placed for state maintained highways as indicated on the Drawings. The subslab shall have a minimum thickness of 6 inches. Concrete for the subslab shall be 2500 psi, in accordance with the Details shown on the Drawings.

3.08 UNPAVED DRIVEWAY (CRUSHED STONE) SURFACE REPLACEMENT

A. The Contractor shall replace those sections of existing driveways and parking areas required to be removed to install the pipe lines under this contract. He shall construct same to the original lines and grades and in such manner as to

leave all such surfaces in fully as good or better condition than that which existed prior to the operations.

B. Material for backfilling of the pipeline trench shall be dense-graded aggregate in accordance with Method B as described hereinbefore.

3.09 REMOVING AND REPLACING CONCRETE CURB AND GUTTER OR SIDEWALK

A. The Contractor shall remove the curb and gutter or sidewalk when encountered when required for laying the pipe. Only that portion of the curb and gutter or sidewalk needed to lay the pipe shall be removed.

B. Where concrete curb and gutter or sidewalk is removed or disturbed during the construction work, it shall be replaced, using 3000 psi concrete, in fully as good or better condition than that which existed prior to the Contractor's operation.

3.10 REPLACEMENT OF EXISTING MAIL BOXES, CULVERTS, CLOTHES LINE POSTS, FENCES AND OTHER SUCH FACILITIES

A. Existing mail boxes, drainage culverts, clothes line posts, fences and the like shall not be damaged or disturbed unless necessary, in which case, they shall be replaced in as good condition as found as quickly as possible. Existing materials shall be reused in replacing such facilities when materials have not been damaged by the Contractor's operations. Existing facilities damaged by Contractor's operation shall be replaced with new materials of the same type at the Contractor's expense. Work in this category is not a pay item.

B. Replacement of paved drainage ditches within highway right-of-way shall be accomplished in accordance with Department of Transportation specifications.

3.11 PORTLAND CEMENT CONCRETE DRIVEWAY REPLACEMENT

A. Wherever Portland cement concrete driveways are removed, they shall be reconstructed to the original lines and grades and in such manner as to leave all such surfaces in fully as good or better condition than existed prior to the operation.

B. The existing concrete paving shall be sawed or cut to straight edges 12-inches outside the edges of the trench or broken out to an existing joint, as directed by the Engineer. The concrete pavement shall be equal to the existing pavement thickness but not less than 6-inches in thickness for driveways.

C. Pavement shall be reinforced with 6 x 6 #10-10 wire mesh and shall be constructed with 3000 psi concrete.

3.12 RIP-RAP STREAM BANK SLOPE PROTECTION

A. The Contractor shall install rip-rap stream bank slope protection at locations directed by the Engineer. Rip-rap slope protection shall be 12-inches thick and shall meet State D.O.T. Standard Specifications for Class III Rip Rap.

3.13 TESTING

A. All pressure piping (lines not laid to grade) shall be given a hydrostatic test to the rated pressure of the pipe, under which leakage shall not exceed 10 psi in a 24 hour period, 5 psi in a 10 hour period or, 0 psi in a 4 hour period.

B. Contractor shall furnish a recording gauge and water meter for measuring water used during leakage test and recording pressure charts during duration of test. Recording pressure charts shall be turned over to the Engineer at conclusion of tests. The pressure recording device shall be suitable for outside service, with a range from 0-200 psig, 24- hour spring wound clock, designed for 4" or 9 " charts, and shall be approved by the Engineer. For Contractor's information only, such pressure recording devices may be available from the Foxboro Company, Foxboro, Massachusetts; Bristol Division of ACCO, Waterbury, Connecticut; or Weksler Instruments Corporation, Freeport, New York.

C. Duration of test shall be not less than 24 hours where joints are covered.

D. Where leaks are visible at exposed joints and/or evident on the surface where joints are covered, the joints shall be laid and leakage must be minimized, regardless of total leakage as shown by test.

E. All pipe, fittings, valves, and other materials found to be defective under test shall be removed and replaced at no additional expense to the Owner.

F. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with. The owner will provide the engineer for the first test, if any additional test day is required due to failure to pass or contractors not ready, then the contractor will pay for any additional time at the engineers' hourly rate.

G. The Owner will provide initial water for testing the pressure piping. Should the first test fail to pass, all additional water required for subsequent tests shall be furnished at the Contractor's expense.

H. The cost of testing of pressure piping is incidental and is to be included in the Contractor's unit Contract Price.

I. **No line may be connected or put into service until it has passed all tests.**

J. Contractor must give the engineer 10 days' notice prior to testing and the engineer must be present for testing.

3.14 CLEAN UP

A. Upon completion of installation of the piping and appurtenances, the Contractor shall remove all debris and surplus construction materials resulting from the Work. The Contractor shall grade the ground along each side of pipe trenches in a uniform and neat manner leaving the construction area in a shape as near as possible to the original ground line.

3.15 DISINFECTION OF POTABLE WATER LINES

A. The new potable waterlines shall not be placed in service--either temporarily or permanently--until they have been thoroughly disinfected in accordance with the following requirements and to the satisfaction of the Engineer.

B. After testing, a solution of hypochlorite using HTH or equal shall be introduced into the section of the line being disinfected sufficient to insure a chlorine dosage of at least 50 ppm in the main. While the solution is being applied, the water should be allowed to escape at the ends of the line until tests indicate that a dosage of at least 50 ppm has been obtained throughout the pipe. Open and close all valves and cocks while chlorinating agent is in the piping system. The chlorinated water shall be allowed to remain in the pipe for 24 hours, after which a residual of at least 25 ppm shall be obtained. The disinfection shall be repeated until 25 ppm is obtained after which time the main shall be thoroughly flushed until the residual chlorine content is not greater than 1.0 ppm, and then may be connected to the system. Also, no additional payment will be allowed for providing taps for chlorine injection and/or flushing, if necessary. The Contractor is responsible for the disposal of highly chlorinated water flushed from the main.

C. As with all testing and disinfection, the contractor must give the Engineer a minimum of 5 days' notice prior to disinfection.

3.16 ALTERNATE METHOD OF INSTALLATION

A. In lieu of traditional trenching methods for pipe installation, with the approval of the Engineer, the Contractor may choose to install the pipe utilizing the trenchless technology of horizontal directional drilling (HDD). Horizontal directional drilling shall be as specified in Section 02508.

SECTION 02515 - VALVES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install all valves shown on the Drawings and/or specified herein.

1.02 SUBMITTALS

A. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Engineer for review before ordering. Comply with provisions of Section 01340.

B. At the time of submission, the Contractor shall, in writing, call Engineer's attention to any deviations that the submittals may have from the requirements of the Engineer's Contract Drawings and Specifications.

PART 2 - PRODUCTS

2.01 GATE VALVES

A. Gate valves shall conform with AWWA C-509 standard, and shall be of the resilient seat type, iron body, fully bronze mounted, non-rising stem and have a design working pressure of 200 psi. Valves shall be of standard manufacturer and of the highest quality both as to materials and workmanship.

B. All gate valves shall be furnished with mechanical joint connections, unless otherwise shown on the Drawings or specified hereinafter.

C. An epoxy coating conforming to AWWA C-550 shall be applied to the interior and exterior ferrous surfaces of the valve except for finished or seating surfaces.

D. All gate valves shall have the name or monogram of the manufacturer, the year the valve casting was made, the size of the valve, and the working water pressure cast on the body of the valve.

E. Each gate valve shall be installed in a vertical position with a roadway type valve box. Gate valves set with valve boxes shall be provided with a 2-inch square operating nut and shall be opened by turning to the left (counter-clockwise). There shall be a maximum 48" depth of valve operating nut. Contractor must use extension stems, if necessary, to raise operator nut within 48" of final grade.

2.02 PLUG VALVES

A. All plug valves shall be eccentric plug valves unless otherwise specified.

B. Valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the plans. Flanged valves shall be faced and drilled to the ANSI 125/150 lb. standard. Mechanical joint ends shall be to the AWWA Standard C111-64, grooved ends per AWWA C-606-87. Screwed ends shall be to the NPT standard.

C. Valve bodies shall be of ASTM A126 Class B cast iron. Bodies in 4" and larger valves shall be furnished with a 1/8" welded overlay seat of not less than 90% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to insure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable.

D. Plugs shall be of ASTM A126 Class B cast iron. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plug shall be resilient faced with neoprene or hycar, suitable for use with sewage.

E. Valves shall have sleeve type metal bearings and shall be of sintered, oil impregnated permanently lubricated type 316 ASTM A743 Grade CF-8M in 2" sizes. In valves larger than 36", the upper and lower plug journals shall be fitted with ASTM A-240 type 316 stainless sleeves with bearings of ASTM B30, Alloy C95400 aluminum bronze. Non-metallic bearings shall not be acceptable.

F. Valve shaft seals shall be of the multiple V-ring type and shall be externally adjustable and repackable without removing the bonnet or actuator from the valve under pressure. Valves utilizing O-ring seals or non-adjustable packing shall not be acceptable.

G. Valve pressure ratings shall be 175 psi through 12" and 150 psi for 14" through 72". Each valve shall be given a hydrostatic and seat test with test results being certified when required by the specifications.

H. Manual valves shall have lever or gear actuators and tee wrenches, extension stems, floorstands, etc., as indicated on the plans. All valves 6" and larger shall be equipped with gear actuators. All gearing shall be enclosed in a semi-steel housing and be suitable for running in a lubricant with seals provided on all shafts to prevent entry of dirt and water into the actuator. The actuator shaft and the quadrant shall be supported on permanently lubricated bronze bearings. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque and to provide seat adjustment to compensate for change in pressure differential or flow direction change. All exposed nuts, bolts and washers shall be zinc plated.

I. Valves and gear actuators for buried or submerged service shall have seals or all shafts and gaskets on the valve and actuator covers to prevent the entry of water. Actuator mounting brackets for buried or submerged service shall be totally enclosed and shall have gasket seals. All exposed nuts, bolts, springs and washers shall be stainless steel.

J. Actuators shall be equipped with an operating nut to allow manual valve operation in case of supply failure.

K. All valves and actuators shall be as manufactured by DEZURIK or approved equal, and shall open to 100% of the corresponding pipe diameter.

L. All buried service plug valves shall have mechanical joint ends, have all exterior surfaces shop painted with two coats of Fed. Spec. TT-C-494A Asphalt Varnish with 2-inch square nut operator in a vertical position for use in a valve box. Provide nut operator stem extension for all plug valves buried deeper than 5 feet, sufficient to raise operator nut to within 3 feet of finished grade.

2.03 BALL VALVES

A. Plastic ball valves (shut-off valves) shall be Chemtrol TU Series 150 psi threaded true union ball valves as manufactured by Chemtrol Industrial Products NIBCO, Inc., Louisville, Kentucky; Hayward Manufacturing Co., Inc., Elizabeth, New Jersey; or equal, NSF listed for potable water.

B. Valves for PVC shall be manufactured of PVC material and valves for CPVC lines shall be manufactured CPVC material. Install so indicator arrow is in direction of flow.

2.04 BUTTERFLY VALVES

A. All butterfly valves shall be of the tight closing, rubber seat type with Buna-N rubber seats, which are recess mounted and securely fastened to the valve body or to the valve disc. Seating surfaces shall be stainless steel. Valves shall be rated for 150 psi pressure (Class 150B) and shall be satisfactory for applications involving valve operation after long periods of inactivity. Valve discs shall rotate 90 degrees from the full open position to the tight shut position. Valves shall meet the full structural requirements of the application class of AWWA C504-87.

B. Valve bodies shall be constructed of cast iron ASTM A126, Class B and shall have integrally cast mechanical joint ends. Two trunnions for shaft bearings shall be integral with each valve body. Body thickness shall be strictly in accordance with AWWA C504. Valve shafts shall be constructed of 18-8 stainless steel or of approved construction.

C. Disc shall be constructed of any material described in AWWA C504, Section 3.4. All disc seating edges shall be smooth and polished. Valve shafts shall be a one piece unit extending full size through the valve disc and bearings or a two piece unit (stub-shaft type). Disc mounted seats shall be mechanically retained; body mounted seats shall be bonded to the valve body. Bonded-in seats must be simultaneously molded in, vulcanized and bonded to the body and the seat. Bearings shall be corrosion resistant and self-lubricating: Henry Pratt Co., American Flow Control, M&H, or equal.

D. Operator shall be the traveling nut type, AWWA C504, Class 150.

E. All operators shall be fully gasketed and grease packed and designed to withstand submersion in water to 10 psi. Valve shall open with a counterclockwise rotation of the operator, and operation shall closely resemble conventional distribution valve practice and shall minimize water hammer. Operator shall be equipped for buried service.

F. Butterfly valves shall be supplied for mains 14" and larger where shown on the Plans.

G. All surfaces of the valve shall be clean, dry and free from grease before painting. An epoxy coating conforming to AWWA C550 shall be factory applied to the interior and exterior ferrous surfaces of the valve except for finished or seating surfaces.

H. Hydrostatic and leakage tests shall be conducted in strict accordance with AWWA C504, Section 5.

I. Butterfly valves installed in the ground shall have the operator nut in a vertical position for use in a roadway type valve box.

J. There shall be a maximum 48" depth to valve operator nut. Contractor must use extension stems, if necessary, to raise operator nut within 48" of the final grade.

K. Butterfly valves shall be sized as shown on the Drawings.

2.05 CHECK VALVES

A. The valve is a counterweighted, rubber seated check valve with attached cushion chamber whose function is to permit flow in only one direction, close tightly when its discharge side pressure exceeds its inlet pressure, and to close without a slam or bang.

B. The swing check valve shall be constructed with heavy cast iron or cast steel body with a bronze or stainless steel seat ring, a non-corrosive shaft for attachment of weight and lever, and complete non-corrosive shockless chamber.

C. It shall absolutely prevent the return of water, oil or gas back through the valve when the inlet pressure decreases below the delivery pressure. The valve must be tight seating, and must be shockless in operation. The seat ring must be renewable.

D. The cushion chamber shall be attached to the side of the valve body externally and so constructed with a piston operating in a chamber that will effectively permit the valve to be operated without any hammering action. The shock absorption shall be by air, and the cushion chamber shall be so arranged that the closing speed will be adjustable to meet the service requirements.

E. The valve disc shall be of cast iron or cast steel and shall be suspended from a non-corrosive shaft which will pass through a stuffing box and be connected to the cushion chamber on the outside of the valve.

F. All material and workmanship shall be first class throughout and the purchaser reserves the right to inspect this valve before shipment.

G. The valves will be Golden-Anderson Industries, Inc. Fig. No. 250-D, 125# or equal.

2.06 GATE VALVES - BURIED

A. Gate valves shall conform to the Specifications of Section 02515, Paragraph 2.01, except be designed for buried service, have mechanical joint ends, have all exterior surfaces shop painted with two coats of Fed. Spec. TT-V-51F Asphalt Varnish, with 2-inch square nut operator in a vertical position for use in a valve box.

B. Gate valves shall be Mueller Catalog No. A-2380 Series or approved equal.

2.07 PLUG VALVES -BURIED

A. Plug valves shall conform to the Specifications of Section 02515, Paragraph 2.03, except be designed for buried service, have mechanical joint ends, have all exterior surfaces shop painted with two coats of Fed. Spec. TT-V-51F Asphalt Varnish with 2-inch square nut operator in a vertical position for use in a valve box. Provide nut operator stem extension for all plug valves buried deeper than 5 feet, sufficient to raise operator nut to within 3 feet of finished grade.

2.08 VALVE BOXES - BURIED VALVES (EXCEPT AIR RELEASE AND SEWAGE COMBINATION VALVES)

A. Valve boxes shall be of 5-1/4 inch standard cast iron, two-piece, screw type valve box with drop cover marked "WATER", "SEWER", "DRAIN", as applicable. Valve boxes for gate valves larger than 8 inches shall be three-piece. Valve boxes shall be accurately centered over valve operating nut, and backfill thoroughly tamped about them. They shall be set vertically and properly cut and/or adjusted so that the tops of boxes will be grade in any paving, walk or road surface, and 2 to 3 inches above finish grade in grass plots, fields, woods or other open terrain. Valve boxes and covers shall be as manufactured by Tyler Corporation, Opelika Foundry, Clow or equal.

B. Contractor shall furnish two (2) 6-foot T-handle operating wrenches for underground valves. Nut operator extensions for all valves buried deeper than 3 feet shall be provided with stem extensions sufficient to raise operator nut to within 3 feet of finished grade.

C. Valve boxes inside a paving, walk, or road surface shall not be set on the valves but shall be supported on crushed stone fill.

D. Wherever valve boxes fall outside of the roadway pavement, the top of the box shall be set in a concrete slab 18" x 18" x 4" thick (or 18" circular x 4" thick) with the top of the slab and box flush with the top of the ground. This provision shall apply to all new and all existing valve boxes which fall within the limits of the contract, unless otherwise stated on the plans or ordered by the Engineer.

E. All buried valves shall be furnished with a valve box alignment device (VBAD). This device shall be HDPE and colored white. It shall be furnished intwo (2) pieces that will lock together under the operating nut without requiring removal of the operating nut. The device shall not affect the operation of the valve. This device shall be BoxLok as manufactured by Almar Molded Products, Inc., or

approved equal. The all cost associated with the BoxLok including installation, shall be incidental to the valve.

2.09 TAPPING SLEEVES AND VALVES

A. Tapping sleeves for connections to existing water lines shall be of the mechanical joint type suitable for working pressures of 200 psi and shall be Mueller No. H-615, American Valve and Hydrant No. 1004, M & H No. 1574, or equal, for taps up to 12" x 12". Tapping sleeves larger than 12" x 12" (up to 24" x 24") shall be of the mechanical joint type suitable for working pressure of 250 psi and shall be American Flow Control Series 2800, or equal.

B. Tapping Valves:

1. Tapping valves shall be of the mechanical joint type suitable for working pressures of 200 psi and shall be Mueller No. T-2360, American Valve and Hydrant No. 565, M & H No. 4751, or equal, for taps up to 12" diameter.

2. Tapping valves for taps larger than 12" diameter shall be of the mechanical joint type suitable for working pressure of 250 psi and shall be American Flow Control Series 2500, Mueller No. T-2361, or equal, and shall be side mounted with geared actuator.

C. All existing water mains to be tapped under this contract shall be exposed in order to verify line sizes prior to ordering tapping sleeves and valves.

2.10 BACKWATER VALVES

A. Valve assembly shall be PVC, with bolted cover. Flapper shall be non-corrosive flexible PVC and shall provide a maximum 1/4" clearance between flapper and seat for air circulation.

B. Valve ends shall suit piping material. Valve shall be manufactured by Plastic Oddities, Inc., R&G Sloane or approved equal.

2.11 SILENT CHECK VALVES

A. Silent check valves shall have a semi-steel body, per ASTM A126, Grade B, 150 psi pressure class, flanged and drilled ANSI B16.1, Class 125. Plug, seat and guide bushings shall be ASTM B 584. Stainless steel helical spring shall be ASTM A 276.

B. The plug which shall be guided at both ends with a through integral shaft will be opened by the velocity flow and closed by a stainless steel helical spring, which returns the plug to the seat before the reversal of flow occurs.

C. To permit regrinding of seat in the field, the seat, plug and guide bushing shall all be easily removable and replaceable without the need for any special training and without the need for any tools unless provided by the manufacturer with the

valve.

D. Silent check valves shall be Apco Series 600 as manufactured by Valve & Primer Corporation, or approved equal.

2.12 TELESCOPING VALVES

A. General:

Telescoping valves are used primarily for sludge removal, or liquid level control, and are considered to be fully open when in the lowermost position. The valve tube travels inside a cast iron or ductile iron riser pipe as shown in the plan drawings. The nominal riser pipe diameter determines the valve tube diameter. V-notch, flared, or baffled tube tops shall be provided when required by the plan drawings.

B. Tube (Metal):

Brass tubes for 10 inch nominal diameter and smaller valves shall be manufactured from seamless tube or pipe. For 12 inch and larger brass valves the tube shall be of rolled plate construction with the weld seam ground smooth. The finish O.D. of the tube is to be ± .04 inches, cylindrical within .100 TIR and have a smooth, 125 micro inch or better surface. Stainless steel or steel tubes up through 24" size shall be manufactured from seamless pipe or tube. Steel tubes are to be fusion epoxy coated. Tube lengths shall be as shown or noted on the drawings and must be of sufficient length to facilitate valve travel and maintain an appropriate insert depth. Valve tubes are to be a minimum 1/8" thick and are attached to connecting stems by use of a lifting bail.

C. Tube (PVC):

Valve tubes shall be of PVC plastic pipe. Tube lengths shall be as shown or noted on the plan drawings and must be of sufficient length to facilitate valve travel and maintain an appropriate insert depth. Valve tubes are to be attached to connecting stems by use of a lifting bail and must include bushings or an inner reinforcing ring of stainless steel, to prevent bolt hole enlargement on tube.

D. Seal Flange:

A cast iron or stainless steel companion flange and neoprene slip seal gasket shall be provided by the valve manufacturer. The gasket must be a minimum 1/4" thick. The inside diameter of the gasket is to be 1/8" smaller than the outside diameter of the valve tube to provide a friction seal. The gasket is to be sandwiched between the riser pipe flange and the companion flange. The gasket and companion flange shall include a 125# standard drilling pattern to match the riser pipe.

E. Lifting Bail:

On brass and PVC tubes the lifting bail shall be stainless steel construction and be fastened to the valve body with stainless steel attaching bolts. On stainless steel and steel tubes, the bail shall be the same material as the tube and be rigidly welded to the tube.

F. Lift and Stems (Rising):

Lifts shall be handwheel type, with UHMW polyethylene thrust bearings along with a stub acme threaded type 304 stainless steel stem to provide automatic self-locking, infinite valve positioning. The standard rising stem lift shall use a galvanized steel square tube with torque nut design to prevent telescoping valve tube rotation. Alternately, where
conditions require, a vee keyed shaft, with torque plate, shall be used to prevent valve tube rotation. Handwheels shall be a minimum of 12" in diameter and shall include a clear plastic Butyrate stem cover with a mylar strip type position indicator, calibrated in ¼ inch increments to illustrate valve position. The mylar strip, provided by the manufacturer, will be affixed by the contractor after installation to provide a true and accurate indication of the tube elevation by comparing it to the top of the rising stem. Stainless steel anchor bolts shall be provided for all pedestals. Cleaning and shop prime coat of lift housing and handwheel will be (as specified in Section 09960 in this specification).

G. Lift (Non-Rising Stem):

Lifts shall be ball bearing supported handwheel type with dial position indicator, mounted to a fabricated galvanized steel non-rising stem pedestal. The pedestal shall be manufactured with a square, main vertical member and a telescoping type torque tube. The torque tube must incorporate a square thrust pocket at the top to house a square thrust nut, to prevent rotation of the valve tube assembly. The bottom of the torque tube is attached to the lifting bail with bolts & nuts, same as rising stem lift.

H. Non-Rising Stem:

Where mounting conditions do not permit standard rising or non-rising stem lifts, a non-rising stem telescoping valve shall be provided. The valve bail design shall include nut pocket for NRS thrust nut and guides to prevent tube rotation. Stems shall be stub acme threaded type 304 stainless steel non-rising stem, threaded and keyed to either ball bearing supported lift, or floor box type lift. Lift shall have dial position indicator and 2" square nut to be operated by T-handle.

Telescoping valve shall be Model TS-2 as manufactured by Waterman Industries, Inc. or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All valves shall be installed in accordance with details on the Contract Drawings and with the manufacturer's recommendations.

B. All valves shall be anchored in accordance with the details on the Contract Drawings.

SECTION 02517 - HYDRANTS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required for furnishing and installing all hydrants and appurtenances specified herein.

1.02 SUBMITTALS

A. Submit shop drawings and product data in accordance with Section 01340 of this specification.

B. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Engineer for review before ordering.

C. At the time of submission, the Contractor shall, in writing, call the Engineer's attention to any deviations that the submittals may have from the requirements of the Engineer's Contract Drawings and Specifications.

PART 2 - PRODUCTS

2.01 FIRE HYDRANTS

A. The Contractor shall furnish and install fire hydrants and auxiliary gate valves where shown on the Drawings or directed by the Engineer. Hydrants shall conform in all respects to the most recent requirements of AWWA C502. Hydrant barrel shall have safety breakage feature above the ground line. All hydrants shall have 6-inch mechanical joint shoe connection, two (2) 2-1/2-inch discharge nozzles, and one (1) 4 1/2-inch pumper nozzle with rubber gasketed caps fitted with cap chains. Cap nuts are to be five (5) sided. Connection threads shall be National Standard Thread. Main valve shall have 5-1/4-inch full opening and be of the compression type opening against water pressure so that valve remains closed should barrel be broken off.

B. Hydrants shall be fully bronze mounted. Main valve shall have a threaded bronze seat ring assembly of such design that it is easily removable by unscrewing from a threaded bronze drain ring. Bronze drain ring shall have multiple ports providing positive automatic drainage as the main valve is opened or closed. Drainage waterways shall be completely bronze to prevent rust and corrosion.

C. The operating nut shall be five (5) sided bronze or bronze with a five (5) sided ductile iron cap, and mounted so that a counter clockwise motion will open the valve. There must be cast on top an arrow and the word "Open" indicating the direction of turn to open the hydrant.

D. Operating stem shall be equipped with anti-friction thrust bearing to reduce operating torque and assure easy opening. Stop shall be provided to limit stem

travel. Stem threads shall be enclosed in a permanently sealed lubricant reservoir protected from weather and the waterway with O-ring seals.

E. Hydrants shall be shop tested to 300 psi pressure with main valve both opened and closed. Under test the valve shall not leak, the automatic drain shall function and there shall be no leakage into the bonnet.

F. Type of shoe connection shall be mechanical joint and size shall be six inches (6").

G. Hydrants shall be given two (2) coats of enamel high visibility paint to be selected by the Owner.

H. Hydrants shall be Mueller Super Centurion Model A-423, or approved equal.

PART 3 - EXECUTION

3.01 SETTING OF FIRE HYDRANTS

A. Location:

1. Hydrants shall be located as shown or as directed so as to provide complete accessibility and minimize the possibility of damage from vehicles or injury to pedestrians.

2. When placed behind the curb, the hydrant barrel shall be set so that the pumper or hose nozzle cap will be a minimum of five feet (5') from the back of curb.

3. 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 six inches (6") of the sidewalk.

B. Position:

All hydrants shall be set plumb with not less than two (2) cubic feet of crushed stone and shall have their nozzles parallel with the roadway, with the pumper nozzle facing toward the roadway. Hydrants shall be set to the established grade, with nozzles at least eighteen inches (18") above the ground, as shown or as directed by the Engineer.

C. Connection to Main:

Each hydrant shall be connected to the main with a six-inch (6") mechanical joint shoe fitted with strapping lugs controlled by an independent six -inch (6") gate valve, unless otherwise specified.

D. Hydrant Drainage in Pervious Soil:

Whenever a hydrant is set in soil that is pervious, drainage shall be provided at the base of the hydrant by placing uncrushed course aggregate (AAHSTO M-43) No. 57 from the bottom of the trench to at least six inches (6") above the drain opening in the hydrant and to a distance of one foot (1') around the elbow. No drainage system shall be connected to a sewer.

E. Hydrant Drainage in Impervious Soil:

Whenever a hydrant is set in clay or impervious soil, a drainage pit two feet (2') in diameter and three feet (3') deep shall be excavated below each hydrant and filled compactly with uncrushed course aggregate (AASHTO M-43) No. 57 under and around the elbow of the hydrant and to a level of six inches (6") above the drain opening. No drainage pit shall be connected to a sewer (see Standard Details).

3.02 ANCHORAGE

A. The bowl of each hydrant shall be tied to the pipe with suitable anchor couplings, as shown on the Standard Details in the Drawings or as directed by the Owner or Engineer.

3.03 FIRE HYDRANT WRENCHES

A. One (1) hydrant wrench shall be furnished for each ten (10) hydrants or less. When the number of hydrants furnished and installed exceeds twenty-five (25), one (1) hydrant repair kit shall be supplied at no additional cost to the Owner.

SECTION 02520 - GRAVEL PACKED WELLS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The work to be done by the Contractor shall consist of furnishing and delivering to the job site all material and equipment and furnishing all labor necessary for the complete installation of two (2) new gravel walled well and well pump. Wells have previously been drilled and tested, see drawings for details. The new wells shall meet all requirements as set forth in the following detailed Specifications.

1.02 WELL LOCATION

A. The two new wells shall be located in the area shown on the Contract Drawings, on the site of the new ground storage tank

1.03 DEPTH OF WELLS

A. It is expected that the wells will be approximately 80' deep below existing grade.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.01 VERTICAL ALIGNMENT AND PLUMBNESS

A. The wells shall be constructed round, true to line and shall not depart from the vertical more than 6" per each 100'. If doubt exists as to the departure form the vertical. No well will be accepted if the straightness or vertical alignment is unsatisfactory to the extent that is interferes with the installation of the pump intended for the well.

3.02 WELL DEVELOPMENT

A. The Contractor shall develop the well by means of both straight mechanical and air surging. The surge blocks shall consist of double surge blocks that are spaced at least 2' to three 3' apart and the surge block should fit freely in the well casing.

The proper air supply for this diameter well shall be furnished by the Contractor and consist of an air compressor of no less than 375 cfm capacity.

Prior to development, a solution of HTH shall be pumped into the well. This mixture shall consist of 100 pounds of HTH and shall be mixed in a drum or container of water on the surface.

The solution shall then be pumped into the well and straight mechanically surged throughout the full length of the screen for four (4) to five (5) hours. The well shall then be air surged throughout the full length of the screen for at least twelve (12) hours.

A second charge of HTH, equal in weight to the first charge, shall then be added to the well in the same manner as the first charge. Following straight mechanical surging of the solution of the well, the well shall be air surged until the water being discharged is clear of any discoloration due to the silt, clay, and/or chemicals being pumped out of the well. This second period of air surging shall be at least twelve (12) hours, and may be required for an additional 16 hours in order to accomplish maximum efficiency.

3.03 WELL STERILIZATION

A. At the conclusion of redevelopment, a solution of HTH with 70% available chlorine by weight shall be applied to the well in order to sterilize the well. The solution of ten (10) pounds of HTH shall be dissolved in a drum or container of water on the surface and then pumped into the well. The HTH shall have a contact time of four (4) hours and shall be straight mechanically surged throughout the full length of the well in order to disinfect the well screen and casing. The chlorine solution shall then be pumped to waste.

3.04 PROTECTION OF WELL

A. At all times during the progress of the work, the Contractor shall protect the well in such a manner as to effectively prevent either tampering with the well or the entrance of foreign matter into it.

3.05 CONTRACTOR'S RESPONSIBILITY

A. The Contractor shall be responsible for performing all of the work in strict accordance with these Specifications. If evidence indicates that the screen or casing in a well is broken or that the well is not constructed in accordance with the Specifications to the satisfaction of the Engineer, the Engineer may order that proper changes be made by the Contractor. In the event that proper changes cannot be made, the Engineer may order the Contractor to abandon the well, without additional cost and to drill a new well.

3.06 WELL DISCHARGE PIPING

A. The well contractor shall be responsible for making final piping connections from each well to the raw water pipe line.

Ductile iron pipe shall conform to AWWA C 151 Class 51, with push-on or mechanical joints.

The interior of the pipe shall be cement-mortar lined with bituminous seal coat in accordance with AWWA C 104-80. Thicknesses of the lining shall be as set forth in Section 4.8.1 of the aforementioned specification unless otherwise directed by the Engineer. The exterior of all pipe, unless otherwise specified, shall receive either coal tar or asphalt base coating a minimum of 1 mil thick.

Each piece of pipe shall bear the manufacturer's name or trademark, the year in which it was produced and the letters ADI" or ADUCTILE. Pipe manufacturer shall furnish notarized certificate of compliance to the above AWWA or ANSI specifications.

Fittings shall be ductile iron in accordance with AWWA C 110-77 and shall conform to the details and dimensions shown therein. Fittings shall have mechanical joints meeting the requirements of AWWA C 111-80. Fittings shall have interior cement-mortar lining as specified for the pipe.

All well discharge piping shall be installed with a minimum cover of 42" over the top of the pipe. All water main pipe shall be installed with a minimum of 4" of sand bedding under the bells of the pipe. Sand bedding shall completely support the lower quadrant of the pipe and the pipe barrel. Backfilling the remainder of the trench shall be accomplished with material free from rock and/or acceptable to the Engineer. Backfill material shall be carefully compacted to avoid displacement of the pipe. Water mains shall have concrete thrust or "kicker" blocks at all pipe intersections and changes in direction. Piping laid under existing gravel or paved roadways shall receive full depth crushed stone backfill under the roadway.

3.07 CONCRETE FOR THRUST BLOCKS

A. Concrete shall be a minimum six (6) sack mix with a 6% air content and a compressive strength of at least 4,000 psi after twenty-eight (28) days.

SECTION 02700 - ASPHALTIC CONCRETE PAVING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The asphalt concrete paving replacement work includes the construction of an aggregate base course, asphalt binder and wearing courses to match existing courses and as specified herein. This work is to replace paving disturbed by the construction and any damages to paving by Contractor's operations, as well as new pavement and driveways, within the limits shown on the plans.

1.02 APPLICABLE STANDARDS

A. All references in this section to the standard specifications shall refer to the most recent Edition of Standard Specifications for Road and Bridge Construction with all amendments thereto as published by the Department of Transportation.

1.03 ENVIRONMENTAL REQUIREMENTS

A. Weather Limitations: Apply prime and tack coats only when ambient temperature is above 50 degrees F., and when temperature has not been below 35° for 12 hours immediately prior to application. Do not apply when bases is wet or contains an excess of moisture.

B. Construct asphalt concrete surface courses only when atmosphere temperature is above 40°F., and when base is dry. Base course may be placed when air temperature is above 30°F. and rising.

C. Grade Control: Establish and maintain required lines and elevations.

PART 2 - PRODUCTS

2.01 MATERIALS

All materials required for work in this section shall be as specified in the Standard Specifications as follows:

A. Base Course: Section 303.

B. Bituminous Concrete Surface and Bituminous Concrete Base: Section 402 and 403.

PART 3 - EXECUTION

3.01 INSPECTION

A. Pavement installer must examine the areas excavated and backfilled and conditions under which pavement is to be constructed. Notify the Contractor in

writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until satisfactory embankments and subgrade have been established to a uniform line, properly shaped and compacted.

3.02 BASE COURSE

A. Base course for all new paving shall match existing depth or consist of a minimum eight (8) inches of dense graded aggregate.

B. Base courses shall be constructed in accordance with Section 303 of the Standard Specifications.

3.03 PRIME COAT

A. Prior to placing the bituminous binder course, the granular base course shall be thoroughly cleaned and broomed and a prime coat of Refined Tar RT-2 shall be uniformly applied at the rate of 0.35 gallons per square yard by pressure distributor or other approved pressure spray method.

3.04 BITUMINOUS CONCRETE COURSES

A. The bituminous base course shall be hot mixed, hot laid, bituminous concrete base, furnished and placed in accordance to match the existing depth or to a minimum compacted thickness of 3 inches.

B. The surface course shall be hot mixed, hot laid, bituminous concrete in accordance to match existing depth or to a minimum compacted depth of 1-1/2 inches.

C. Standard Specifications: All bituminous concrete paving work shall comply with Section 402 of the Standard Specifications, including the removal of pavement samples to be tested by an independent laboratory for composition and density to insure quality control.

SECTION 02720 - AGGREGATE BASE COURSE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to construct the access roads and parking areas shown on the Drawings. Parking area and entrance road are to be surfaced with an aggregate base course.

B. This work shall be scheduled near the end of the project to minimize construction traffic on finished surface.

1.02 APPLICABLE STANDARDS

A. All references in this section to the Standard Specifications shall refer to the most recent edition of Standard Specifications for Road and Bridge Construction with all amendments and supplements thereto as published by the Department of Transportation, Bureau of Highways.

1.03 DEFINITIONS

A. Unimproved surfaces shall mean grass, other vegetative cover and non-traffic areas.

B. Improved surfaces shall mean existing gravel or dirt travel ways (existing access road adjacent to site).

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials required for work in this section shall be as specified in the Standard Specifications.

B. Aggregate base course for the access road and parking area shall consist of Type "O", Size No. 53 aggregate. Compacted thickness shall be nine (9) inches over unimproved areas and eight (8) inches over improved areas.

C. Perforated Polyethylene Drain Pipe shall be as specified in Section 810 of the Standard Specifications

D. Coarse aggregate for drains shall be as specified in Section 805 of the Standard Specifications.

E. Geotextile Fabric shall be as specified in Section 845 of the Standard Specifications.

PART 3 - EXECUTION

3.01 SUBGRADE

A. On the unimproved areas, the ground surface shall be stripped of all vegetative cover, and the top 6" layer of soil shall be scarified and compacted in place.

B. On the improved areas, the existing gravel surface shall be leveled and prepared to receive aggregate base.

C. The preparation of the subgrade shall be in accordance with Section 208 of the Standard Specifications and compacted to 95% standard proctor density.

D. The subgrade shall be prepared to the full width of the base course plus one foot of additional width beyond each edge, except where limited by structures.

E. The subgrade shall be shaped by mechanical means until a uniform line and grade are established.

F. Subgrade for the aggregate surface access road shall be shaped to a crown with slopes 1/2" to 3/4" per foot.

3.02 PIPE UNDERDRAINS

A. Pipe underdrains shall be placed in a trench to the required lines and grades, backfilled with coarse aggregate and wrapped in geotextile fabric.

B. Installation shall be in accordance with Section 705 of the Standard Specifications.

3.03 AGGREGATE COURSE

A. Aggregate base course for the access road and parking area shall consist of Type "O", Size No. 53 aggregate. Compacted thickness shall be nine (9) inches over unimproved areas and eight (8) inches over improved areas.

B. Thickness on the access road shall be uniform over the shaped subgrade to maintain the crown.

C. Aggregate shall be machine compacted to the density established as satisfactory by the Engineer.

D. The mixture shall be placed, spread to a string-line, and shaped without segregation by the use of power equipment operated so as to produce the desired compacted depth to the line, grade and cross section required.

SECTION 02730 - CRUSHED STONE ACCESS DRIVE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to construct the access roads and parking areas shown on the Drawings.

B. This work shall be scheduled near the end of the project to minimize construction traffic on finished surface.

1.02 APPLICABLE STANDARDS

A. All references in this section to the DOT Standard Specifications shall refer to the most recent edition of Standard Specifications for Road and Bridge Construction with all amendments and supplements thereto as published by the Kentucky State Transportation Cabinet, Department of Highways.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials required for work in this section shall be as specified in the DOT Standard Specifications.

B. Crushed stone aggregate course for the access road and parking area shall consist of DGA as specified in DOT Standard Specifications.

C. Final compacted thickness shall be nine (9) inches.

PART 3 - EXECUTION

3.01 SUBGRADE

A. On all areas, the ground surface shall be stripped of all vegetative cover, and the top 3" layer of soil shall be scarified and compacted in place.

B. The subgrade shall be prepared to a smooth finish without indentation to the full width of the base course plus one foot of additional width beyond each edge, except where limited by structures.

C. The subgrade shall be shaped by mechanical means until a uniform line and grade are established.

D. Subgrade for the aggregate surface access road shall be shaped to a crown with slopes 1/2" to 3/4" per foot.

3.02 AGGREGATE COURSE

A. Aggregate base course for the access road and parking area shall consist of DGA. Compacted thickness shall be six (6) inches over all areas.

B. Thickness on the access road shall be uniform over the shaped subgrade to maintain the crown.

C. Aggregate shall be machine compacted to the density established as satisfactory by the Engineer.

SECTION 02820 - CHAIN LINK SECURITY FENCES AND GATES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and service required to furnish and install epoxy coated chain link fencing and gates according to the layout shown on the Contract Drawings.

1.02 SUBMITTALS

A. Comply with provisions of Section 01340. At the time of submission, the Contractor shall in writing, call the Engineer's attention to any deviations that the submittals may have from the requirements of the Engineer's Contract Drawings and Specifications.

B. Shop Drawings:

Indicate details of fabrication and installation, including but not limited to fence height, post spacing, dimensions, unit weights and footing details.

C. Manufacturer's Literature:

1. Descriptive data of installation methods and procedures;

2. Standard drawings of fence and gate installation.

1.03 PRODUCT DELIVERY, HANDLING AND STORAGE

A. Deliver materials with manufacturer's tags and labels.

B. Handle and store material as to avoid damage.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Framework shall conform to one of the following:

1. Steel pipe with 1.8 ounces of zinc coating per square foot of surface area conforming to ASTM F1043 - Group IA

2. High strength steel pipe triple coated per ASTM F1043 - Group IC;

3. All frame work shall be vinyl coated in accordance to the fabric coating.

All coatings to be applied after welding.

Pipe shall be straight, true to section and shall conform to the following weights:

Pipe Size Outside Diameter	Group 1A Weight (Lbs per Ft.)	Group 1C Weight (Lbs per Ft.)
1-5/8"	2.27	1.84
2"	2.72	2.28
2-1/2"	3.65	3.12
3"	5.79	4.64
3-1/2"	7.58	5.71
4"	9.11	6.56

B. The base metal of the chain link fence fabric shall be composed of commercial quality, medium-carbon galvanized (zinc coated) steel wire. The vinyl coating shall be thermally bonded to a thermoset bonding layer over a galvanized steel wire. Vinyl coating thickness, galvanized coating weight, and wire tensile strength conform to Federal Specifications RR-F-191, ASTM F668, Class 2a and AA HTO M-181 Type IV, Class A. The wire shall be PVC coated before weaving and flexible at all joints. Fabric woven shall be in 2 in. (50mm) mesh, and knuckled at both selvages. As manufactured by SPS or equal.

2.02 COMPONENTS

Components of the fencing system shall be in accordance with the following requirements, and shall all be vinyl coated in accordance with fabric coating

A. Fence Posts:

	Group IA or Group IC	
Fabric Height	**Line Post O.D.**	**Terminal Post O.D.**
Under 6"	2"	2-1/2"
6' to 9'	2-1/2"	3"
9' to 12'	3"	4"

B. Gate Posts:

Single Gate Width	Double Gate Width	Group IA or Group IC Post O.D.
Up to 6'	Up to 12'	3"
7' to 12'	13' to 25'	4"

C. Rails and Braces: 1-5/8" O.D.

D. Fittings:

1. Post Caps: Pressed steel, cast iron or cast aluminum alloy designed to fit snugly over posts to exclude moisture. Supply cone type caps for terminal posts and loop type for line posts. All fittings to conform to ASTM F-626.

2. Rail and Brace Ends: Pressed steel, cast iron or cast aluminum alloy, cup-shaped to receive rail and brace ends.

3. Top Rail Sleeves: Tubular steel, 0.051 thickness x 7" long, expansion type.

4. Tension Bars: Steel strip, 5/8" wide x 3/16" thick.

5. Tension Bands: Pressed steel, 14 gauge thickness x 3/4" wide.

6. Brace Bands: Pressed steel, 12 gauge thickness x 3/4" wide.

7. Truss rods: Steel rod, 3/8" diameter merchant quality with turnbuckle.

E. Tension Wire: Marcelled 7 gauge steel wire with minimum coating of 0.80 ounces of zinc or 0.40 ounces of aluminum per square foot of wire surface and conforming to ASTM A-824.

F. Tie Wires: Aluminum, 9 gauge, alloy 1100-H4 or equal.

G. Hog rings: Steel wire, 11 gauge, with a minimum zinc coating of 0.80 ounces per square foot of wire surface.

2.03 CONCRETE MIX

A. Concrete for footings shall be ASTM C-94 Portland Cement concrete with maximum 3/4" aggregate having a minimum compressive strength of 3,000 PSI at 28 days.

2.04 GATES

A. Gates shall be of the types and sizes shown on the Drawings. Gate filler fabric shall be of the same as that used in fence.

B. Frames:

Swing gate frames shall be of 2" outside diameter galvanized Group IA or Group IC, having corners fitted with rigid watertight heavy malleable castings or electrically welded joints. Internal bracing shall be of 1-5/8" outside diameter galvanized steel pipe, Group IA or Group IC, and shall be coated in vinyl.

C. Hinges:

Gate hinges shall be double clamping offset type allowing gates to swing back parallel with line of fence. They shall be malleable iron and forged steel heavily galvanized.

D. Latches and Keepers:

Gate latch shall be of eccentric double locking type which engage strike securely bolted to either gate frame or gate post at both top and bottom. Latches shall be readily locked with padlock.

Gatekeeper shall be furnished with each gate frame to automatically engage gate frame when swung to open position.

E. Gate manufacturer and supplier shall be responsible for all hardware associated with attaching gates and removable panels.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Installation to conform to ASTM F-567.

B. Post Spacing: Space line posts at intervals not exceeding ten feet.

C. Post Setting: Set terminal, gate and line posts plumb in concrete footings of the dimensions shown on the Details. Top of footing to be 2" above grade and sloped to direct water away from posts.

D. Bracing: Brace gate and terminal posts back to adjacent line posts with horizontal brace rails and diagonal truss rods.

E. Top Rail: Install through line post loop caps connecting sections with sleeves to form a continuous rail between terminal posts.

F. Top Tension Wire: If top rail is not required, stretch tension wire through loop caps and fasten to terminal posts.

G. Bottom Tension Wire: Stretch between terminal posts 6" above grade and fasten to outside of line posts with tie wires.

H. Fabric: Pull fabric taut with bottom selvage 2" above grade. Fasten to terminal posts with tension bars threaded through mesh and secured with tension bands at maximum 15" intervals. Tie to line posts and top rails with tie wires spaced at maximum 12" on posts and 24" on rails. Attach to bottom tension wire with top rings at maximum 24" intervals.

I. Gates: Install gates plumb, level and secure for full opening without interference. Anchor center stops and keepers in concrete.

J. Fasteners: Install nuts for fittings, bands, and hardware bolts on inside of fence.

3.02 COMPLETION

A. Adjust brace rails and tension rods for rigid installation.

B. Tighten hardware, fasteners, and accessories.

C. The area of installation shall be left free of debris caused by the installation of the fence.

SECTION 02920 - LAWNS AND GRASSES

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment, and services required for seeding of all disturbed areas caused by construction activities and for installation of sod where indicated on the Contract Drawings or specified herein.

1.02 MAINTENANCE

A. Maintenance shall begin immediately following the last operation of installation for each portion of lawn.

B. Lawns shall be maintained by watering, mowing, and for resodding for a period of forty-five (45) days. At the end of this period an inspection will be made and any deficiencies, which may be attributable to the Contractor, will be noted in writing. At this time, the Owner will assume the maintenance. Another inspection will be made at the beginning of the next planting season, and any of the previously noted deficiencies still existing shall be repaired by the Contractor.

1.04 INSPECTION FOR ACCEPTANCE

A. The Inspection of the Work:

The inspection of the work of lawns to determine the completion of contract work exclusive of the possible replacement of plants, will be made by the Architect/Engineer upon written notice requesting such inspection submitted by the Contractor at least ten (10) days prior to the anticipated date.

B. Acceptance:

After inspection, the Contractor will be notified in writing by the Owner of acceptance of all work of this Section, exclusive of the possible replacement of plants subject to guaranty, or if there are any deficiencies of the requirements of completion of the Work.

PART 2 - PRODUCTS

2.01 WATER

A. Water used in this work shall be suitable for irrigation and free from ingredients harmful to plant life.

B. Hose and other watering equipment required for the Work shall be furnished by the Contractor.

2.02 TOPSOIL

A. The Contractor shall furnish and place sufficient topsoil for the seeding and installation of sod.

2.03 FERTILIZER

A. Commercial fertilizer for lawn areas shall be complete fertilizer, formula 10-10-10, for lawns and shall conform to the applicable state fertilizer laws. Fertilizer shall be uniform in composition, dry and free flowing and shall be delivered to the site in the original, unopened containers, each bearing the manufacturer's guarantee analysis. Any fertilizer which becomes caked or otherwise damaged making it unsuitable for use will not be accepted.

B. Fertilizer shall be applied at the rate of 25 pounds per 1,000 square feet.

2.04 GRASS SEED

A. The seed mixture to be sown shall be in the following proportions:

Common Name	Proportion By Weight	% of Purity	% of Germination
Fine Lawn Fescue	60	90	85
Chewings Fescue	20	90	85
Italian Rye Grass	15	90	85
Red Top	5	90	85

B. All seed shall be fresh and clean and shall be delivered mixed, in unopened packages, bearing a guaranteed analysis of the seed mixture.

C. Germination must be certified to conform to the following minimums:

Purity	90%
Germination	85%

2.05 SOD

A. Sod shall be at least 70% Bluegrass, strongly rooted and free of pernicious weeds.

B. It shall be mowed to a height not to exceed 3" before lifting, and shall be of uniform thickness with not over 1-1/2" or less than 1" of soil.

2.06 MULCH

A. Mulch for seeded areas shall be Conwed Hydro Mulch, Silva-Fiber, or equal. It shall be suitable for use in a water slurry or for application with hydraulic equipment.

B. Clean straw is acceptable as mulch. It shall be spread at the rate of one (1) bale per 1,000 feet (approximately 2 inch loose depth).

C. Mulch on slopes greater than 1: 3 shall be held in place with erosion control

netting.

D. Mulch on areas subject to surface water run-off or in drainage ditches shall be held in place with erosion control netting.

PART 3 - EXECUTION

3.01 TIME OF PLANTING

A. Planting operations shall be conducted under favorable weather conditions during seasons which are normal for such work as determined by accepted practice in the locality of the project. At the option and on full responsibility of the Contractor, planting operations may be conducted under unseasonable conditions without additional compensation.

3.02 LAWNS

A. Areas to be sodded are designated on the Drawings. All other lawn areas, including areas of cut and fill and where existing ground has been disturbed by construction operations shall be seeded.

B. Fertilizer:

Fertilizer shall be applied at the rate of 25 pounds per 1,000 square feet to the lawn area being prepared for planting and mixed lightly into the top few inches of topsoil. Fertilizer may be mixed with and distributed with grass seed.

C. Planting of Lawns:

1. Sowing of Seed:

Immediately before any seed is to be sown, the ground shall be scarified as necessary, and shall be raked until the surface is smooth, friable and of uniformly fine texture. Lawn areas shall be seeded evenly with a mechanical spreader at the rate of 4 pounds per 1,000 square feet of area, lightly raked, rolled with a 200-pound roller and watered with a fine spray. The method of seeding may be varied at the discretion of the Contractor on his own responsibility to establish a smooth, uniform turf composed of the grasses specified. The sowing of seed shall be done only within the season extending from March 1st to May 15th and from September 1st to October 15th, unless other seasons may be approved by the Owner.

2. Laying of Sod:

Before any sod is laid, all soft spots and inequalities in grade shall be corrected. Fertilizer spread shall be raked in. Sod shall be laid so that no voids occur, tamped or rolled and then thoroughly watered. The complete sodded surface shall be true to finished grade, even and firm at all points. Sodding shall be done only within the seasons extending from March 1st to May 15th and from September 1st to October 15th, unless other seasons may be approved by the Owner.

3. Sod on Slopes:

Sod on slopes 2 to 1 or steeper shall be held in place by wooden pins about 1-inch square and about 6 inches long driven through the sod into the soil until they are flush with the top of the sod, or by other approved methods for holding the sod in place.

4. Mulching:

All seeded areas are to be mulched with Conwed Hydro Mulch, Silva-Fiber, or equal, or with clean straw as specified under PRODUCTS. Mulch shall be applied at the rate of 1,500 pounds per acre. It may be applied with hydraulic equipment or may be added to the water slurry in a hydraulic seeder and the seeding and mulching combined in one operation. Clean straw may be spread by hand to cover the seeded areas at a depth of two (2) inches. Erosion control netting shall be installed and anchored per manufacturer's instructions in areas of slopes, ditches, or surface water runoff.

3.03 CLEAN UP

A. All soil, peat or similar material which has been brought over paved areas by hauling operations or otherwise, shall be removed promptly, keeping these areas clean at all times. Upon completion of the planting all excess soil, stone and debris which have not previously been cleaned up shall be removed from the site or disposed of as directed by the Owner. All lawns shall be prepared for final inspection.

3.04 OTHER WORK

A. The Contractor also shall be responsible for the repair of any damage caused by his activities or those of his subcontractors, such as the storage of topsoil or other materials, operations or equipment, or other usages to all on-site areas outside the contract limits. Such repair operations shall include any regrading, seeding or other work necessary to restore such areas to an acceptable condition.

3.05 QUALITY CONTROL

A. Areas seeded shall be protected until a uniform stand develops, when it will be accepted and the Contractor relieved of further responsibility for maintenance. Displaced mulch shall be replaced or any damage to the seeded area shall be repaired promptly, both in a manner to cause minimum disturbance to the existing stand of grass. If necessary to obtain a uniform stand, the Contractor shall refertilize, reseed and remulch as needed. Scattered bare spots up to one (1) square yard in size will be allowed up to a maximum of 10 percent of any area.

SECTION 03

SECTION 03300 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install all cast-in-place concrete as indicated on the Drawings and specified herein.

B. All concrete construction shall conform to all applicable requirements of ACI 301 (latest), Specifications for Structural Concrete for Buildings, except as modified by the supplemental requirements specified herein.

1.02 SUBMITTALS

The Contractor shall submit the following data for Engineer's review in accordance with Section 01340.

A. Concrete mix designs, test results and curves plotted to establish water-cement ratio if ACI 301-05 Section 4.2.3.4.b is followed.

B. Proposed mix designs and all necessary substantiating data used to establish the proposed mix designs if ACI 301-05 Section 4.2.3.1 is followed.

C. Mix designs shall be submitted for all mixes proposed or required to be used, including all mixes containing admixtures.

D. A certified copy of the control records of the proposed production facility establishing the standard deviation as defined in Paragraph 4.2.3.2. of ACI 301.

E. Submit shop drawings as specified in ACI 301. Submit shop drawing showing the location of proposed construction and control joints separate from the steel reinforcement shop drawings.

1. Construction Joints

2. Control Joints

3. Steel Reinforcement

1.03 QUALITY ASSURANCE

The Contractor shall obtain and have available in the field office at all times, the following references:

A. Specifications for Structural Concrete for Buildings ACI 301 (latest Revision).

B. Field Reference Manual: Specifications for Structural Concrete for Buildings SP-15 (89).

Available from:

The American Concrete Institute
Publications Department
P.O. Box 19150
Detroit, Michigan 48219-0150

C. Manual of Standard Practice - CRSI. (Latest Edition).

D. Placing Reinforcing Bars - CRSI (Latest Edition).

Available from:

Concrete Reinforcing Steel Institute
933 North Plum Grove Road
Schaumburg, Illinois 60173-4758

PART 2 - PRODUCTS

2.01 CLASSES OF CONCRETE AND USAGE

A. Structural concrete of the various classes required shall be proportioned by either Method 1 or Method 2 of ACI 301 to produce the following 28-day compressive strengths:

1. Selection of Proportions for Class A Concrete:

   a. 4,000 psi compressive for strength at 28 days.

   b. Type II cement plus dispersing agent and air.

   c. Max. (water)/(cement and dispersing agent) ratio = 0.45.

   d. Min. cement content = 564 lbs. (6.0 bags)/cu. yd. concrete.

   e. Nominal max. size coarse aggregate = No. 67 (3/4" max.) or No. 57 (1" max.). Walls with architectural treatment shall use No. 67 (3/4" max.).

   f. Air content = 6% plus or minus 1% by volume.

   g. Slump = 3" - 4" in accordance with ASTM C 143.

2. Selection of Proportions for Class B Concrete:

a. 3,000 psi compressive strength at 28 days.

b. Type I cement plus dispersing agent and air.

c. Max. (water)/(cement and dispersing agent) ratio = 0.56.

d. Min. cement content = 470 lbs. (5.0 bags)/cu. yd. concrete.

e. Nominal max. size coarse aggregate = No. 67 (3/4" max.) or No. 57 (1" max). Walls with architectural treatment shall use No. 67 (3/4" max.).

f. Air content = 6% plus or minus 1% by volume.

g. Slump - 3" - 4" in accordance with ASTM C 143.

B. Concrete shall be used as follows:

1. Class A concrete for all concrete work except as noted below.

2. Class B concrete for fill concrete, thrust blocks and topping over hollow-core slabs, and where indicated on the Drawings.

C. Type II cement conforming to ASTM C 150 shall be used in all structural concrete. The alkali content shall not exceed 0.6% calculated as sodium oxide. Cement for exposed to view concrete shall have a uniform color classification.

D. Coarse aggregate for concrete shall be size No. 57, as specified in ASTM C33 unless a smaller size aggregate is required to conform to provisions of Section 4.2.2.3 of ACI 301. Coarse aggregate shall conform to all requirements of ASTM C33.

E. Manufactured sand shall not be used as fine aggregate in concrete.

F. Flyash: Flyash shall not be used.

G. Silica Fume: Silica fume shall conform to ASTM D 1240. Use Force 10,000S Silica Fume by W.R. Grace; Sikacrete 950 by Sika Corporation; Rheomac SF 110 by Master Builders; or equal. Blended cements with interground silica fume will not be allowed.

1. Water content of liquid slurry silica fume admixtures shall be considered as part of the mixing water when calculating the water/cement ratio.

2. Silica fume shall be added at the batch plant as recommended by the manufacturer. For all types of mixing equipment, mix times shall be increased by 40 percent over the minimum mix time required to achieve mix uniformity as defined by ASTM C 94. For truck-mixed and central mixed concrete, maximum allowable batch size shall be 80 percent of the maximum as called out by ASTM 94.

2.02 ADMIXTURES

A. An air entraining admixture shall be used on all concrete and shall be synthetic air entrainment such as that manufactured by Master Builders or approved equal. Certification attesting to the percent of effective solids and compliance of the material with ASTM C 260 shall be furnished, if requested.

B. A water-reducing, set controlling admixture (nonlignin type) shall be used in all concrete. The admixture shall be a combination of polyhydroxylated polymers including catalysts and components to produce the required setting time based on job site conditions, specified early strength development, finishing characteristics required, and surface texture, as determined by the Engineer.

C. Certification shall be furnished attesting that the admixture exceeds the physical requirements of ASTM C 494, Type A, water-reducing and normal setting admixture, and when required, for ASTM C 494, Type D, water-reducing and retarding admixture when used with local materials with which the subject concrete is composed.

D. The admixture manufacturer, when requested, shall provide a qualified concrete technician employed by the manufacturer to assist in proportioning concrete for optimum use. He shall also be available when requested to advise on proper addition of the admixture to the concrete and on adjustment of the concrete mix proportions to meet changing job conditions.

E. The use of admixtures to retard setting of the concrete during hot weather, to accelerate setting during cold weather, and to reduce water content without impairing workability will be permitted if the following conditions are met:

   The admixture shall conform to ASTM C494, except that the durability factor for concrete containing the admixture shall be at least 100 percent of control, the water content a maximum of 90 percent of control and length change shall not be greater than control, as defined in ASTM C 494.

F. Where the Contractor finds it impractical to employ fully the recommended procedures for hot weather concreting, the Engineer may at his discretion, require the use of a set retardant admixture for mass concrete 2.5 feet or more thick for all concrete whenever the temperature at the time concrete is cast exceeds 80°F. The admixture shall be selected by the Contractor subject to the review of the Engineer. The admixture and concrete containing the admixture shall meet all the requirements of these Specifications. Preliminary tests of this concrete shall be required at the Contractor's expense.

G. When more than one (1) admixture is used, all admixtures shall be compatible. They should preferably be by the same manufacturer.

H. Calcium chloride will not be permitted as an admixture in any concrete.

2.03 REINFORCEMENT

A. The minimum yield strength of the reinforcement shall be 60,000 pounds per square inch. Bar reinforcement shall conform to the requirements of ASTM A 615. All bar reinforcement shall be deformed.

B. Wire-mesh reinforcement shall be continuous between expansion joints. Laps shall be at least one full mesh plus 2 inches, staggered to avoid continuous lap in either direction, and securely wired or clipped with standard clips.

C. Smooth dowels shall be plain steel bars conforming to ASTM A 615, Grade 60, or steel pipe conforming to ASTM A 120, Schedule 80. Pipe, if used, shall be closed flush at each end with mortar or metal or plastic cap. Dowels shall be installed at right angles to construction joints and expansion joints. Dowels shall be accurately aligned parallel to the finished surface, and shall be rigidly held in place and supported during placing of the concrete. One end of dowels shall be oiled or greased or dowels shall be coated with high density polyethylene with a minimum thickness of 14 mils.

D. Reinforcement supports and other accessories in contact with the forms for members which will be exposed to view in the finished work shall be of stainless steel or shall have approved high-density polyethylene tips so that the metal portion shall be at least one-quarter of an inch from the form or surface. Supports for reinforcement, when in contact with the ground or stone fill, shall be precast stone concrete blocks. Particular attention is directed to the requirement of Paragraph 3.3.2.4 of ACI Standard 301. These requirements apply to all reinforcement, whether in walls or other vertical elements, inclined elements or flatwork.

E. Particular care shall be taken to bend tie wire ends away from exposed faces of beams, slabs and columns. In no case shall ends of tie wires project toward or touch formwork.

2.04 OTHER MATERIALS

A. Anchorage items shall be of standard manufacture and of type required to engage with the anchors to be installed therein under other sections of the Specifications and shall be subject to approval by the Engineer.

1. Slots shall be galvanized dovetail-type as specified in Section "Masonry Work".

2. Inserts shall be malleable iron or steel, and of sturdy design adequate strength for the load to be carried. All inserts shall be galvanized. Adjustable wedge inserts shall have an integral loop or strap at the back, or shall be slotted to receive a special-headed bolt not smaller than 5/8-inch in diameter and of the required length and fitted with hexagonal nut. Other inserts shall be either threaded or slotted as required by their usage. Threaded inserts shall have integral lugs to prevent running.

3. Concrete anchors shall be an approved expansion type conforming to Federal Specification FF-S-325, Groups I, II, III, or VIII and shall be installed in strict accordance with the manufacturer's recommendations. Material for anchors shall be as specified in Section 05500 "Miscellaneous Metals". Anchors shall develop ultimate shear and pull out loads of not less than the following values in Class A concrete:

Bolt Diameter (Inches)	Min. Shear (Pounds)	Min. Pull-Out Load (Pounds)
2	4,500	4,600
5/8	6,900	7,700
3/4	10,500	9,900

B. Epoxy bonding adhesive used to bond fresh plastic concrete to sound, hardened concrete shall meet the following Specification. Contractor shall furnish a notarized certification by the manufacturer that the proposed material meets the Specification.

1. Material:

The epoxy material shall consist of a 2-component system whose components conform to the following requirements:

a. Component A - Component A shall be a modified epoxy resin of the epichlorohydrin bisphenol A condensation type, containing suitable viscosity control agents and having an epoxide equivalent of 180-200.

b. Component B - The B component shall be primarily a reaction product of one mole of an aliphatic polyamine and two moles of mono-functional epoxide containing compounds modified with 2, 4, 6 tri (dimethylaminomethyl) phenol.

c. The component ratio of B to A by volume shall be as specified by the manufacturer.

2. Properties of Mixed Components:

a.	Solids Content	100% by weight
b.	Pot Life	25-35 min. @ 73 degree F.
c.	Tack-Free Time (Thin Film)	4-5-1/2 hrs @ 73 degrees F.
d.	Final Cure ASTM D 695 (75% ultimate strength)	3 days at 73 degrees F.

e.	Initial Viscosity (A+B)	2,000 cps. min at 73 degrees F.
f.	Color Mixed	Straw

3. Properties of Cured Material (Neat Material):

a.	Tensile Strength ASTM D 638	3,000 psi min. @ 14 days 73 degrees F. cure
b.	Tensile Elongation ASTM D 638, modified	2 - 2% at 14 days 73 degrees F. cure
c.	Compressive Strength ASTM D 695	12,500 psi min. at 73 degrees F. cure
d.	Compressive Modules ASTM D 695	470,000 psi min. @ 28 days, 73 degrees F cure
e.	Compressive Strength ASTM D 695	5,500 psi min. @ 24 days 73 degrees F cure
f.	Water Pick-up ASTM D 570	1.5 max.

C. Flashing reglets shall be as specified in Section 07530. Reglets shall be correctly placed into forms prior to placing concrete in formwork.

D. Premolded expansion-joint filler strips shall conform to ASTM D 1752 and shall be 3/8-inch thick unless otherwise shown.

E. Joint sealants shall conform to ANSI A 116.1. The following joint sealants are acceptable:

1. Colma by Sika Chemical Corporation

2. Hornflex by A.C. Horn, Inc.

3. Sonolastic by Sonneborn Division of Contech, Inc.

F. Nonshrink grout shall be Embeco 636 grout by Master Builders Company, Euco Firmix grout by the Euclid Chemical Company, or equal. The approved product shall be delivered to the site of the Work in the original sealed containers, each bearing the trade name of the material and the name of the manufacturer.

G. Hardeners and dustproofers shall be colorless, aqueous solution of zinc or magnesium fluosilicate. Each gallon of solution used for the first application shall contain not less than one pound of crystals. Each gallon of solution used for subsequent application shall contain not less than two pounds of crystals. Materials shall be reviewed by the Engineer.

H. Porous fill shall be crushed rock or gravel of such size that all will pass a 1-1/2 inch screen and not more than 5 percent will pass a No. 4 screen, free from earth clay or other foreign substances.

I. Waterstops: Waterstops shall be styrene-butadiene rubber, standard (non-split) type, flat dumbbell shape (no center bulb), of size shown on Drawings, complete with fittings as required such as unions, vertical tees, vertical ells, flat crosses, flat ells, flat tees, etc. Waterstops shall be securely wired into place to maintain proper position during placement of fresh concrete, as shown on the Drawings. Care shall be taken in the installation of the waterstop and the placing of the concrete to avoid "folding" while concrete is being placed, and to prevent voids in the concrete surrounding the waterstop.

All materials, including adhesive, shall be W.R. Grave SERVICISED Construction Products; Williams Products, Inc.; Construction Gaskets, Inc.; or equal, and shall be installed in accordance with the manufacturer's recommendations.

J. Form Liners: Form liners for construction of fluted wall treatment shall be prefabricated plastic liners as manufactured by Greenstreak Plastic Products, Interform Company, or Symons Corporation.

Liners shall be fiberglass or ABS (acrylonitrile - butadiene - styrene) of such configuration as to obtain the fluted pattern shown or indicated on the Drawings.

For purposes of designating type and quality of material required, form liners shall be pattern 361 trapezoidal liners as manufactured by Greenstreak Plastic Products.

Preparation of forming materials, sealing of joints to prevent grout leakage and form release treatment (if required) shall be in strict compliance with the manufacturer's printed instructions and recommendations.

PART 3 - EXECUTION

3.01 FINISHES

A. Exposed to Public View Concrete Surfaces:

1. All concrete exposed to view in the completed structure shall be produced using materials and workmanship to such quality that only nominal finishing will be required. The provisions of paragraphs 6.2.2.1 and 6.3.6 of ACI 301 shall apply to all exterior exposed to public view concrete surfaces, including the outside surfaces of tanks.

2. Forms for exposed concrete surfaces shall be exterior grade, high-density overlay plywood, steel, or wood forms with smooth tempered hard-board form-liners.

3. Forms shall be coated with an approved release agent before initial pour and between subsequent pours, in accordance with the manufacturer's printed instructions. Form boards shall not be wet water prior to placing concrete.

4. Recessed joints in concrete shall be formed using lacquer-coated wood battens or forms, milled to indicated profiles. Battens and corner strips shall be carefully inspected before concrete is placed and damaged pieces replaced.

5. Chamfer strips shall be one (1) inch radius with leg, polyvinyl chloride strips by Gateway Building Products, Saf-T-Grip Specialties Corp., Vinylex Corp., or equal.

6. Particular attention is directed to the requirements of paragraphs 5.3.3.3G and 6.3.3 of ACI 301. Form panels shall be provided in the maximum sized practicable in order to minimize form joints. Wherever practicable, form joints shall occur at recessed joints. All form joints in exterior exposed to view surfaces shall be carefully caulked with an approved nonstaining caulking compound. Joints shall not be taped. Form oil or other material which will impart a stain to the concrete shall not be allowed to contact concrete surfaces.

7. Care shall be taken to prevent chipping of corners or other damage to concrete when forms are removed. Exposed corners and other surfaces which may be damaged by ensuing operations shall be protected from damage by boxing, corner boards or other approved means until construction is completed.

8. Form ties shall remain in the walls and shall be equipped with a waterseal to prevent passage of water through the walls. Minimum set back of form ties shall be 1-1/2 inches from faces of wall. The hole left by removal of tie ends shall be sealed and grouted in accordance with the procedure described hereinafter in Par. 3.01.F. Form ties will be permitted to fall within as-cast areas of architecturally treated wall surfaces (ACI Chapter 13); this does not apply to walls receiving decorative waterproof masonry coating.

9. All formed exposed to view concrete surfaces shall have a "smooth rubbed finish". Exterior vertical surfaces shall be rubbed to one foot below grade. Interior exposed to public view vertical surfaces of liquid containers shall be rubbed to one (1) foot below the minimum liquid level that will occur during normal operations.

B. All vertical surfaces in liquid containing structures shall have a "smooth form" finish.

All "smooth form" concrete vertical surfaces shall be a true plane within 1/4 inch in ten (10) feet as determined by a ten (10) foot straightedge placed anywhere on the surface in any direction. Abrupt irregularities shall not exceed 1/8 inch.

C. Basin, flume, conduit and tank floors shall have a "troweled" finish unless shown otherwise on Drawings.

D. Weirs and overflow surfaces shall be given a "troweled" finish.

E. Exterior platforms, steps and landings, shall be given a "broom" finish. "Broom" finish shall be applied to surfaces which have been steel-troweled to an even, smooth finish. The troweled surface shall then be broomed with a fiber-bristle brush in the direction transverse to that of the main traffic.

F. Patching of holes due to removal of tie ends and other repairable defective areas, shall be as follows: Entire contact area of hole shall be coated with two-part moisture insensitive epoxy bonding compound as specified in Par. 2.04.B. in accordance with manufacturer's specifications, and prior to placing of freshly mixed patching mortar. Parching mortar shall be mixed and placed in general accordance with ACI Par. 5.3.7.5.

G. For floors and slabs in which drains occur, special care shall be exercised to slope the floors uniformly to the drains. All floors with drains shall be sloped not less than 1/8 inch per foot unless otherwise shown. In all areas where quarry tile or other materials requiring more than 1/4 inch drop are to be overlaid, the concrete base slab shall be depressed as shown to provide a finished floor at the same elevation as surrounding areas.

3.02 TESTING

A. All testing shall be in accordance with provisions of ACI 301. Testing services listed in ACI Sections 1.6.4 shall be performed by a testing agency acceptable to the Engineer and Owner.

B. The testing services of ACI sections 1.6.4.2 and 1.6.4.3 shall be performed at the Contractor's expense. The Contractor shall be responsible for making concrete test cylinders, storing and protecting concrete cylinders and delivering cylinders to the Owner-approved testing laboratory.

C. Testing services of ACI Section 1.6.4.4 shall be paid for by the Contractor. Test shall be made for each 50 cubic yards of concrete and/or each day concrete is placed.

3.03 ADDITIONAL REQUIREMENTS

A. Unless otherwise directed by the Engineer, the vertical surfaces of footings shall be formed. Excavations and reinforcement for all footings shall have been inspected by the Engineer before any concrete is placed.

B. The installation of underground and embedded items shall be inspected before slabs are placed. Pipes and conduits shall be installed below the concrete unless otherwise indicated. Fill required to raise the subgrade shall be placed as specified in Section 02300 "Earthwork". Porous fill not less than 6 inches in compacted thickness shall be installed under all slabs, tank bottoms, and foundations. The fill shall be leveled and uniformly compacted to a reasonably true and even surface. The surfaces shall be clean, free from frost, ice, mud and water. Waterproof paper, polyethylene sheeting of nominal 4-mil minimum thickness, or polyethylene-coated burlap shall be laid over all surfaces receiving concrete.

C. Concrete shall be placed in layers not over 18 inches deep and each layer shall be compacted by mechanical internal-vibrating equipment supplemented by hand spading, rodding and tamping as directed. Vibrators shall not be inserted into lower courses that have begun to set.

D. Concrete that is truck mixed or transported in truck mixers or truck agitators shall be delivered to the site of the work and discharged completed in the forms within the time specified in Paragraph 11.7 of ASTM C 94 except that when the concrete temperature exceeds 85°F., the time shall be reduced to 45 minutes. Transit-mixed concrete that is completely mixed at the site of concrete placement or batched cement and aggregates transported to mixers shall be placed in the forms within 1-1/2 hours after cement has been added. Concrete shall be placed in the forms within 15 minutes after discharge from the mixer at the job site.

E. If concrete is placed by pumping, no aluminum shall be used in any parts of the pumping system which contact or might contaminate the concrete. Aluminum chutes and conveyors shall not be used.

F. All concrete surfaces not in contact with forms shall be moist cured by the application of absorptive mats or double thicknesses of fabric kept continuously wet. Forms shall be kept continuously wet. Use of other curing methods will not be permitted unless written authorization is received from the Engineer.

G. The unit of operation shall not exceed 30 feet for tank walls and walls exposed to weather, and 45 feet for other work in any horizontal direction and not less than 48 hours shall elapse between casting of adjoining units unless these requirements are waived by the Engineer. Provision shall be made for jointing successive units as indicated or required to be made at spacing of approximately 25 feet. Additional construction joints required to satisfy the 25 foot spacing shall be located by the Contractor subject to the review of the Engineer. The Contractor shall submit for review drawings separate from the steel reinforcing drawings, showing the location of all proposed construction joints. All construction joints shall be prepared for bonding by roughening the surface of the concrete in an acceptable manner which will expose the aggregate uniformly and will not leave laitance, loosened particles of aggregate or damaged concrete at the surface. Joints in walls and columns shall be maintained level. Concrete shall be placed in layers not over 18 inches deep and each layer shall be compacted by mechanical internal-vibrating equipment supplemented by hand

spading, rodding and tamping as directed. Vibrators shall not be inserted into lower courses that have begun to set.

H. Formwork for beam soffits and slabs and other parts that support the weight of concrete, shall remain in place until the concrete has reached its specified 28-day strength, unless otherwise specified or permitted.

I. Concrete Walks and Curbs:

1. Subgrade shall be true and well compacted at the required grades. Spongy and otherwise unsuitable material shall have been removed and replaced with approved material. Concrete walks shall be placed upon porous fill covered with waterproof paper, polyethylene sheeting of nominal 4-mil minimum thickness or polyethylene-coated burlap.

2. Concrete walks shall be not less than 4 inches in thickness. Walks shall have contraction joints every 5 linear feet in each groove in the top surface of the slab to a depth of at least one-fourth the slab thickness with a jointing tool. Transverse expansion joints shall be installed at all returns, driveways, and opposite expansion joints in adjacent curbs. Where curbs are not adjacent, transverse expansion joints shall be installed at intervals of approximately forty (40) feet. Sidewalks shall receive a "broomed" finish. Scoring shall be in a transverse direction. Edges of the sidewalks and joints shall be edged with a tool having a radius not greater than 1/6 inch. Sidewalks adjacent to curbs shall have a slope of 1/4 inch per foot toward the curb. Sidewalks not adjacent to curbs shall have a slope of 1/4 inch per foot. The surface of the concrete shall show no variation in cross section in excess of 1/4 inch in 5 feet. Concrete walks shall be reinforced with 66-1010 welded wire fabric.

3. Concrete curbs shall be constructed to the section indicated on the Standard Detail, and all horizontal and vertical curves shall be incorporated as indicated or required. Forms shall be steel as approved by the Engineer. At the option of the Contractor, the curbs may be precast or cast-in-place. Cast-in-place curbs shall be divided into sections 8 to 10 feet in length using steel divider plates. The divider plates shall extend completely through the concrete and shall be removed. Precast curbs shall be cast in lengths of 4 to 5 feet. All exposed surfaces of concrete shall be finished smooth. All sharp edges and the edges of joints and divisions shall be tooled to 1/4 inch radius. Steel reinforcement shall be installed where the curb crosses pipe trenches or other insecure foundations. Such reinforcement shall consist of two (2) No. 4 deformed bars near the bottom of the curb and shall extend at least 24 inches beyond the insecure area. Transverse expansion joints shall be installed at all curb returns and at intervals of approximately 40 feet.

J. Column base plates, bearing plates for beams and similar structural members, machinery and equipment bases shall, after being plumbed and properly positioned, be provided with full bearing with nonshrink grout. Concrete surfaces shall be rough, clean, free of oil, grease, and laitance and shall be moistened

thoroughly immediately before grout is placed. Metal surfaces shall be clean and free of oil, grease and rust. Mixing and placing shall be in conformance with the material manufacturer's printed instructions. After the grout has set, exposed surfaces shall be cut back one (1) inch and covered with a parge coat of mortar consisting of one (1) part Portland cement, two (2) parts sand and sufficient water to make the mixture placeable. Parge coat shall have a smooth dense finish. Exposed surfaces of grout and parge coat shall be water cured with wet burlap for seven (7) days.

K. Grout fill which is formed in place by using rotating equipment as a screen, such as clarifiers and similar types of equipment, shall be mixed in proportions and consistencies as required by the manufacturer or supplier of the equipment.

L. Watertightness:

1. The structures which are intended to contain liquids and/or will be subjected to exterior hydrostatic pressures shall be so constructed that, when completed and tested, there shall be no loss of water and no wet spots shall show.

2. As soon as practicable, after the completion of the structures, the Contractor shall fill them with water and if leakages develop or wet spots show, the Contractor shall empty such structures and correct the leakage in an approved manner. Any cracks which appear in the concrete shall be dug out and suitably repaired. Temporary bulkheads over pipe openings in walls shall be provided as required for the testing.

3. After repairs, if any are required, the structures shall be tested again and further repaired if necessary until satisfactory results are obtained. All work in connection with these tests and repairs shall be at the expense of the Contractor.

4. Waterstops shall be placed in other locations as indicated on the Drawings and as may be required to assure the watertightness of all containers of liquids. Special shop fabricated ells, tees and crosses shall be provided at junctions. Waterstops shall be extended at least 6 inches beyond end of placement in order to provide splice length for subsequent placement. In slabs and tank bottoms, water stops shall be turned up to be made continuous with waterstops at bottom of walls or in walls.

5. Joints between pipe (except cast iron wall pipe) and cast-in-place concrete walls shall be sealed by means of a groove cast completely around the pipe; the groove shall be filled with a quick setting hydraulic compound similar and equal to Waterplug as made by Standard Dry Wall Products, Inc., mixed and applied in accordance with the manufacturer's instructions.

M. Unless otherwise shown or directed, all pumps, other equipment, and items such as lockers, motor control centers and the like, shall be installed on concrete bases. The bases shall be constructed to the dimensions shown on the plans or as required to meet plan elevations. Where no specific plan elevations are

required, the bases shall be 6 inches thick and shall extend 3 inches outside the metal equipment base. In general, the concrete bases shall be placed up to 1-inch below the metal base. The equipment shall then be properly shimmied to grade and the 1-inch void filled with nonshrink grout. Prior to the final set of the grout it shall be cut back and the edge plastered with 1:2 cement mortar.

N. Concrete which, in the opinion of the Architect-Engineer, has excessive honeycomb, aggregate pockets or depressions will be rejected and the Contractor shall, at his own expense, remove the entire section containing such defects and replace it with acceptable concrete.

O. Manhole or access steps shall be plastic, constructed of copolymer polypropylene meeting the requirements of ASTM D 2146 for Type II, Grade 16906 material. Step shall be reinforced with ASTM A 615, Grade 60, #4 deformed steel reinforcing bar, be 9" deep, 14" wide, provided with notched tread ridge, foot retainer lugs on each side of tread and penetration stops for press fit installation. Plastic steps shall be PS2-PF as manufactured by M.A. industries, Inc., Peachtree City, Georgia. Steps shall be installed by drilling 1" diameter holes, minimum 3-3/4 inches deep into the wall, and then driving steps into hole to the penetration stop, resulting in a press fit condition.

P. Tank pressure relief valves shall be 6" diameter Neenah Foundry Company R-5001-1, American Valve & Hydrant B315.1, or equal, floor type, with outside hooks or inside self-contained lock; quantity and spacing as shown on structural drawings. No part of pressure relief valves shall project above the neat line of the tank floor to prevent fouling of scraper mechanisms where used.

Q. All existing contact surfaces with new patch shall be coated with moisture insensitive epoxy bonding adhesive, Sikadur Hi-Mod, Sonobond, or equal. Patch shall consist of base pour of 4,000 psi structural concrete, then a topping of non-shrink natural aggregate grout, Master Builders Masterflow 713, Sonogrout, or equal, mixed and placed in accordance with manufacturer's instructions, to the thicknesses shown on Drawings. Coat base pour with epoxy bonding adhesive prior to placing grout course.

SECTION 03395 - CURING, SEALING, AND HARDENING CONCRETE FLOORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Single application cure-seal-hardener for new concrete floors.

B. Precautions for avoiding staining concrete before and after application.

1.02 SUBMITTALS

A. Submit under provisions of Section 01300.

B. Material requirements for concrete to which cure-seal-hardener is to be applied, including cement type, water-cement ratio, type of trowel finish, limitations on admixtures, pigments, bonding agents, and bond breakers, etc.

C. Product Data: Manufacturer's data sheets, including product specifications, test data, preparation instructions and recommendations, storage and handling requirements and recommendations, and installation methods.

D. Maintenance instructions, including precautions for avoiding staining after application.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Applicator experienced with installation of product and certified by manufacturer, or applicator experienced with similar products and providing manufacturer's field technician on site to advise on application procedures; and providing adequate number of skilled workers trained and familiar with application requirements.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver product in factory numbered and sealed drums, with numbers recorded for Owner's records.

B. Store products in manufacturer's unopened drums until ready for installation.

1.05 PROJECT CONDITIONS

A. No satisfactory procedures are available to remove petroleum or rust stains from concrete. Prevention is therefore essential. Take precautions to prevent staining of concrete prior to application of cure-seal-hardener and for minimum of three months after application:

1. Prohibit parking of vehicles on concrete slab.

2. If construction equipment must be used for application, diaper all components that might drip oil, hydraulic fluid, or other liquids.

3. Prohibit pipe cutting using pipe cutting machinery on concrete slab.

4. Prohibit temporary placement and storage of steel members on concrete slab.

B. Do not install products under environmental conditions outside manufacturer's absolute limits.

C. Do not use frozen material; thaw and agitate prior to use.

1.06 WARRANTY

A. Provide manufacturer's warranty that a structurally sound concrete surface prepared and treated according to the manufacturer's directions will remain permanently dustproof, hardened and water repellent. If after the specified sealing period the treated surface does not remain dustproof, hardened and water repellent, provide, at manufacturer's expense, sufficient material to reseal defective areas.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturer: Curecrete Distribution, Inc; 1203 West Spring Creek Place, Springville, UT 84663. ASD. Tel: (800) 998-5664. Fax: (801) 489-3307. Email: techsupport@ashfordformula.com. www.ashfordformula.com

2.02 MATERIALS

A. Cure-Seal-Hardener: Ashford Formula; water-based chemically-reactive penetrating sealer and hardener, that seals by densifying concrete so that water molecules cannot pass through but air and water vapor can, while allowing concrete to achieve full compressive strength, minimizing surface crazing, and eliminating dusting.

1. Colorless, transparent, odorless, non-toxic, non-flammable.

2. Containing no solvents or volatile organic compounds.

3. USDA approved for food handling facilities.

4. Allowing traffic on floors within 2 to 3 hours, with chemical process complete within 3 months.

5. No change to surface appearance except a sheen developed due to traffic and cleaning.

B. Water: Clean, potable.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared and are suitable for application of product.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. If this is the applicator's first project using this product, provide the manufacturer's technical representative on-site to familiarize installers with proper procedures.

C. Prevent damage to and soiling of adjacent work.

D. New Concrete: Apply cure-seal-hardener to new concrete as soon as the concrete is firm enough to work on after troweling, except on colored concrete wait minimum of 30 days.

1. Spray on at rate of 200 square feet per gallon (4.8 sq m/L).

2. Keep surfaces wet with cure-seal-hardener for minimum soak-in period of 30 minutes, without allowing drying out or becoming slippery. In hot weather slipperiness may appear before the 30 minute time period has elapsed. If that occurs, apply more cure-seal-hardener as required to keep entire surface in a non-slippery state for the first 15 minutes. For the remaining 15 minutes, mist the surface as needed with water to keep the material in a non-slippery state.

3. After this period, when treated surface becomes slippery lightly mist with water until slipperiness disappears.

4. Wait for surface to become slippery again and then flush entire surface with water removing all residue of cure-seal-hardener.

5. Squeegee surface completely dry, flushing any remaining slippery areas until no residue remains.

6. Wet vacuum or scrubbing machines may be used to remove residue, provided manufacturer's instructions are followed.

3.04 PROTECTION

A. Protect installed floors until chemical reaction process is complete; at least three months.

1. Comply with precautions listed under PROJECT CONDITIONS.

2. Clean floor regularly in accordance with manufacturer's recommendations because water will accelerate the sealing and scrubbing will impart a shine.

3. Clean up spills immediately and spot-treat stains with good degreaser or oil emulsifier.

B. Precautions cleaning are the responsibility of the General Contractor until Substantial Completion.

SECTION 03405 - PRECAST CONCRETE VAULTS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install all precast sections as shown on the Drawings and specified herein.

1.02 SUBMITTALS

A. Shop drawings shall be submitted in accordance with Section 01340.

1.03 QUALITY ASSURANCE

A. All precast concrete shall conform to all applicable provisions of Section 03300 "Cast-in-Place Concrete."

B. The following publications form a part of this Specification to the extent indicated by the reference thereto:

1. ASTM C478.

2. ASTM C 76.

3. ASTM C850.

PART 2 - PRODUCTS

2.01 CIRCULAR PRECAST CONCRETE BARREL SECTIONS

A. Circular precast concrete barrel section for wet wells, valve vaults or manholes shall conform to ASTM C 478 except sections deeper than 12 feet shall have reinforcing equal to that of ASTM C 76 Class III reinforced concrete pipe, unless otherwise noted on the Drawings.

B. AASHTO M-198-75 performed flexible butyl type joint sealant, Hamilton-Kent "Kent-Seal No. 2", K. T. Snyder Company "Rub'r-Nek", Press Seal Gasket "E-Z Stik," or equal; or joined with bituminous mastic joint sealing compound meeting Kentucky Department of Transportation Specifications 807.02.04. When making joints with mastic compound, prime and seal all joints with primer supplied with the joint compound. Joints shall be watertight.

2.02 CONCRETE BASE AND TOP SLABS

A. Reinforced concrete base and top slab shall be 4,000 psi concrete of the dimensions shown on the Drawings and conforming to the requirements of Section 03300 hereinbefore.

B. A precast concrete top slab (for the wet well) may be used in lieu of the cast-in-place top slab shown on the Drawings. Reinforcing shall be equivalent to that shown on the Drawings. Wet well access hatch and wet well vent shall be cast in the top slab.

C. Base shall be 9" of compacted DGA to allow for drainage.

D. Vault covers shall be cast iron with minimum clear opening of 22" and be marked in larger letters "WATER"

2.03 JOINT SEALERS

A. Joints shall be sealed with AASHTO M-198-75 performed flexible butyl type joint sealant, Hamilton-Kent "Kent-Seal No. 2", K. T. Snyder Company "Rub'r-Nek", Press Seal Gasket "E-Z Stik," or equal; or joined with bituminous mastic joint sealing compound meeting Kentucky Department of Transportation Specifications 807.02.04. When making joints with mastic compound, prime and seal all joints with primer supplied with the joint compound. Joints shall be watertight.

PART 3 - EXECUTION

3.01 JOINTS

A. Joints shall be sealed with an approved sealant as specified in Part 2, and shall be mortared or grouted.

B. When making joints with mastic compound, prime and seal all joints with primer supplied with the joint compound.

C. Joints shall be watertight.

SECTION 05

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SECTION 05511- FIXED METAL LADDERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fixed aluminum wall ladders.

B. Fasteners and installation accessories.

1.02 REFERENCES

A. ANSI A14.3 - American National Standard for Ladders -- Fixed -- Safety Requirements; 1992.

B. ASTM B 210 - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2002.

C. ASTM B 221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2000.

D. ASTM B 308 - Standard Specification for Aluminum - Alloy T6061-T6 Standard Structural; 2002

E. OSHA 29 CFR Standard 1910.27 - Fixed ladders; Occupational Safety and Health Standards; current edition

1.03 SUBMITTALS

A. Submit under provisions of Section 01340.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Installation methods.

C. Shop Drawings: Detailed drawings showing complete dimensions, all materials, mounting attachments, and fabrication details.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in the engineering and manufacturing of metal ladders, with not less than twenty years of experience.

1.05 WARRANTY

A. See Section 01782 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's standard limited five-year warranty against defects in materials and workmanship.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable Manufacturers: Subject to compliance with requirements, provide products of one of the following:

1. Alaco Ladder Co.
2. ACL Industries, Inc.
3. Jomy Products, Inc.
4. O'Keeffe's, Inc.

B. Requests for substitutions will be considered in accordance with provisions of Section 01631.

2.02 MATERIALS

A. Extruded Aluminum Profiles: ASTM B 221, ASTM B 210, ASTM B 308, Alloy 6061-T6; standard mill finish.

B. Aluminum Sheet and Plate: ASTM B 209, Alloy 6061-T6; standard mill finish.

C. Fasteners: Aluminum solid aircraft rivets rated at 300 lbs shear strength.

D. Cast fittings, connectors and rung ends: Cast Aluminum alloy 356

2.03 LADDERS

A. Ladders - General: Comply with ANSI A14.3 and OSHA regulations.

B. Fixed Wall Ladders: Extruded aluminum; serrated rungs 1-1/8 inches (29 mm) in diameter, connected to 2-7/8 inch (73 mm) side rail channels with cast aluminum rung connectors, each secured to rails by means of four solid aircraft rivets.

1. Capacity: 500 lbs (225 kg).

2. 24" Wide.

2.04 FINISHES

A. Provide all aluminum in standard mill finish.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings, and in compliance with ANSI A14.3 and OSHA 1910.27.

3.03 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

SECTION 05520 - HANDRAILS AND RAILINGS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Extent and dimensions of handrails and railings are indicated on Drawings and include miscellaneous handrails and railing systems not included in other Sections of these Specifications.

B. Type of handrails and railing systems in this Section is aluminum pipe handrails and railing systems.

C. Products furnished but not installed under this Section include inserts and anchors preset in masonry and concrete for anchorage of hand rails and railing systems.

1.02 SUBMITTALS

A. Product Data: Manufacturer's technical data for products and processes used in handrails and railing systems, including finishes and grout.

B. Shop Drawings: Shop details of fabrication and installation for each type and material of handrail and railing system required including plans, elevations, sections, profiles of rails, fittings, connections, and anchors.

C. Samples: Prepare samples of each type of metal finish required on metal of same thickness and alloy indicated for final work. Where finish involves normal color and texture variations, include sample sets composed of two (2) or more units showing limits of such variations expected in completed work. Include 6" long samples of each distinctly different railing member including handrails, top rails, posts, and samples of fittings and brackets.

1.03 DEFINITIONS

A. Definitions in ASTM E 985 for railing-related terms apply to this Section.

1.04 SYSTEM DESCRIPTION

A. Structural Performance of Handrails and Railing Systems: Design, engineer, fabricate, and install handrails and railing systems to withstand the following structural loads without exceeding the allowable design working stress of the materials for handrails, railing systems, anchors, and connections. Apply each load to produce the maximum stress in each of the respective components comprising handrails and railing systems.

1. Top Rail of Guardrail Systems: Concentrated load of 200 lbf (890 N) applied at any point and in any direction and a uniform load of 50 lbf per linear foot (730 N/m) applied horizontally and concurrently with a uniform load of 100 lbf per linear foot (1460 N/m) applied vertically downward.

Concentrated and uniform loads need not be assumed to act concurrently.

2. Handrails Not Serving as Top Rails: Concentrated load of 200 lbf (890 N) applied at any point and in any direction and a uniform load of 50 lbf per linear foot (730 N/m) applied in any direction. Concentrated and uniform loads need not be assumed to act concurrently.

3. Infill Area of Guardrail Systems: Horizontal concentrated load of 200 lbf (890 N) applied to 1 sq. ft. (0.09 sq. m) at any point in the system including gates, panels, intermediate rails, balusters, or other elements composing the infill area. Loads on infill area need not be assumed to act concurrently with loads on top rails.

B. Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

C. Material for rails and gates shall be a minimum of 1-1/2" diameter Schedule 40 and for posts, a minimum of Schedule 80.

1.05 QUALITY ASSURANCE

A. Single Source Responsibility: Obtain handrails and railing systems of each type and material from a single manufacturer.

B. Design Responsibility: Engage a qualified professional engineer to prepare or supervise the preparation of structural computations for handrails and railing systems to determine compliance with structural performance requirements indicated.

1.06 STORAGE

A. Store handrails and railing systems in clean, dry location, away from uncured concrete and masonry, protected against damage of any kind. Cover with waterproof paper, tarpaulin, or polyethylene sheeting; allow for air circulation inside the covering.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, provide handrails and railing systems of one of the following, or an approved equal. Handrail System shall be equal to "TUFRAIL" as manufactured by Thompson Fabricating Company.

1. Thompson Fabricating Company, Inc., Birmingham, Alabama.

2. Superior Railing Company

3. Alumaguard

2.02 METALS

A. General: Comply with standards indicated for forms and types of metals indicated or required for handrail and railing system components.

B. Aluminum: Provide alloy and temper recommended by aluminum producer or finisher for type of use and finish indicated, and with not less than the strength and durability properties of the alloy and temper designated below for each aluminum form required.

1. Extruded Bar and Shapes: ASTM B 221, 6063-T6.

2. Extruded Pipe and Tube: ASTM B 429, 6063-T6.

3. Plate and Sheet: ASTM B 209, 6061-T6.

4. Die and Hand Forgings: ASTM B 247, 6061-T6.

5. Castings: ASTM B 26, 356-T6.

2.03 MISCELLANEOUS MATERIALS

A. Nonshrink Nonmetallic Grout: Pre-mixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with CE CRD C621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this Section.

B. Welding Electrodes and Filler Metal: Provide type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS Specifications, and as required for color match, strength, and compatibility in fabricated items.

C. Fasteners: Use fasteners of stainless steel for aluminum components, unless otherwise indicated. Do not use metals which are corrosive or incompatible with materials joined.

D. Provide concealed fasteners for interconnection of handrail and railing components and for their attachment to other work except where exposed fasteners are unavoidable or are the standard fastening method for handrail and railing system indicated.

E. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

F. Anchors and Inserts: Provide anchors of type, size, and material required for type of loading and installation condition shown, as recommended by manufacturer, unless otherwise indicated. Use nonferrous metal of hot-dipped galvanized anchors and inserts for exterior locations and elsewhere as required for corrosion resistance. Use toothed steel or expansion bolt devices for drilled-in-place anchors.

G. Galvanizing Repair Paint: High zinc dust content paint for regalvanizing welds in galvanized steel: Sherwin-Williams Zinc-Clad Galvanizing Compound #143-0255 or equal.

H. Bituminous Paint: SSPC-Paint 12 (cold-applied asphalt mastic).

I. Zinc Chromate Primer for Galvanized Metals: Sherwin-Williams Galvite, B50W3 or equal; for Ferrous Metals: Sherwin-Williams KemKromik Universal, B50Z Series or equal.

2.04 FABRICATION

A. General: Fabricate handrails and railing systems to design, dimensions and details shown. Provide handrail and railing members in sizes and profiles indicated, with supporting posts and brackets of size and spacing shown, but not less than required to comply with requirements indicated for structural performance. Handrail systems which use fittings which are glued or pop-riveted will not be acceptable.

B. Shop Assembly: Pre-assemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

C. Nonwelded Connections: Fabricate railing systems and handrails for interconnection of members by means of railing manufacturer's standard concealed mechanical fasteners and fittings unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

D. Welded Connections for Aluminum Pipe: Fabricate aluminum pipe handrails and railing systems for interconnection of members by concealed internal welds, which eliminate surface grinding, using manufacturer's standard system of sleeve and socket fittings.

E. Form changes in direction of railing members by bending members, insertion of prefabricated elbow fittings, radius bends, or by mitering.

F. For handrails and railing systems with nonwelded connections which are exposed to exterior or to moisture from condensation or other sources, provide weepholes or other means for evacuation of entrapped water in hollow sections of railing members.

G. Toe Boards: Where required by O.S.H.A. and where indicated on the Drawings, provide toe boards at railing systems around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details shown or, if not shown, use manufacturer's standard detail. Toe boards shall be 4" high.

H. Brackets, Flanges, Fittings and Anchors: Provide manufacturer's standard wall brackets, flanges, hinges, miscellaneous fittings and anchors for interconnection of handrail and railing members to other work, unless otherwise indicated.

I. Furnish inserts and other anchorage devices for connecting handrails and railing systems to concrete or masonry work. Fabricate anchorage devices which are capable of withstanding loadings imposed by handrails and railing systems. Coordinate anchorage devices with supporting structure.

J. For railing posts set in concrete provide preset sleeves of steel, not less than 6" long and inside dimensions not less than 2" greater than outside dimensions of post, with steel plate forming bottom closure.

K. Provide slip-fit metal sockets to receive removable railing posts. Fabricate sockets for a close fit with posts and to limit deflection of post without lateral load, measured at top, not to exceed 1/12 of post height. Design and fabricate socket covers to resist accidental dislodgement.

L. Gates: Provide gates of equal structural properties of railing system, with toe board. Hinges shall be capable of providing a swing of 180 degrees. Provide positive latching device which shall be operable from both sides of gate.

2.05 METAL FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations and designations of finishes, except as otherwise indicated.

B. Class I Clear Anodized Finish: AA-M10C22A41 (medium satin directional textured mechanical finish; chemical etch, medium matte; 0.7 mil min. thick clear anodic coating) complying with AAMA 607.1.

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate setting drawings, diagrams, templates, instructions, and directions for installation of anchorages, such as sleeves, concrete inserts, anchor bolts, and miscellaneous items having integral anchors, which are to be embedded in concrete as masonry construction. Coordinate delivery of such items to project site.

B. Field Measurements: Take field measurements prior to fabrication.

3.02 INSTALLATION, GENERAL

A. Fit exposed connections accurately together to form tight, hairline joints.

B. Perform cutting, drilling, and fitting required for installation of handrails and railing systems. Set work accurately in location, alignment, and elevation, plumb, level, true, and free of rack, measured from established lines and levels. Do not weld, cut or abrade surfaces of handrails and railing components which have been coated or finished after fabrication, and are intended for field connection by mechanical means without further cutting or fitting.

C. Field Welding: Comply with applicable AWS Specification for procedures of manual shielded metal-arc welding, for appearance and quality, of welds made, and for methods used in correcting welding work. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed welded joints smooth and restore finish to match finish of adjacent rail surfaces.

D. Corrosion Protection: Coat concealed surfaces of aluminum, which will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint or zinc chromate primer.

E. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at 5'-0" o.c. MAX but not more than that required by design loadings.

3.03 ANCHORING POSTS

A. Anchor aluminum handrail posts to concrete with manufacturer's base flange assembly (3 anchors per base) for top and side mount brackets recommended for meeting the design criteria. Base flanges and side mount brackets will not be welded to the post but will be mechanically fastened so as to achieve a rigid construction without annealing the post. All connections to concrete will be made using stainless steel wedge anchors, which are to be sized and furnished by the handrail manufacturer as an integral part of their handrail system. Anchor post on new concrete shall be side mounted except where shown otherwise on the drawings.

B. Anchor posts to metal surfaces with manufacturer's standard fittings designed for this purpose unless otherwise indicated.

C. Provide removable railing sections as indicated, using slip-fit metal sockets. Accurately locate sockets to match post spacing.

3.04 RAILING CONNECTIONS

A. Nonwelded Connections: Use manufacturer's standard mechanical joints for permanently connecting railing components. Components that are glued or pop riveted at the joints will not be acceptable. All components must be mechanically fastened with stainless steel hardware. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic filler cement colored to match finish of handrails and railing systems.

B. Welded Connections: Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contact or use manufacturer's standard fittings designed for this purpose.

3.05 ANCHORING RAILING ENDS

A. Anchor railing ends into concrete or masonry with manufacturer's standard fittings designed for this purpose, unless otherwise indicated.

B. Anchor railing ends to metal surfaces with manufacturer's standard fittings using concealed fasteners, unless otherwise indicated.

C. Expansion Joints: Provide expansion joints at locations indicated or, if not indicated, at intervals not to exceed 40 feet. Provide slip-joint internal sleeve

extending 2" beyond joint on either side; fasten internal sleeve securely to one side, locate joint within 6" of post.

3.06 ATTACHMENT OF HANDRAILS TO WALLS

A. General: Secure handrails to walls with manufacturer's standard wall brackets and end fittings, unless otherwise indicated.

B. For concrete and solid masonry, use drilled-in expansion shields and concealed hanger bolts, unless otherwise indicated.

C. For hollow masonry anchorage, use toggle bolts with square heads, unless otherwise indicated.

3.07 PROTECTION

A. Protect finishes of railing systems and handrails from damage during construction period by use of temporary protective coverings approved by railing manufacturer. Remove protective covering at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items which cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units as required.

SECTION 07

SECTION 07200 - INSULATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services for furnishing and installing the insulation in accordance with the Drawings and as specified herein.

B. Extent of insulation work is shown on Drawings and includes batt insulation for application above the ceiling.

1.02 SUBMITTALS

A. Comply with the requirements of Section 01340.

B. Product Data: Submit manufacturer's product literature and installation instructions for each type of insulation.

1.03 DELIVERY, STORAGE, AND HANDLING

A. General Protection: Protect insulations from physical damage and from becoming wet, soiled, or covered with ice or snow.

B. Comply with manufacturer's recommendations for handling, storage and protection during installation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Owens Corning Fiberglass Corp.

B. Manville Building Materials Corp.

C. Certainteed Corporation

2.02 INSULATING MATERIALS

A. General: Provide insulating materials which comply with requirements indicated for materials, compliance with referenced standards, and other characteristics.

B. Batt Insulation: Glass fiber insulation Type 1 per Fed. Spec. HH-I-521E, incombustible type with a flame spread rating of 25 or less per ASTM E 84, minimum 4" thick and minimum 1.65 pcf density to achieve a U-factor thermal insulating value of 0.117 or better. Provide polyvinyl chloride film vapor retarder with a flame spread rating equal to or better than the insulation, a perm rating of 0.2 or less, and shall be formed and installed to provide a continuous barrier to vapor transmission across the entire ceiling.

C. Mechanical Anchors: Type and size indicated or, if not indicated, as recommended by insulation manufacturer for type of application and condition of substrate.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

A. Require Installer to examine substrate and conditions under which insulation work is to be performed. A satisfactory substrate is one that complied with requirements of the section in which substrate and related work is specified. Obtain installer's written report listing conditions detrimental to performance of work in this section. Do not proceed with installation of insulation until unsatisfactory conditions have been corrected.

B. Clean substrates of substances harmful to insulations or vapor retarders, including removal of projections which might puncture vapor retarders.

3.02 INSTALLATION, GENERAL

A. Comply with manufacturer's instructions for particular conditions of installation in each case. If printed instructions are not available or do not apply to project conditions, consult manufacturer's technical representative for specific recommendations before proceeding with work.

B. Extend insulation full thickness as shown over entire area to be insulated. Cut and fit tightly around obstructions, and fill voids with insulation. Remove projections which interfere with placement.

C. Apply a single layer of insulation of required thickness, unless otherwise shown or required to make up total thickness.

3.03 INSTALLATION OF INSULATION

A. Apply insulation units to substrate by method indicated, complying with manufacturer's recommendations.

B. If no specific method is indicated, bond units to substrate with adhesive or use mechanical anchorage to provide permanent placement and support of units.

3.04 PROTECTION

A. Protect installed insulation from harmful weather exposures and from possible physical abuses, where possible by non-delayed installation of concealing work or, where that is not possible, by temporary covering or enclosure.

SECTION 07611 - STANDING SEAM METAL ROOFING SYSTEM

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish and install roofing, gutters, downspouts, ridge vents, fascia panels, fasteners, clips, flashings, closures, snow guards, vented soffit and miscellaneous accessories required to complete the roofing enclosure, as indicated on the contract drawings.

1.02 RELATED DOCUMENTS SPECIFIED ELSEWHERE

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division-1 Specification sections, apply to work of this section.

B. Rough Carpentry: Section 06100

C. Metal Plate Connected Wood Trusses: Section 06176

1.03 SUBMITTALS

Comply with Section 01340 as well as the requirements specified herein.

A. Shop Drawings: Submit six (6) sets consisting of catalog cuts, design and erection drawings, finish specifications, and other data necessary to clearly describe design, materials, sizes, layouts construction details, fasteners, and erection including panel layouts and details of edge conditions, joints, fastener and sealant placement, flashings, penetrations and curbs, and special details. Distinguish between factory and field assembly work. Drawings shall be approved before fabrication can begin.

B. Erection procedures and instructions shall be submitted with the drawings.

C. Performance Requirements: Submit to verify load-carrying capacities of panel system, fasteners, and expansion control calculations.

D. Certification:

1. Certified laboratory test reports shall be furnished showing that the specified system has been tested and conforms to applicable provisions specified herein.

2. Certification by the manufacturer that the roofing assembly is listed in the UL Building Materials Directory with a Class 90 wind uplift rating shall be submitted and shall include relevant construction number. Certified statements from the manufacturer are not acceptable in lieu of a UL 90 classification.

3. A certified statement from the manufacturer that the roofing system has been manufactured for a minimum of fifteen (15) years shall be provided.

E. Samples and Descriptive Data:

1. Roof panel: full panel width, 12 inches long, including batten.

2. Anchor clips: two required.

3. Fasteners: two of each type to be used; include a statement regarding the intended use.

4. Closures: one metal closure with foam filler.

5. Sealant: one sample of each sealant with a statement regarding the intended use.

6. Ridge Vent, Gutter and Downspouts: descriptive data

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: The manufacturer shall have had at least fifteen (15) years' experience in architectural roofing, and the specified panel system itself shall have been in use for a minimum of fifteen (15) years and shall submit the names and addresses of five (5) previous standing seam metal roofing projects of comparable size, scope, and complexity.

B. Installer's Qualifications: The installer shall have had a minimum of five (5) years' experience in the installation of concealed clip, structural standing seam roofing and shall submit the names and addresses of the five (5) previous standing seam metal roofing projects of comparable size, scope and complexity.

1.05 REFERENCE LATEST EDITIONS OF PUBLICATIONS AND STANDARDS

A. Building Design Codes - uplift, live and dead loads

1. American National Standards Institute, Inc. (ANSI) Publication A58.1.

2. Basic Building Code (BBC), Building Officials and Code Administrators, International (BOCA).

B. Reference Standards:

1. American Iron and Steel Institute (AISI), Specification for the Design of Cold-Formed Steel Structural Members (August 1986).

2. American Society of Steel construction (AISC) Manual of Steel Construction (Current Edition).

3. American Society For Testing and Materials (ASTM).

(a) A792-86 Steel Sheet, Aluminum-Zinc Alloy-Coated by the hot-dip process, general requirements for Galvalume.

(b) G23-81 Weatherometer.

(c) D659-86-Chalking Resistance.

(d) D2244-85 Color Change.

(e) D2247-87 Humidity.

(f) B117-85 Salt Spray.

(g) D1308-87 Pollution Resistance.

(h) D1737-85 Formability.

(i) D2794-84 Impact Resistance or D522.

(j) D968-81 Abrasion Resistance.

(k) E84-81 Surface Burning Characteristics of Building Materials.

C. Underwriters Laboratories (UL)-Building Materials Directory (Current Issue).

1.06 WARRANTY

A. Submit executed copy of metal roof manufacturer's "Warranty" Agreement including flashing endorsement, countersigned by an authorized representative of manufacturer and installer. Provide form that was published with product literature as of date of Contract Documents, for the following periods of time:

1. Materials - 20 years after date of substantial completion.

2. Color - 10 years after date of substantial completion.

1.07 PRE-ROOFING CONFERENCE

A. Prior to installation of roofing and associated work, meet at project site, or other mutually agreed location, with installer, roofing sheet manufacturer, installers of related work, and other entities concerned with roofing performance, including (where applicable) Owner's insurer, test agencies, governing authorities, Engineer, and Owner. Record discussions and agreements and furnish copy to each participant. Provide at least 72 hours advance notice to participants prior to convening pre-roofing conference.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Subject to compliance with requirements, manufacturers offering metal roof or wall panel systems that may be incorporated in the work include but are not limited to the following:

1. AEP-Span

2. ECI Building Components, Inc.

3. Merchant & Evans, Inc. ("Zip-Rib")

4. H.H. Robertson Company

5. Smith Steelite, Inc.

2.02 MATERIALS

A. Metal Panels: Fabricate metal panels from 24 gauge G90 galvanized steel, conforming to ASTM A446, Grade A and ASTM A525.

Panel width to be 16" wide with a minimum of 1 1/2" vertical rib height and four (4) longitudinal ribs located in the pan to minimize oil-canning. The panel system shall be designed as a true standing seam shape, requiring no trapezoidal foam closures, plugs, or fillers at the fascia.

B. Concealed Clips - Standing seam roofing shall be fastened directly to the roof sheathing with 16 gauge G-90 galvanized steel A446 Grade D concealed fastening clips. The clips shall provide for unlimited, unimpeded panel movement confirmed by testing from an independent testing laboratory.

C. Gutters: Fabricate metal gutters from 24 gage steel to match roof panels. Shall be six (6) inches wide.

D. Downspouts: Fabricate metal downspouts from 26 gage steel to match roof panels. 2 ¾ inch by 4 ¼ inch size.

E. Snow Guards: Prefabricated, noncorrosive units, approved for use by the roofing manufacturer, designed to use with roof panels and complete with predrilled holes or hooks for anchoring.

F. Finish:

1. Fluorofinish, hot dipped (1.25 oz) galvanized steel with fluorocarbon, kynar (70%) resin finish. Primer to be 0.2± 0.05 mil. with 0.8± 0.1 mil. exterior topcoat and interior backercoat. Minimum coating for backercoat same as primer.

2. Color of the exterior side shall be selected from the manufacturer's standard color selections by the Owner.

3. Finish performance characteristics shall comply with the following ASTM requirements:

(a) Weatherometer Test (ASTM G23) 2,000 Hours

(b) Chalking Resistance (ASTM D659-80) 2,000 Hours

(c) Color Change (ASTM D2244) 2, Hours

(d) Humidity Test (ASTM D2247) Scribed - (ASTM D1654) Table 1 & 2 1,000 Hours

(e) Salt Spray (ASTM B117) Scribed - (ASTM D1654) Tables 1 & 2 1,000 Hours

(f) Pollution Resistance Test (ASTM D1308) 24 Hours

(g) Formability (ASTM D1737)

(h) Impact Resistance Test (ASTM D2794)

(i) Abrasion Resistance Test (ASTM D968)

G. Ridge vents, flashing fascia, trim and soffit panels shall be of the same material, gauge, finish and color as the panels unless otherwise indicated.

H. Accessories:

1. Fasteners: Screws shall be 300 series stainless steel, No. 14 diameter self-tapping type with 5/8" diameter combination stainless steel and perma-seal neoprene washers. Exposed fasteners shall be color finished to match the panel color. Blind rivets shall be solid threaded sealed stem type and have a weather tight perma-seal neoprene washer under the head.

2. Closures: Profile closures shall be precut from cross linked closed cell polyethylene composition foam. All ridge and hip foam closures shall be protected and supported by a formed metal closure manufactured from the same material as the roofing. Ridge closures shall be factory fabricated and hip closures shall be field cut.

3. Sealants: All sealants shall contain no oil, asbestos, or asphalt.

a. Factory-applied sidelap sealant; non-drying non-skinning, synthetic polymer based, designed for metal-to-metal concealed joints. Use JS-779 by Tremco.

b. Field-applied panel and sealant; extruded polymeric butyl tape, non-skinning and not easily displaced under compression. Use Webbed mastic by Tremco.

c. Exposed sealant; one component, skinning, polyurethane joint sealant. Color to be coordinated with panel color. Use Dymonic By Tremco.

4. Thermal Barriers - The thermal blocks shall be non-treated wood per the manufacturer's recommendations.

5. EDPM Flashing: Rounded penetrations - premolded EDPM boot with metal collar. Provide products by Dektite Builded or an acceptable equivalent.

6. Provide continuous ridge ventilators and screened soffit ventilators to balance the air circulation through the attic space.

2.03 PRODUCT PERFORMANCE

A. Fasten roof panels to the sheathing with concealed anchor clips designed to allow for thermal movement of the panels except where specific fixed points are indicated.

B. There shall be no exposed fasteners except to fasten flashings, or at fixing points, or as indicated on the drawings.

C. Metal gauge minimum thickness shall be 24 gauge.

D. Roofing panels, fascia panels, soffit panels, clips, closures, flashings, and related accessories shall be the product of a single manufacturer.

E. Individual panels shall be removable for replacement of damaged material without disturbing adjacent panels.

F. Panels shall be fabricated in full length with no end laps.

G. The panel system shall be a symmetrical design, allowing panels to be installed in either direction.

H. Water penetration of the panel assembly at 20 psf pressure for 15 minutes shall be **NONE** when tested in accordance with ASTM Test Procedures E331 by recognized independent testing laboratory.

I. Air infiltration of panel assembly by 20 psf pressure shall be no more than 0.0156 cfm/sq. ft. of panel when tested in accordance with ASTM Test Procedure E283 by a recognized independent testing laboratory.

J. The panel system shall have a U.L. Class 90 rating.

K. Deflection shall be L/240 for positive loading.

L. The standing seam panel system shall be designed to safely resist the positive and negative loads as specified below or as indicated on the drawings.

Area	Positive	Negative
Main Roof	40 PSF	25 PSF
Ridge, Eave, Gable	40 PSF	55 PSF
Corners	40 PSF	82 PSF

M. The panels shall withstand a 250 lb. concentrated load applied to a four square inch area at the center of the panel at mid span between supports without panel deformation, rib buckling, or panel sidelap separation that will adversely affect the weather tightness of the system.

PART 3 - EXECUTION

3.01 DELIVERY AND STORAGE

A. Materials shall be delivered to the site in a dry and undamaged condition and unloaded per the manufacturer's instructions. When materials arrive at the site, the installer shall inspect them for damage and stains.

B. The materials shall be stored out of contact with the ground, covered with weather tight covering, and kept dry per the manufacturer's recommendations. Storage accommodations shall provide good air circulation and protection from surface staining.

3.02 INSTALLATION

A. The roofing system shall be installed in accordance with approved erection drawings and instructions.

B. All attachments shall allow for thermal expansion and contraction of the roofing panels.

C. Install the panels in one continuous length from ridge to eave.

D. Seal the exterior perimeter of the closures with gun applied Dymonic caulking, or Proglaze caulking.

E. Seam panels and battens together with electric-powered seaming machine supplied by the manufacturer to ensure sidelap weather tightness.

F. Installed panels shall be protected from abuse by other trades. The Contractor shall be responsible for protecting the roofing from wet cement, plaster, and painting operations. The installer shall provide walk boards in heavy traffic areas to prevent damage to the panels.

G. Battens shall be hand crimped at each anchor clip or seamed before workers can stand on the panels.

3.03 DAMAGED MATERIAL AND CLEANING

A. Replace damaged panels and other components of work which cannot be repaired by finish touch-up similar to minor repair.

B. To prevent rust staining on finished surfaces, immediately remove filings caused by drilling or cutting.

SECTION 07900 - JOINT SEALERS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services for furnishing and installing the joint sealers in accordance with the Drawings and as specified herein.

B. The extent of each form and type of joint sealer is indicated on the drawings and includes but is not limited to, the following general locations:

1. Exterior wall joints.

2. Paving and sidewalk joints.

3. Joints at penetrations of walls, decks, and floors by piping and other services and equipment.

4. Joints between items of equipment and other construction.

5. Joints at windows, doors and louvers.

1.02 SUBMITTALS

Comply with the requirements of Section 01340 as well as the requirements specified herein.

A. Product Data: Submit manufacturer's technical data for each joint sealer product required, including instruction for joint preparation and joint sealer application.

B. Samples for Initial Selection Purposes: Submit manufacturer's standard bead samples consisting of strips of actual products showing full range of colors available, for each product exposed to view.

C. Certificates: Submit certificates from manufacturers of joint sealers attesting that their products comply with specification requirements and are suitable for the use indicated.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Engage an Installer who has successfully completed within the last 3 years at least 3 joint sealer applications similar in type and size to that of this project and who will assign mechanics from these earlier applications to this project of which one will serve as lead mechanic.

B. Single Source Responsibility for Joint Sealer Materials: Obtain joint sealer materials from a single manufacturer for each different product required.

C. System Performance: Provide joint sealers that have been produced and installed to establish and maintain watertight and airtight continuous seals.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to project site in original unopened containers or bundles with labels informing about manufacturer, product name and designation, color, expiration period for use, pot life, curing time and mixing instructions for multi component materials.

B. Store and handle materials to prevent their deterioration or damage due to moisture, temperature changes, contaminants, or other causes.

1.05 PROJECT CONDITIONS

A. Environmental Conditions: Do not proceed with installation of joint sealers under the following conditions:

1. When ambient and substrate temperature conditions are outside the limits permitted by joint sealer manufacturer or below 40 degrees F. (4.4 degrees C).

2. When joint substrates are wet due to rain, frost, condensation or other causes.

B. Joint Width Conditions: Do not proceed with installation of joint sealers when joint widths are less than allowed by joint sealer manufacturer for application indicated.

PART 2 - PRODUCTS

2.01 MATERIALS, GENERAL

A. Compatibility: Provide joint sealers, joint fillers and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by testing and field experience.

B. Colors: Provide color of exposed joint sealers indicated or, if not otherwise indicated, as selected by Architect from manufacturer's standard colors.

2.02 ELASTOMERIC JOINT SEALANTS

A. Elastomeric Sealant Standard: Provide manufacturer's standard chemically curing, elastomeric sealant of base polymer indicated which complies with ASTM C 920 requirements, including those for Type, Grade, Class, and Uses.

B. Two-Part Pourable Urethane Sealant: Type M; Grade NS; Class 25; Uses T, M, A, and as applicable to joint substrates indicated, O.

C. One-Part Nonsag Urethane Sealant: Type S; Grade NS; Class 25; Uses NT, M, A, and as applicable to joint substrates indicated, O.

D. Products: Subject to compliance with requirements, provide one of the following:

1. Two Part, Pourable, Urethane Sealant:

   "Chem-Calk 550"; Bostik Construction Product Division
   "Pourthane"; W.R. Meadows, Inc.
   "Sonolastic Paving Joint Sealant"; Sonneborn Building Products Division, Rexnord Chemical Products, Inc.

2. One-Part Nonsag Urethane Sealant:

   "Chem-Calk 900"; Bostik Construction Products Division
   "Vulkem 116"; Mameco International, Inc.
   "Sonolastic NP 1"; Sonneborn Building Products Division, Rexnord Chemical Products, Inc.

2.03 LATEX JOINT SEALANTS

A. Acrylic-Emulsion Sealant: Manufacturer's standard, one part, nonsag, acrylic, mildew-resistant, acrylic-emulsion sealant complying with ASTM C 384, formulated to be paintable and recommended for exposed applications on interior and on protected exterior exposures involving joint movement of not more than + or - 7.5%.

B. Products: Subject to compliance with requirements, provide one of the following:

   "Chem-Calk 600"; Bostik Construction Products Division
   "AC-20"; Pecora Corp.
   "Sonolac"; Sonneborn Building Products Division;
   Rexnord Chemical Products, Inc.
   "Tremco Acrylic Latex Caulk"; Tremco, Inc.

2.04 JOINT SEALANT BACKING

A. General: Provide sealant backings of material and type which are non-staining; are compatible with joint substrates, sealants, primers and other joint fillers; and are approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Plastic Foam Joint-Fillers: Preformed, compressible, resilient, non-waxing, non-extruding strips of plastic foam of material and size, shape and density to control sealant depth and otherwise contribute to producing optimum sealant performance. Provide either flexible, open cell polyurethane foam or non-gasing, closed-cell polyethylene foam, unless otherwise indicated, subject to approval of sealant manufacturer.

2.05 MISCELLANEOUS MATERIALS

A. Primer: Provide type recommended by joint sealer manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint sealer-substrate and field tests.

B. Cleaners for Nonporous Surfaces: Provide non-staining, chemical cleaner of type acceptable to manufacturer of sealant and sealant backing materials which are not harmful to substrates and adjacent nonporous materials.

C. Masking Tape: Provide non-staining, non-absorbent type compatible with joint sealants and to surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 INSPECTION

A. Require Installer to inspect joints indicated to receive joint sealers for compliance with requirements for joint configuration, installation tolerances and other conditions affecting joint sealer performance.

B. Obtain Installer's written report listing any conditions detrimental to performance of joint sealer work.

C. Do not allow joint sealer work to proceed until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealers to comply with recommendations of joint sealer manufacturers and the following requirements:

1. Remove all foreign material from joint substrates which could interfere with adhesion of joint sealer, including dust; paints, except for permanent protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer; oil; grease; waterproofing; water repellants; water; surface dirt and frost.

2. Clean concrete, masonry and similar porous joint substrate surfaces, by brushing, grinding, blast cleaning, mechanical abrading, acid washing or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealers. Remove loose particles remaining from above cleaning operations by vacuuming or blowing out joints with oil-free compressed air.

3. Remove latence and form release agents from concrete.

4. Clean metal and other non-porous surfaces by chemical cleaners or other means which are not harmful to substrates or leave residues capable of interfering with adhesion of joint sealers.

B. Joint Priming: Prime joint substrates where indicated or where recommended by joint sealer manufacturer based on preconstruction joint sealer-substrate tests or prior experience. Apply primer to comply with joint sealer manufacturer's recommendations. Confine primers to areas of joint sealer bond, do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALERS

A. General: Comply with joint sealer manufacturer's printed installation instructions applicable to products and applications indicated, except where more stringent requirements apply.

B. Elastomeric Sealant Installation Standard: Comply with recommendations of ASTM C 962 for use of joint sealants as applicable to materials, applications and conditions indicated.

C. Latex Sealant Installation Standard: Comply with requirements of ASTM C 790 for use of latex sealants.

D. Installation of Sealant Backings: Install sealant backings to comply with the following requirements:

E. Install joint-fillers of type indicated to provide support of sealants during application and at position required to produce the cross-sectional shapes and depths of installed sealants relative to joint widths which allow optimum sealant movement capability. Do not leave gaps between ends of joint-fillers. Do not stretch, twist, puncture or tear joint-fillers. Remove absorbent joint-fillers which have become wet prior to sealant application and replace with dry material.

F. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration and providing uniform, cross-sectional shapes and depths relative to joint widths which allow optimum sealant movement capability.

G. Tooling of Nonsag Sealants: Immediately after sealant application and prior to time skinning of curing begins, tool sealants to form smooth, uniform beads of configuration indicated, to eliminate air pockets and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents which discolor sealants or adjacent surfaces or are not approved by sealant manufacturer. Provide concave joint configuration per Figure 6A in ASTM C 962, unless otherwise indicated.

3.04 PROTECTION AND CLEANING

A. Protect joint sealers during and after curing period from contact with contaminating substances or from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of substantial completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealers immediately and reseal joints with new materials to produce joint sealer installations with repaired areas indistinguishable from original work.

B. Clean off excess sealants or sealant smears adjacent to joints as work progresses by methods and with cleaning materials approved by manufacturers of joint sealers and of products in which joints occur.

SECTION 08

SECTION 08110 - STEEL DOORS AND FRAMES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and service for furnishing and installing steel doors and frames as indicated and scheduled on drawings.

1.02 QUALITY ASSURANCE

A. Steel Door and Frame Standard: Comply with ANSI A 250.8, unless more stringent requirements are indicated.

B. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 252.

1.03 SUBMITTALS

Comply with Section 01340 as well as the requirements specified herein.

A. Product Data: Submit manufacturer's technical product data substantiating that products comply with requirements.

B. Shop Drawings: Submit for fabrication and installation of steel doors and frames. Include details of each frame type, elevations of door design types, conditions at openings, details of construction, location and installation requirements of finish hardware and reinforcements, and details of joints and connections. Show anchorage and accessory items. Provide schedule of doors and frames using same reference numbers for details and openings as those on contract drawings. Coordinate of glazing frames and stops with glass and glazing requirements.

1.04 DELIVERY, STORAGE AND HANDLING

A. Deliver hollow metal work cartoned or crated to provide protection during transit and job storage. Provide additional sealed plastic wrapping for factory finished doors.

B. Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided refinished items are equal in all respects to new work and acceptable to Architect; otherwise, remove and replace damaged items as directed.

C. Store doors and frames at building site undercover. Place units on minimum 4" high wood blocking. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet,

remove carton immediately. Provide 1/4" spaces between stacked doors to promote air circulation.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Curries Manufacturing, Inc. Series 747 Extra Heavy Duty seamless doors with 16 gauge face panels. Frames are to be 14 gauge.

B. Comparable doors manufactured by Steelcraft, or The Ceco Corp. are acceptable.

2.02 MATERIALS

A. Hot-Rolled Steel Sheets and Strip: Commercial quality carbon steel, pickled and oiled, complying with ASTM A 569 and ASTM A 568.

B. Galvanized Steel Sheets: Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A 526, with ASTM A 525, G60 zinc coating, mill phosphatized.

C. Cold-Rolled Steel Sheets: Commercial quality carbon steel, complying with ASTM A 366 and ASTM A 568.

D. Supports and Anchors: Fabricate of not less than 18 gage galvanized sheet steel.

E. Inserts, Bolts, and Fasteners: Manufacturer's standard units, except hot-dip galvanized items to be built into exterior walls, complying with ASTM A 153, Class C or D as applicable.

F. Shop Applied Paint:

Primer: Rust-inhibitive enamel or paint, either air-drying or baking, suitable as a base for specified finish paints.

2.03 FABRICATION, GENERAL

A. Fabricate steel door and frame units to be rigid, neat in appearance and free from defects, warp or buckle. Wherever practicable, fit and assemble units in manufacturer's plant. Clearly identify work that cannot be permanently factory-assembled before shipment, to assure proper assembly at project site. Comply with SDI-100 requirements as applicable.

B. Fabricate exposed faces of doors and panels, including stiles and rails of nonflush units from only cold-rolled steel.

C. Fabricate frames, concealed stiffeners, reinforcement, edge channels, louvers and moldings from either cold-rolled or hot-rolled steel (at fabricator's option).

D. Fabricate doors, panels, and frames from galvanized sheet steel. Close top and bottom edges of exterior doors as integral part of door construction or by addition of minimum 16-gage inverted steel channels.

E. Exposed Fasteners: Unless otherwise indicated, provide counter sunk flat Phillips heads for exposed screws and bolts.

F. Finish Hardware Preparation: Prepare doors and frames to receive mortised and concealed finish hardware in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A 115 series specifications for door and frame preparation for hardware.

G. Reinforce doors and frames to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.

H. Locate finish hardware as indicated on final shop drawings or, if not indicated, in accordance with "Recommended Locations for Builder's Hardware", published by Door and Hardware Institute.

I. Shop Painting:

1. Clean, treat, and paint exposed surfaces of steel door and frame units.

2. Clean steel surfaces of mill scale, rust, oil, grease, dirt, and other foreign materials before application of paint.

3. Apply shop coat of prime paint of even consistency to provide a uniformly finished surface ready to receive finish paint.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install standard sheet doors, frames, and accessories in accordance with final shop drawings, manufacturer's data, and as herein specified.

B. Placing Frames: Comply with provisions of SDI-105 "Recommended Erection Instructions for Steel Frames", unless otherwise indicated. Except for frames located at in-place concrete or masonry and at drywall installations, place frames prior to construction of enclosing walls and ceilings. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is completed, remove temporary braces and spreaders leaving surfaces smooth and undamaged. In masonry construction, locate 3 wall anchors per jamb at hinge and strike levels. At in-place masonry construction, set frames and secure to adjacent construction with machine screws and masonry anchorage devices.

C. Door Installation: Fit hollow metal doors accurately in frames, within clearances specified in SDI-100.

3.02 ADJUSTING AND CLEANING

A. Prime Coat Touch-up: Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

B. Protection Removal: Immediately prior to final inspection, remove protective plastic wrappings from prefinished doors.

C. Final Adjustments: Check and readjust operating finish hardware items, leaving steel doors and frames undamaged and in complete and proper operating condition.

SECTION 08330 - OVERHEAD COILING DOORS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipments and services for furnishing and installing the overhead coiling doors in accordance with the Drawings and specified herein.

B. Provide complete operating door assemblies including insulated door curtains, guides, counterbalance mechanisms, hardware, operators and installation accessories.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product data, roughing in diagrams, and installation instructions for each type and size of overhead coiling door. Provide operating instructions and maintenance information, and complete information describing fire release system including electrical rough-in instructions.

B. Shop Drawings: Submit shop drawings for special components and installations which are not fully dimensioned or detailed on manufacturers data sheets.

C. Comply with all requirements of Section 01340 as well as those specified herein.

1.03 QUALITY ASSURANCE

A. Furnish each overhead coiling door as a complete unit produced by one manufacturer, including hardware, accessories, mounting and installation components.

B. Unless otherwise acceptable to Architect, furnish overhead coiling door units by one manufacturer for entire project.

C. Inserts and Anchorages: Furnish inserts and anchoring devices which must be set in concrete or built into masonry for the installation of the units. Provide setting drawings, templates, instructions, and directions for installation of anchorage devices. Coordinate delivery with other work to avoid delay.

D. See concrete and masonry sections of these specifications for installation of inserts and anchorage devices.

E. Wind Loading: Design and reinforce overhead coiling doors to withstand a 20 lb. per sq. ft. wind loading pressure unless otherwise indicated.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

Subject to compliance with requirements, provide products of one of the following:

A. Kinnear Div., Harsco Corp.

B. North American Door, Div. of Jim Walters.

C. Overhead Door Corp.

D. Or equal

2.02 DOOR CURTAIN MATERIALS AND CONSTRUCTION

A. Door Curtain: Fabricate overhead coiling door curtain of interlocking slats designed to withstand required wind loading, of continuous length for width of door without splices. Unless otherwise indicated, provide slats of material gage recommended by door manufacturer for size and type of door required, and as fabricated of structural quality, cold-rolled galvanized steel sheets complying with ASTM A 446, Grade A, with C90 zinc coating, complying with ASTM A 525, and phosphate treated before fabrication. Furnish manufacturer's standard "flat-face" slats with flat galvanized back cover enclosing 3/4" thick closed cell polyethylene foam insulation (U=.50).

B. Endlocks: Malleable iron castings galvanized after fabrication, secured to curtain slats with galvanized rivets. Provide locks on alternate curtain slats for curtain alignment and resistance against lateral movement.

C. Bottom Bar: Consisting of 2 angles, each not less than 1-1/2" x 1-1/2" x 1/8" thick, either galvanized or stainless steel or aluminum extrusions to suit type of curtain slats. Provide a replace able gasket of flexible vinyl or neoprene between angles as a weather seal and cushion bumper for manually operated doors unless shown as an overlapping joint.

D. Curtain Jamb Guides: Fabricate curtain jamb guides of steel angles, or channels and angles with sufficient depth and strength to retain curtain loading. Build-up units with minimum 3/16" thick steel sections, galvanized after fabrication. Slot bolt holes for track adjustment. Secure continuous wall angle to wall framing by 3/8" mini mum bolts at not more than 30" o.c., unless closer spacing recommended by door manufacturer. Extend wall angles above door opening head to support coil brackets, unless otherwise indicated. Place anchor bolts on exterior wall guides so they are concealed when door is in closed position. Provide removable stops on guides to prevent over-travel of curtain, and continuous bar for holding windlocks.

E. Weather Seals: Provide vinyl or neoprene weatherstripping for exterior exposed doors except where otherwise indicated. At door heads, use 1/8" thick continuous sheet secured to inside of curtain coil hood. At door jambs, use 1/8" thick continuous strip secured to exterior side of jamb guide.

2.03 COUNTERBALANCING MECHANISM

A. Counterbalance doors by means of adjustable steel helical torsion spring, mounted around a steel shaft and mounted in a spring barrel and connected to door curtain with required barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.

B. Counterbalance Barrel: Fabricate spring barrel of hot- formed structural quality carbon steel, welded or seamless pipe, of sufficient diameter and wall thickness to support roll-up of curtain without distortion of slats and limit barrel deflection to not more than 0.03" per ft. of span under full load. Provide spring balance of one or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Provide cast steel barrel plugs to secure ends of springs to barrel and shaft. Fabricate torsion rod for counterbalance shaft of case-hardened steel, of required size to hold fixed spring ends and carry torsional load.

C. Brackets: Provide mounting brackets of manufacturer's standard design, either cast iron or cold-rolled steel plate with bell mouth guide groove for curtain.

D. Hood: Form to entirely enclose coiled curtain and operating mechanism at opening head and act as weather seal. Contour to suit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Provide closed ends for surface- mounted hoods, and any portion of between-jamb mounting projecting beyond wall face. Provide intermediate support brackets as required to prevent sag. Fabricate steel hoods for doors of not less than 24 gage hot- dip galvanized steel sheet with G 90 zinc coating, complying with ASTM A 525. Phosphate treat before fabrication.

2.04 PAINTING

A. Shop clean and prime ferrous metal and galvanized surfaces, exposed and unexposed, except facing and lubricated surfaces, with door manufacturer's standard rust inhibitive primer.

B. Owner will select color.

2.05 ELECTRIC DOOR OPERATORS:

A. Provide electric motor operator consisting of 1/2 HP motor, #120 volts, 1 phase service, with high starting torque instant reversing, and with automatic reset thermal overload. The reversing, contactor shall be electrically and mechanically interlocked. Control circuit will be 24-volt AC, Class 2, three (3) button OPEN, CLOSE, STOP. Mounting position shall be top-of-hood. Backup/emergency chain hoist shall not be located more then 14" from door opening. Operator shall be Model RDA as manufactured by Overhead Door, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install door and operating equipment complete with necessary hardware, jamb and head mold strips, anchors, inserts, hangers, and equipment supports in accordance with final shop drawings, manufacturer's instructions, and as specified herein.

SECTION 09

SECTION 09960 - HIGH PERFORMANCE PAINTS AND COATINGS – WATER PLANT

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide all labor, materials, equipment and services for furnishing and installing the finishes as indicated on drawings and schedules, and as herein specified.

B. Work includes painting and finishing of interior and exterior exposed items and surfaces throughout project, except as otherwise indicated. Surface preparation, priming and coats of paint specified are in addition to shop-priming and surface treatment specified under other sections of work.

C. Work includes field painting of exposed bare and covered pipes and ducts (including color coding), and of hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work, except as otherwise indicated.

D. "Paint" as used herein means all coating systems materials, including primers, emulsions, enamels, stains, sealers and fillers, and other applied materials whether used as prime, intermediate or finish coats.

E. Surfaces to be Painted: Except where natural finish of material is specifically noted as a surface not to be painted, paint exposed surfaces whether or not colors are designated in "schedules". If color or finish is not designated, Owner/Engineer will select these from standard colors or finishes available.

F. Following categories of work are not included as part of field- applied finish work.

1. Pre-Finished Items: Unless otherwise indicated, do not include painting when factory-finishing or installer-finishing is specified for such items as (but not limited to) toilet enclosures, prefinished partition systems, acoustic materials, architectural woodwork and casework, and finish mechanical and electrical equipment, including light fixtures, switchgear, and distribution cabinets.

2. Concealed Surfaces: Unless otherwise indicated, painting is not required on surfaces such as walls or ceilings in concealed areas and generally inaccessible areas, furred areas, pipe spaces, and duct shafts.

3. Finished Metal Surfaces: Unless otherwise indicated, metal surfaces of anodized aluminum, stainless steel, chromium plate, copper, bronze and similar finished materials will not require finish painting.

4. Operating Parts: Unless otherwise indicated, moving parts of operating units, mechanical and electrical parts, such as valve and damper operators, linkages, sinkages, sensing devices, motor and fan shafts will not require finish painting.

G. Following categories of work are included under other sections of these Specifications.

1. Shop Priming: Unless otherwise specified, shop priming of ferrous metal items is included under various sections for structural steel, metal fabrications, hollow metal work and similar items.

2. Unless otherwise specified, shop priming of fabricated components such as architectural woodwork, wood casework and shop-fabricated or factory-built mechanical and electrical equipment or accessories is included under other sections of these Specifications.

H. Do not paint over any code-required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates.

I. PVC plastic process piping shall not be painted, but shall be stenciled and labeled or tagged for identification surfaces. Each type of process piping using PVC pipe shall be installed using the same color pipe.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's technical information including paint label analysis and application instructions for each material proposed for use.

B. Samples: Prior to beginning work, submit color chips for surfaces to be painted. Use representative colors when preparing samples for review. Submit samples for Architect-Engineer's review of color and texture only. Provide a listing of material and application for each coat of each finish sample.

1.03 QUALITY ASSURANCE

A. Single Source Responsibility: Provide primers and other undercoat paint produced by same manufacturer as finish coats. Use only thinners approved by paint manufacturer, and use only within recommended limits.

B. Coordination of Work: Review other sections of these Specifications in which prime paints are to be provided to ensure compatibility of total coatings systems for various substrates. Upon request from other trades, furnish information or characteristics of finish materials provided for use, to ensure compatible prime coats are used.

1.04 DELIVERY AND STORAGE

A. Deliver materials to job site in original, new and unopened packages and containers bearing manufacturer's name and label, and following information:

1. Name or title of material.

2. Fed. Spec. number, if applicable.

3. Manufacturer's stock number, batch number, and date of manufacturer.

4. Manufacturer's name.

5. Contents by volume, for major pigment and vehicle constituents.

6. Thinning instructions.

7. Application instructions.

8. Color name and number.

B. Store materials not in actual use in tightly covered containers. Maintain containers used in storage of paint in a clean condition, free of foreign materials and residue. Protect from freezing where necessary. Keep storage area neat and orderly. Remove oily rags and waste daily. Take all precautions to ensure that workmen and work areas are adequately protected from fire hazards and health hazards resulting from handling, mixing and application of paints.

1.06 JOB CONDITIONS

A. Apply water-base paints only when temperature of surfaces to be painted and surrounding air temperatures are between 50 degrees F (10 degrees C) and 90 degrees F (32 degrees C), unless otherwise permitted or restricted by paint manufacturer's printed instructions.

B. Apply solvent-thinned paints only when temperature of surfaces to be painted and surrounding air temperatures are between 45 degrees F (7 degrees C) and 95 degrees F (35 degrees C), unless otherwise permitted or restricted by paint manufacturer's printed instructions.

C. Do not apply paint in snow, rain, fog or mist, or when relative humidity exceeds 85%, or to damp or wet surfaces, unless otherwise permitted or restricted by paint manufacturer's printed instructions. Painting may be continued during inclement weather if areas and surfaces to be painted are enclosed and heated within temperature limits specified by paint manufacturer during application and drying periods.

D. Paint only when the surface temperature is at least 5 degrees F above the dew point, unless otherwise permitted by paint manufacturer's printed instructions.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include, but are not limited to, the following:

1. Tnemec Company, Inc. (Tnemec)

2. The Sherwin-Williams Company

2.02 MATERIALS

A. Material Quality: Provide best quality grade of various types of coatings as regularly manufactured by acceptable paint materials manufacturers. Materials not displaying manufacturer's identification as a standard, best-grade product will not be acceptable.

B. Proprietary names used to designate colors or materials are not intended to imply that products of named manufacturers are required to exclusion of equivalent products of other manufacturers.

C. Color Pigments: Pure, non-fading, applicable types to suit substrates and service indicated.

1. Lead content in pigment, if any, is limited to contain not more than 0.06% lead, as lead metal based on the total non-volatile (dry-film) of paint by weight.

PART 3 - EXECUTION

3.01 INSPECTION

A. Applicator must examine areas and conditions under which painting work is to be applied and notify Contractor in writing of conditions detrimental to proper and timely completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to Applicator.

B. Starting of painting work will be construed as Applicator's acceptance of surfaces and conditions within any particular area.

C. Do not paint over dirt, rust, scale, grease, moisture, scuffed surfaces, or conditions otherwise detrimental to formation of a durable paint film.

3.02 SURFACE PREPARATION

A. General: Perform preparation and cleaning procedures in accordance with paint manufacturer's instructions and as herein specified, for each particular substrate condition.

1. Provide barrier coats over incompatible primers or remove and re-prime as required. Notify Architect-Architect-Engineer in writing of any anticipated problems in using the specified coating systems with substrates primed by others.

2. Remove hardware, hardware accessories, machined surfaces, plates, lighting fixtures, and similar items in place and not to be finish-painted, or provide surface-applied protection prior to surface preparation and painting operations. Remove, if necessary, for complete painting of items and adjacent surfaces. Following completion of painting of each space or area, reinstall removed items.

3. Clean surfaces to be painted before applying paint or surface treatments. Remove oil and grease prior to mechanical cleaning per SSPC SP-1.

Program cleaning and painting so that contaminants from cleaning process will not fall onto wet, newly-painted surfaces.

4. Abrasives for blasting shall be sharp, washed, salt free, angular, and free from feldspar or other constituents that tend to breakdown and remain on the surface.

5. Concrete floors shall be dry as indicated by testing in accordance with ASTM D4263, Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.

B. Cementitious Materials: Per ASTM D4261, Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating, prepare cementitious surfaces of concrete block to be painted by removing efflorescence, chalk, dust, dirt, grease, oils, and by roughening as required to remove glaze. Per ASTM D4262, Standard Test Method for pH of Chemically Cleaned or Etched Concrete Surfaces, determine alkalinity of surfaces to be painted by performing appropriate tests. If surfaces are found to be sufficiently alkaline to cause blistering and burning of finish paint, correct this condition before application of paint. Test the surface for moisture and do not paint over surfaces where moisture content exceeds that permitted in manufacturer's printed directions.

C. Wood: Clean wood surfaces to be painted of dirt, oil, or other foreign substances with scrapers, mineral spirits, and sandpaper, as required. Sandpaper smooth those finished surfaces exposed to view, and dust off. Scrape and clean small, dry, seasoned knots and apply a thin coat of white shellac or other recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty or plastic wood-filler. Sandpaper smooth when dried.

1. Prime, stain, or seal wood required to be job-painted immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of such wood, including cabinets, counters, cases, paneling.

2. When transparent finish is required, use spar varnish for backpriming.

D. Ferrous Metals: Clean ferrous surfaces, which are not galvanized or shop-coated, of oil, grease, dirt, and other foreign substances by solvent cleaning per SSPC SP-1. Mechanical cleaning shall be in accordance with SSPC-SP6 Commercial Blast Cleaning specifications for non-immersion surfaces and SSPC-SP10 Near White Metal Blast Cleaning for immersion in potable or non-potable water.

E. Galvanized Surfaces: Clean free of oil and surface contaminants with non-petroleum based solvent.

F. Shop Primed Surfaces: Prepare shop-applied prime coats wherever damaged or bare as required by other sections of these Specifications. Clean and touch-up with same type shop primer.

3.03 MATERIALS PREPARATION

A. Mix and prepare painting materials in accordance with manufacturer's directions.

B. Maintain containers used in mixing and application of paint in a clean condition, free of foreign materials and residue.

C. Stir materials before application to produce a mixture of uniform density, and stir as required during application. Do not stir surface film into material. Remove film and, if necessary, strain material before using.

3.04 APPLICATION

A. General: Apply paint in accordance with manufacturer's directions. Use applicators and techniques best suited for substrate and type of material being applied.

1. Painting requirements, surface treatments, and finishes, are indicated in "schedules" of the contract documents and as noted in Paragraph 3.11 hereinafter.

2. Provide finish coats which are compatible with prime paints used.

3. Apply additional coats when undercoats, stains or other conditions show through final coat of paint, until paint film is of uniform finish, color and appearance. Give special attention to insure that surfaces, including edges, corners, crevices, welds, and exposed fasteners receive a dry film thickness equivalent to that of flat surfaces.

4. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Paint surfaces behind permanently- fixed equipment or furniture with prime coat only before final installation of equipment.

5. Paint interior surfaces of ducts, where visible through registers or grilles, with a flat, non-specular black paint.

6. Paint back sides of access panels, and removable or hinged covers to match exposed surfaces.

7. Finish exterior doors on tops, bottoms and side edges same as exterior faces, unless otherwise indicated.

8. Sand lightly between each succeeding enamel or varnish coat.

9. Omit first coat (primer) on metal surfaces which have been shop-primed and touch-up painted, unless otherwise indicated.

B. Scheduling Painting: Apply first-coat material to surfaces that have been cleaned, pretreated or otherwise prepared for painting as soon as practicable after preparation and before subsequent surface deterioration. Allow sufficient time between successive coatings to permit proper drying. Do not recoat until paint has dried to where it feels firm, does not deform or feel sticky under moderate thumb pressure, and application of another coat of paint does not cause lifting or loss of adhesion of the undercoat.

C. Minimum Coating Thickness: Apply materials at not less than manufacturer's recommended spreading rate, to establish a total dry film thickness as indicated or, if not indicated, as recommended by coating manufacturer. **NOTE: PA-2 is only for large flat surfaces.**

D. Mechanical and Electrical Work: Painting of mechanical and electrical work is limited to those items exposed in mechanical equipment rooms and in occupied spaces.

1. Mechanical items to be painted include, but are not limited to, the following:

   a. Piping, pipe hangers, supplementary steel and supports except galvanized surfaces.

   b. Heat exchangers.

   c. Tanks.

   d. Ductwork, insulation.

   e. Motor, mechanical equipment, and supports.

   f. Accessory items.

2. Electrical items to be painted include, but are not limited to, the following:

   a. Conduits and fittings except galvanized surfaces.

   b. Switchgear.

   c. Hanger and support except galvanized surfaces.

E. Prime Coats: Apply prime coat of material which is required to be painted or finished, and which has not been prime coated by others. Recoat primed and sealed surfaces where there is evidence of suction spots or unsealed areas in first coat, to assure a finish coat with no burn- through or other defects due to insufficient sealing.

F. Pigmented (Opaque) Finishes: Completely cover to provide an opaque, smooth surface of uniform finish, color, appearance and coverage. Cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness or other surface imperfections will not be acceptable. Holiday test coated steel in immersion areas in accordance with NACE International RP 0188-90.

G. Transparent (Clear) Finishes: Use multiple coats to produce glass-smooth surface film of even luster. Provide a finish free of laps, cloudiness, color

irregularity, runs, brush marks, orange peel, nail holes, or other surface imperfections. Provide satin finish for final coats, unless otherwise indicated.

H. Completed Work: Match approved samples for color, texture and coverage. Remove, refinish or repaint work not in compliance with specified requirements.

3.05 FIELD QUALITY CONTROL

A. The right is reserved by Owner to invoke the following material testing procedure at any time, and any number of times during period of field painting:

1. Engage services of an independent testing laboratory to sample paint being used. Samples of materials delivered to project site will be taken, identified and sealed, and certified in presence of Contractor.

2. Testing laboratory will perform appropriate tests for any or all of following characteristics: Abrasion resistance, apparent reflectivity, flexibility, washability, absorption, accelerated weathering, dry opacity, accelerated yellowness, recoating, skinning, color retention, alkali resistance and quantitative materials analysis.

B. If test results show that material being used does not comply with specified requirements, Contractor may be directed to stop painting work, and remove non-complying paint; pay for testing; repaint surfaces coated with rejected paint; remove rejected paint from previously painted surfaces if, upon repainting with specified paint, the two coatings are non-compatible.

3.06 CLEAN-UP AND PROTECTION

A. Clean-Up: During progress of work, remove from site discarded paint materials, rubbish, cans and rags at end of each work day.

B. Upon completion of painting work, clean window glass and other paint-spattered surfaces. Remove spattered paint by proper methods of washing and scraping, using care not to scratch or otherwise damage finished surfaces.

C. Protection: Protect work of other trades, whether to be painted or not, against damage by painting and finishing work. Correct any damage by cleaning, repairing or replacing, and repainting, as acceptable to Architect-Architect-Engineer. Provide "Wet Paint" signs as required to protect newly-painted finishes. Remove temporary protective wrappings provided by others for protection of their work, after completion of painting operations. At completion of work of other trades, touch-up and restore all damaged or defaced painted surfaces.

3.07 PAINTING SYSTEMS

The coating product names/numbers are based on Tnemec products. Owner will select color during submittal phase.

A. Ferrous Metals - Structural, Tanks, Pipes and Equipment

			Dry Mils
1.	Exterior, Non-Immersion		
	Sur. Prep.:	SSPC-SP6 Commercial Blast Cleaning	
	1st Coat:	1 PurplePrime	2.5 - 3.5
	2nd Coat:	66 Epoxoline	4.0 - 6.0
	3rd Coat:	1074- Endura-Shield	2.0 - 3.0
2.	Interior, Non-Immersion		Dry Mils
	Sur. Prep.:	SSPC-SP6 Commercial Blast Cleaning	
	1st Coat:	1 PurplePrime	2.5 - 3.5
	2nd Coat:	66 Epoxoline	4.0 - 6.0
	Finish Coat:	1074- Endura-Shield	2.0 - 3.0
3.	Immersion, Potable or Non-Potable Water		
	Sur. Prep.:	SSPC-SP10 Near-White Blast Cleaning	
	1st Coat:	1 PurplePrime	2.5 - 3.5
	2nd Coat:	20-1255 Potapox	4.0 - 6.0
	3rd Coat:	20-11WH Potapox	4.0 - 6.0
4.	Factory Primed Interior (Refer to Piping Specifications)		
	Sur. Prep.:	Surface shall be clean and dry	
	Int. Coat:	66 Epoxoline	4.0 - 6.0
	Finish Coat:	1074- Endura-Shield	2.0 - 3.0
5.	Factory Primed, Exterior (Refer to Piping Specifications)		
	Sur. Prep.:	Surface shall be clean and dry	
	1st Coat:	N69 Epoxoline II	4.0 – 6.0
	2nd Coat:	1074- Endurashield	2.0- 3.0
6.	Primed Steel (Doors, Frames, etc.)		
	Touch up:	1 Purpleprime	
	1st Coat:	66 Epoxoline	4.0 - 6.0
	2nd Coat:	1074- Endura-Shield	2.0 - 3.0
B.	Galvanized Steel - Pipe and Miscellaneous Fabrications		
1.	Exterior, Non-Immersion		
	Sur. Prep.:	SSPC-SP1 Solvent Cleaning	
	1st Coat:	66 Epoxoline	4.0 - 6.0
	2nd Coat:	1074-Color Endura-Shield	2.0 - 3.0
2.	Interior, Non-Immersion (Doors, Frames, etc.)		
	Sur. Prep.:	SSPC-SP1 Solvent Cleaning	
	One Coat:	66 Epoxoline	4.0 - 6.0
	2nd Coat:	1074-Color Endura-Shield	2.0 - 3.0

3. Immersion, Potable or Non-Potable Water — Dry Mils

Sur. Prep.:	SSPC-SP1 Solvent Cleaning	
1st Coat:	20-1255 Potapox	4.0 - 6.0
2nd Coat:	20-11WH? Potapox	4.0 - 6.0

C. Porous Masonry - Concrete Masonry Units

1. Interior

Sur. Prep.:	Surface shall be clean and dry	
1st Coat:	130 Envirofill (Spray & Back Roll to Fill Porosity)	80 - 100 sf/gal.
2nd Coat:	84 Ceramlon ENV	4.0 - 6.0
Coat:	84 Ceramlon ENV	4.0 - 6.0

D. Cast-In-Place Concrete

1. Concrete Walls & Precast Concrete Ceilings (Interior)

Sur. Prep.:	Abrasive Blast (SSPC-SP13)	
1st Coat:	N69 Epoxoline II	4.0 - 6.0
2nd Coat:	N69 Epoxoline II	4.0 - 6.0

2. Concrete Walls, Exterior & Non-Potable

Sur. Prep.:	Surface shall be clean and dry	
1st Coat:	Series 156 Enviro-Crete	125 sf/gal.
2nd Coat:	Series 156 Enviro-Crete	200 sf/gal.

3. Concrete Floors (Interior)

Sur. Prep.:	Surface shall be clean and dry	
1st Coat:	204 Cementuff – Sealer/Hardener	300-350 gal/sq.ft.
2nd Coat:	204 Cementuff – Sealer/Hardener	400 gal/sq.ft.

4. Concrete Tanks & Basins

Sur. Prep.:	Abrasive Blast (SSPC-SP13, Severe Service)	
1st Coat:	20-1211 Potapox	4.0 - 6.0
2nd Coat:	20-1255 Potapox	4.0 - 6.0
3rd Coat:	20-11WH	4.0 - 6.0

5. Chemical Containment Areas

Sur. Prep.:	Abrasive Blast (SSPC-SP13, Severe Service)	
1st Coat:	Series 120-5002 Vinyl Ester	12-18
2nd Coat:	Series 120-5001 Vinyl Ester	12-18

E. Wood — Dry Mils

Interior or Exterior

Sur. Prep.:	Surface shall be clean and dry	
1st Coat:	151-1051 Elasto-Grip FC	1.0 - 1.52nd
Coat:	29 Tufcryl	2.0 - 3.0 - 3.5
3rd Coat:	29 Tufcryl	2.0 - 3.0

F. Insulated Pipe

Sur. Prep.:	Surface shall be clean and dry	
1st Coat:	6-Color Tneme-Cryl	2.0 - 3.0
2nd Coat:	6-Color Tneme-Cryl	2.0 - 3.0

G. Gypsum Board

1. Interior Drywall - Architectural

Sur. Prep.:	Surface shall be clean and dry	
1st Coat:	151-1051 Elasto-Grip FC	1.0 - 1.5
2nd Coat:	6-Color Tneme-Cryl	2.0 - 3.0

2. Interior Drywall - Severe Exposure

Sur. Prep.:	Surface shall be clean and dry	
Prime Coat:	151-1051 Elasto-Grip FC	1.0 - 1.5
1st Coat:	113 H.B. Tneme-Tufcoat	2.0 - 3.0
2nd Coat:	113 H.B. Tneme-Tufcoat	2.0 - 3.0

H. PVC Piping – **Do Not Paint**

I. Aluminum Windows, Doors, Handrails & Grating – **Do Not Paint**

J. Fiberglass Reinforced Plastic Doors & Windows – **Do Not Paint**

3.08 PIPING COLOR CODE

To facilitate identification of piping in plants and pumping stations it is recommended that the following color scheme be utilized:

WATER LINES

Raw Water	Olive Green
Settled Water	Light Blue
Filtered or Finished Water	Dark Blue

CHEMICAL LINES

Caustic	Yellow w/ green band
Chlorine	Yellow
Fluoride	Light Blue w/ red band

3.09 STENCILING

A. The Contractor shall supply all materials and labor necessary for stenciling of legends on pipes. The legend shall show the name of the contents. Review by the Architect-Engineer of legends will be required. Names shall be "plainly visible". Arrows showing direction of flow shall also be stenciled on pipes. The legends shall be located not more than 10 feet apart and, in general, at each valve and piece of equipment. The size and location of the legend shall be in general accordance with ANSI A13.1-1981 "Scheme for the Identification of Piping Systems". All visible piping 6" in diameter and larger shall be color-coded and stenciled. "Stick-on" labels are not acceptable.

3.10 PLASTIC IDENTIFICATION MARKERS

A. All visible piping 3/4" and greater and less than 6" which is accessible for maintenance operations shall be color-coded and identified with semi-rigid plastic identification markers equal to SETMARK Pipe Markers as manufactured by Seton Name Plate Corporation, New Haven, Conn.; T & B/Westline, Los Angeles, California; or equal. Direction of flow arrows are to be included on each marker, unless otherwise specified.

B. Each marker background is to be appropriately color coded with a clearly printed legend to identify the contents of the pipe in conformance with the "Scheme for the Identification of Piping Systems" (ANSI A 13.1 - 1981).

C. For pipes under 3/4" O.D. (too small for color bands and legends), brass identification tags 1-1/2" in diameter with depressed 1/4" high black-filled letters above 1/3" blackfilled numbers shall be fastened securely at specified locations.

D. All electrical conduits, which are accessible for maintenance operations, shall be identified with semi-rigid identification markers similar to those specified above.

E. Each marker background is to be color-coded with a clearly printed legend to identify the conductor. Size of markers and sizes of lettering to generally conform with the "Scheme for Identification of Piping Systems" (ANSI A 13.1 - 1981)

F. Locations for pipe and electrical markers to be as follows:

1. Adjacent to each valve and fitting (except on plumbing fixtures and equipment).

2. At each branch and riser take-off.

3. At each pipe passage through wall, floor and ceiling construction.

4. At each pipe passage to underground.

5. On all horizontal pipe runs-marked every 25 feet.

3.11 PAINT SCHEDULE

All items at the Project site shall be painted in accordance with these Specifications and Drawings. The following paint schedule is provided only to assist the Owner and Contractor in selection of the appropriate paint system and is not intended to be a complete list of items to be painted.

Repainting of existing structures, tanks, piping, and all other existing items shall be part of this Contract.

A. Paint Application Schedule

	Location and/or Description		System
1.	Building		
	a.	Block Walls	C.1
	b.	Doors and Frame, Exterior	B.1
	c.	Doors and Frame, Interior	A.6
	d.	Cast-In-Place Concrete	D
	e.	Wood	E
	f.	Piping & Equipment	A

SECTION 11

SECTION 11000 – MASTER METER

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install the master meter and vault shown on the Drawings and/or specified herein.

1.02 SUBMITTALS

A. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Engineer for review before ordering. Comply with provisions of Section 01340.

B. At the time of submission, the Contractor shall, in writing, call Engineer's attention to any deviations that the submittals may have from the requirements of the Engineer's Contract Drawings and Specifications.

PART 2 - PRODUCTS

2.01 MASTER METER

A. Master meter shall conform to AWWA C704 standards and shall have AWWA class D flat face steel flange ends. It shall have a minimum rating of 150 psi and shall have a flow range from 50 – 300 gpm. The totalizer is to read in gallons used.

B. An epoxy coating conforming to AWWA C-550 shall be applied to the interior and exterior.

C. Master meter shall have the name or monogram of the manufacturer, the year the casting was made, the size of the meter, and the working water pressure cast on the body of the meter.

D. Master Meter is to be manufactured by Badger Inc., MJK, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Shall be installed in accordance with details on the Contract Drawings and with the manufacturer's recommendations.

B. All valves fitting shall be a minimum of five (5) pipe diameters from the meter installation location.

SECTION 11219 - BOOSTER PUMPING STATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install one (1) above ground water booster pump station, with all the necessary internal piping, pumps, motors, valves, and controls and other necessary appurtenances.

B. Contractor may supply a modular structure (i.e. manufactured by EFI) and finish with CMU split face.

1.02 CONTRACT DRAWINGS

A. The Contract Drawings are intended to show a general arrangement of pumping equipment, drives, structural supports, foundations, connected piping, valves, electrical components, and other appurtenances.

1.03 QUALITY ASSURANCE

A. If modular option is exercised it is intended that the manufacturer of the specified equipment shall be a business regularly engaged in the manufacture, assembly, construction, start-up and maintenance of water distribution equipment of the type required for this project. The manufacturer shall have at least ten (10) years of successful experience in providing stations of the type, design, function and quality as required for this project.

PART 2 - PRODUCTS

2.01 EQUIPMENT ENCLOSURE

A. The equipment enclosure size as shown on the drawings for this project is appropriate for National Standard mandated clearances and for proper clearances above, below and around equipment to provide for safe servicing, removal and reinstallation of that equipment.

B. Likewise, the equipment hatches as shown shall be sized to provide eventual removal and replacement of any component within the station without altering the station to accomplish that task.

C. The drawing for this equipment illustrates centerline and clearance/maintenance dimensions about major equipment items. These dimensions are minimum. Dimensions less than those shown **will not** be accepted.

2.02 EXTERIOR FINISH

A. 8" CMU split face as shown on the drawing.

B. Colors to be selected by owner during submittal phase.

2.03 INTERIOR FINISH

A. All interior surfaces shall be painted.

B. Color to be selected by owner during submittal phase.

2.04 HINGED ENTRANCE DOORS

A. Insulation shall consist of a full 2" thick foam polyurethane insulation core. Matching metal jambs shall be furnished to fit prefab panels without the use of any interior framing. Jamb members shall attach to panels with sheet metal screws. The door shall be supplied with weatherstripping and a wiper gasket.

B. Door shall be equipped with window and panic bar for emergency.

C. Hardware for Doors – See the schedule on the building details sheet.

D. Door Hinges - Each door shall have three (3) SOSS 450T tamperproof pinned butt hinges.

E. Weatherproof Shields - All doors for outdoor structures shall be supplied with a metal shield above the door to divert rain and snow from the door opening.

F. Sillplates - An extruded aluminum sillplate shall be provided on outdoor buildings.

2.05 BUILDING

A. Dimensions shall be a minimum of those shown on the Drawings for this item.

B. See building detail sheet for specifications.

C. The station shall have a floor drain as shown on the Drawings.

2.06 CORROSION PROTECTION

A. All surfaces of the exposed steel structure, interior and exterior, shall be sandblasted equal to commercial blast cleaning (SSPC-SP6).

B. The protective coating shall take place immediately after surface preparation. The protective coating shall be Tnemec Series 66 Hi-Build Epoxoline consisting of a two-component, high solids, amide-cured epoxy system formulated for high build application having excellent chemical and corrosion resistant properties. The epoxy system shall be self-priming and require no intermediate coatings. The protective coating shall provide in two (2) applications a total dry mil thickness of 8.0 mils.

2.07 BOOSTER PUMPS - HORIZONTAL END SUCTION, CENTRIFUGAL TYPE

A. The pumps employed within the pump station shall be of the horizontal end suction, centrifugal type. As manufactured by Aurora Pump Model 341 or approved equal. Pre-approval request must be submitted to the engineer a minimum of ten (10) days

prior to bid date.

B. Casing:

Material of casing must be Cast Iron (ASTM A48). The casing will be of the end suction design with tangential discharge outlet. For suction piping diameters of 2" or less and discharge piping diameters of 1.5" or less, the suction and discharge connections shall be NPT threaded. For suction piping diameters of 2" or greater, the suction inlet shall be a flat-faced flange connection and the discharge outlet shall be a bolt through flange connection. Flange connections shall be ANSI 125# rated. The casing shall have tapped and plugged holes for priming and draining. The casing bore shall be large enough to allow "back pullout" of the impeller without disturbing the casing or suction and discharge piping. The casing shall be supported by the driving unit.

C. Impeller:

Material of impeller must be Bronze (ASTM B584). The impeller shall be of the enclosed type, vacuum cast in one piece. It shall be finished all over, the exterior being turned and in the interior being finished and smooth and cleaned of all burrs, trimmings, and irregularities. The impeller shall be dynamically balanced. The impeller will be keyed to the shaft, and fastened with a washer, gasket, and cap screw.

D. Wear Rings:

The pump casing shall be fitted with a case wear ring to minimize abrasavie and corrosive wear to the casing. The case wear ring shall be of the radial type, press fitted into the casing.

E. Shaft Sleeves:

The pump shaft shall be fitted with a shaft sleeve to minimize shaft wear. The sleeve shall be sealed to the impeller hub by an O-ring, and shall be positively driving by a pin to the keyway. The use of adhesive compounds to fasten the sleeve to the shaft shall not be accepted.

F. Stuffing Box:
The stuffing box shall be integrally cast with a mounting bracket, and shall provide an adequate area for internal recirculation of the pumped fluid around the sealing medium.

G. Adapter:

Maintains rigid assembly between motor and casing. Machined lock between adapter and motor end bracket keeps adapter and casing in permanent alignment with motor and extended motor shaft.

H. Motor:

Assembled as integral part of the complete units. Shaft carries impeller and sleeve. Motor bearings are ball bearing type, designed to carry all radial and thrust loads, and are installed in sealed housings which retain lubricant and exclude dirt and moisture. Motors shall be open drip proof.

2.08 OPERATING CONDITIONS

A. The pump shall be capable of delivering the fluid medium at the following capacities and heads when operating at 0 feet minimum suction pressure.

PUMPS #1 & #2

Design 150 GPM @ 145 feet TDH;

2.09 PUMP/MOTOR VIBRATION ISOLATION PADS

A. The pump/motor assembly shall be mounted to a fabricated steel base built specifically for the pump/motor to be mounted. Each mounting or attachment point shall be complete with a vibration isolation pad. The pad will be in two (2) parts, a 1/4" base layer followed by a 5/8" upper layer and be a nominal 2" x 2" square size for pump/motor combinations weighing up to 1500 pounds.

B. The mounting or hold down bolts at each base attachment point shall be complete with washer of appropriate size made of the same material and thickness as the 5/8" upper layer pad.

2.10 ELASTOMER PIPE CONNECTOR

A. The inlet side of each booster pump shall include an elastomer connector to help isolate vibration and noise in the piping system. The elastomer connector shall be of single sphere design, constructed of neoprene and nylon with bias-ply tire reinforcing cord to provide a 225 psi working pressure rating to a minimum of 120°F. The elastomer connector shall pass through the plate steel flanges designed to grip the connector so the connector seals without gaskets when the flange bolts are drawn up.

B. A control joint limiting pipe connector movement shall be supplied with each pipe connector.

2.11 PIPING

A. All internal transmission piping shall be steel and conform to ASTM A-53(CW) for nominal pipe size 4 inch and smaller and ASTM A-53(ERW) Grade B for nominal pipe size 5 inch and larger. Butt welded fittings shall conform to ASTM A-106. Forged steel flanges shall conform to ASTM A-181, Grade 1 and ASA B16.5.

1. The piping sizes shall be as shown on the Drawing.

2. Size 10 inch and below - Schedule 40

3. Size 12 inch and above - Standard weight (.375" wall)

B. All pipe welds shall be performed by certified welders employed by the pump station manufacturer. As part of the equipment submittal, the pump station manufacturer shall provide copies of the welding certificates of the employees who are to perform the pipe welds.

C. All piping surfaces shall be prepared by sandblasting, or other abrasive blasting, prior to any welds taking place. Piping of 5" diameter and smaller may be cut by saw. Piping of 6" diameter and larger shall be bevel cut, and Oxyfuel or Plasma-arc cutting techniques shall be used to assure and facilitate bevel pipe cuts. No saw cuts or other form of abrasive cut-offs are allowed on 6" and larger diameter pipe.

D. In all cases, short circuit transfer, spray transfer or pulse-arc transfer modes of the gas metal arc welding process shall be applied semi-automatically. When utilizing the short circuit mode, shielding gas consisting of 50% carbon dioxide and 50% argon gas shall be used. When utilizing the spray or pulse-arc transfer modes, a shielding gas consisting of 5% carbon dioxide and 95% argon shall be used. In all cases, welding wire with a minimum tensile strength of 70,000 psi shall be employed. All flange welds and butt welds of equal size pipe shall be a single continuous nonstop weld around the complete circumference of the pipe. Whenever possible, vertical up weld passes will be applied to all pipe welds. No vertical down weld passes will be allowed. Completed welding assemblies shall create no internal obstruction, restriction or create any unintended sources of water deflection.

E. Piping of six (6) inch diameter and larger shall require a minimum of two (2) weld passes to complete each weld. The first pass, or root pass, shall be applied at the bottom of the bevel cut using the short circuit transfer welding mode, and the second pass, or cap pass, shall be applied over the root pass using the spray or pulse arc transfer welding modes to insure that at a minimum the total weld thickness shall be equal to thinnest of the two pieces being welded together.

2.12 PIPE SUPPORTS

A. Pipe supports by minimum sizing for:

1. 4" and smaller piping shall be 2" x 2" x 3/16" wall rectangular tubing;

2. 6" through 12" piping shall be 3" x 3" x 1/4" wall rectangular tubing;

3. 14" through 24" piping shall be 4" x 4" x 1/4" wall rectangular tubing

4. 6" and larger piping shall be provided with "kick" bracing projecting fully from the underside of the pipe to the floor at an angle of no less than 15□ from vertical out at a right angle to the run of the pipe being supported. These "kick" braces shall be in addition to the vertical pipe supports called out above.

B. Pipe supports are to be fully welded at both end points to the pipe and steel floor where required.

2.13 FUSION BONDED EPOXY COATING - STEEL TRANSMISSION PIPING

A. Steel transmission piping shall have applied to it a Fusion Bonded Epoxy Coating on the interior pipe surface that conforms to AWWA C-213-91 for steel water pipelines. The powder coating product shall be National Sanitation Foundation (NSF) Standard 61 certified material. The final product shall be capable of meeting Salt Spray Resistance ASTM B117 (1000 hour) with no blistering, undercutting or rust bleed; Humidity Resistance ASTM D2247 (1000 hour) with no blistering, undercutting or rust bleed; and Impact Resistance of ASTM G14-72 (160 in. lbs.)

2.14 SERVICE CONNECTIONS ON INTERNAL PIPING

A. All plumbed devices within the station eventually requiring service, such as meters, control valves, pumps and like equipment, shall be easily removed from the piping by the presence of appropriately placed and sufficient quantity of adaptors and couplings as shown on the drawings; no less than the quantity of couplings and adaptors shown shall be allowed.

2.15 RESTRAINING POINTS

A. The main inlet and outlet piping to the station shall each be provided with two (2) or four (4) restraining points as welded on "eyes" or similar device welded to the capsule or framing to facilitate the attachment of joint restraint tie rods or other device to be used in retarding any pipe movement at the connections.

2.16 COMPRESSION COUPLINGS

A. The booster station piping shall include a compression type, flexible coupling to prevent binding and facilitate removal of associated equipment where shown on the plans for this item. In lieu of a compression coupling, a Uni-Flange or a flanged coupling adapter (FCA) may be used.

B. All compression couplings, Uni-Flanges, flanged coupling adapters (FCA), and flexible connectors/expansion joints shall include a minimum of two (2) control joint rods with gusset plates.

2.17 COMBINATION PRESSURE GAUGES

A. Combination pressure gauges shall be glycerine filled with a built-in pressure snubber and have 4-1/2 inch minimum diameter faces and be turret style, black phenolic case with clear glass face. The movement shall be rotary, of 400 Series stainless steel with teflon coated pinion gear and segment. The gauge shall be bottom connected and accept a 1/4" NPT female thread. Combination pressure gauge range and scale graduations shall be in psi and feet of water as follows:

1. INLET PRESSURE - 0 to 100 psi, 10 psi figure intervals, with graduating marks every 1 psi (0-230 feet).

2. OUTLET PRESSURE - 0 to 200 psi, 20 psi figure intervals, with graduating marks every 2 psi (0-460 feet).

B. All gauges will be panel mounted off the pipeline and be flexible connected to their respective sensing point. The gauge trim tubing shall be complete with both isolating and vent valves and the tubing shall be so arranged as to easily vent air and facilitate gauge removal. Gauges mounted directly to the pipeline or at the sensing point **will not** be accepted. Gauges shall be Ashcroft Model 1279ASL.

2.18 SAMPLE TAP

A. A single, right angle outlet, smooth nose, brass sample tap shall be affixed to the

manual vent ball valve for the low suction lockout and suction pressure gauge assembly.

2.19 BUTTERFLY VALVES

A. Valve body shall be wafer style and meet ANSI Class 125/150 flange standards. Metal reinforced dovetail seat shall ensure drop tight, bi-directional shutoff and shall be field replaceable. The stem shall be one piece. The disc and stem shall be connected by a stainless steel torque plug which shall provide positive engagement. The valve shall have upper and
lower RTFE inboard stem bearings, isolated from the line media, and a heavy-duty upper stem bushing.

B. The valve body shall be cast iron; aluminum bronze disc; stainless steel stem; EPDM seat; acetal upper stem bushing; BUNA-N V-cup stem seal.

C. Valve sized six (6) inches and smaller shall be equipped with lever operator and 10 degree increment throttling plate. Valve sized eight (8) inches and larger shall be equipped with a weather-proof, heavy-duty, gear operator complete with a position indicator.

2.20 PUMP CONTROL VALVE

A. Each pump discharge pipe shall include a pilot-operated valve designed to eliminate pipeline surges caused by the starting and stopping of the booster pumps. The control valves shall be a diaphragm activated, single seated, hydraulically operated globe-type valve. It shall have two (2) operating chambers sealed from each other by a flexible synthetic rubber fully-supported diaphragm. The valve disc shall be resilient with a rectangular cross section and shall be retained on three (3) sides.

B. Control of the valve operation shall be by means of an externally mounted, four-way solenoid pilot valve. Self-cleaning strainers shall be used to project the control system. Valves shall utilize line pressure for operation. A limit-switch must be installed to be adjustable over entire valve travel. Valve shall be equipped with a built-in lift type check feature to prevent reverse flow. It shall operate independently of the solenoid control.

C. Valve shall be Clayton 60-11 Booster Pump Valve as manufactured by Cla-Val Company of Newport Beach, California, or approved equal.

2.21 PRESSURE TESTING

A. When the station plumbing is completed, the pressure piping within the station, including valves, pumps, control valves, fittings, connections as make up the entire system shall be hydrostatically tested at a pressure of 200 psi. The test pressure shall be applied for a minimum of 20 minutes, during which time all joints, connections and seams shall be checked for leaking. Any deficiencies found shall be repaired and the system shall be retested.

2.22 CONFORMANCE TO BASIC ELECTRICAL STANDARDS

A. The manufacturer of electrical control panels and their mounting and installation shall be done in strict accordance with the requirements of UL Standard 508 and the National Electrical Code (NEC) latest revision so as to afford a measure of security as to the ability of the eventual owner to safely operate the equipment. **No exceptions to the requirements of these codes and standards will be allowed; failure to meet these requirements will be cause to remove the equipment and correct the violation.**

2.23 U.L. LISTING

A. All control, switchgear, and starting equipment panel(s) shall be constructed in accordance with Underwriter's Laboratories (UL) Standard 508 "Industrial Control Equipment." All components shall bear a UL label.

2.24 EQUIPMENT GROUNDING

A. Each electrical equipment item in the station shall be properly grounded per Section 250 of the National Electrical Code. Items to be grounded include, but are not limited to, pump motor frames, control panel, transformer, convenience receptacles, dedicated receptacle for heater, air conditioner, dehumidifier, lights, light switch, exhaust fans and pressure switches.

B. All ground wires from installed equipment shall be in conduit and shall lead back to the control panel to a copper ground buss specific for grounding purposes and so labeled. The ground buss shall be complete with a lug large enough to accept the installing electrician's bare copper earth ground wire. The bus shall serve as a bond between the earth ground and the equipment ground wires.

2.25 PANEL MOUNTING HARDWARE

A. Metal framing channel shall be used exclusively for mounting of all electrical panels and electrical components except for those specifically designated otherwise.

2.26 ELECTRICAL APPARATUS- DISTRIBUTION PANEL

A. The distribution panel shall be a NEMA 1 enclosure, surface mount, top feed. The main breaker shall be 225 amp. See Panel Schedule drawing for circuit breaker requirements.

2.27 ELECTRICAL APPARATUS- MAIN CONTROL PANEL

A. **Main Control Panel shall be provided as manufactured by Matrix Engineering or approved equal. All circuit breakers, motor starters, variable speed drives, PLC, HMI, telemetry equipment, and chart recorders shall be incorporated into one (1) NEMA 12 control panel.** The electrical service provided for this station will be 240 volt, 3 phase, 60 cycle, 4 wire.

B. Automatic pump alternation shall be provided through the PLC. **Automatic start of**

the backup pump upon lead pump failure shall be provided.

C. A solid state, phase sequence/failure and under voltage release relay shall be supplied. The relay shall be complete with an LED to indicate proper phase sequence, all phases in operation and voltage within limits. The relay shall also include an adjustable voltage monitor, be UL listed and be CSA certified complete with an automatic reset feature.

D. Programmable Logic Controller (PLC): PLC shall be Allen Bradley CompactLogix with EtherNet port and RS-232 communications port for SCADA. Provide a minimum of two spare I/O points for each I/O type used.

E. EtherNet Switch: EtherNet switch shall have a minimum of four ports and have features to autonegotiate for speed and duplex per port as manufactured by Allen Bradley or approved equal

F. Operator Interface (OI): OI shall be Allen Bradley Panelview Plus 600 Color Touchscreen with Ethernet communication.

G. Telemetry for the Booster Pump Station shall be provided and installed in the main control panel for SCADA communications with the Booster Pump PLC. Radio Modem shall be compatible with existing Radio Modem located at the WWTP.

H. Hand-Off-Automatic switches shall be oil tight, 3-position maintained and be located on the main control panel door.

1. Pump #1

2. Pump #2

I. Indicating lights shall be oil tight, with a full voltage pilot light and be located on the main control panel door:

1. Red - Low Suction Pressure

2. Green - Pump #1 in Operation

3. Green - Pump #2 in Operation

J. Nameplates shall be furnished on all panel front mounted switches and lights.

K. Chart Recorders shall be dead front mounted in the main control panel door, wired to the PLC, and read by the SCADA system.

1. Well No. 3 Flow

2. Well No. 4 Flow

3. Booster Pump Flow

L. Flow meter transmitters shall be dead front mounted in the main control panel door and wired to the PLC and read by the SCADA System and chart recorders.

M. Variable Speed Drives for the 10HP Booster Pumps shall be provided and mounted in the main control panel. Drives shall be Allen Bradley PowerFlex 40.

N. Motor Starters for the 5HP Well Pumps shall be provided and mounted in the main control panel. Starters shall be Allen Bradley NEMA Starter.

O. Wire shall be color coded and numbered so as the wire diagram can be easily followed.

P. Wire diagram to be laminated and glued to the inner door with a spare copy provided loosely for files.

Q. Terminal blocks to be 600 volts, heavy duty as manufactured by Allen Bradley, Curtis, or Buchanan.

R. Name plates shall be fabricated from solid white vinyl base material with black colored vinyl overlay fused to the base sheet.

S. Convenience outlet to be 20Amp, 120v duplex outlet to be installed in the main control panel. The outlet shall have ground fault protection.

T. The control panel door shall include a plastic pocket on the interior to hold one (1) laminated copy of the panel wiring diagram. The wiring diagram shall be corrected "as-built" copy and contain individual wire numbers, circuit breaker numbers, switch designations and control function explanations.

2.28 ELECTRICAL APPARATUS – EXISTING WATER TOWER TELEMETRY

A. Telemetry for the Existing Water Tower Station shall be provided and installed in the existing main control panel for SCADA communications with the existing Water Tower PLC. Radio Modem shall be compatible with existing Radio Modem located at the WWTP.

2.29 ELECTRICAL APPARATUS - SUCTION PRESSURE CONTROL

A. Suction control of the pumping operation shall be provided by a bellows type, adjustable differential pressure switch. The switch shall be complete with a single pole, double throw contact block with 5 amp non-inductive rated contacts at 240 volts AC. The set points of the on/off cycle shall be independently adjustable through the full range of the switch rating. The pressure switch shall be wired to the PLC.

1. Low Suction Cut-out, 4-150 psi.

2. Adjustable Differential, 2-25 psi.

B. A pressure gauge shall be sub-panel mounted adjacent to the low suction pressure switch. The gauge and switch shall be so plumbed with the suction header sensing line that a common blow-off valve can relieve pressure in both simultaneously for purposes of checking and calibrating the low suction lock-out.

2.30 ELECTRICAL APPARATUS – SCADA SYSTEM

A. The existing SCADA System shall incorporate all new instrumentation and pump information from the new Booster Pump PLC as well as the existing Water Tower

PLC.

B. The SCADA shall use the existing RSView32 HMI software located at the WWTP. No new computer is needed. Any existing PLC or communication configuration required to communicate with the new Booster Pump Station PLC and the existing Water Tower PLC shall be provided.

C. The SCADA System shall have Win911 Alarm Notification Software installed and configured to alert of triggered alarms from both the existing Water Tower PLC and the new Booster Pump Station PLC.

D. Live communications with the existing Water Tower PLC shall include:

1. Pump 1 status
2. Pump 2 status
3. Water level indication
4. Alarm status

E. Live communications with the new Booster Pump Station PLC shall include:

1. Booster Pump Variable Speed Drive 1 status
2. Booster Pump Variable Speed Drive 2 status
3. Well Pump Motor Starter 1 status
4. Well Pump Motor Starter 2 status
5. All instrumentation and indicators including water level and flows
6. Alarm status

2.29 CONDUIT, WIRING, RECEPTACLES AND LIGHTING

A. Rigid conduit, sized to adequately accept the inbound service conductors, and/or telemetry or telephone cables, shall be installed from the main power or control panel through the equipment enclosure floor and terminate exterior to the equipment enclosure. The service entrance conduit connections shall be plugged for shipment.

B. All wiring within the equipment enclosure and outside of the control panel or panels shall be run in conduit except for the watertight flexible conduit and fittings properly used to connect pump drivers, fan motors, solenoid valves, limit switches, etc., where flexible connections are best utilized. Only the dehumidifier where furnished by the original manufacturer with a UL approved rubber cord and plug, may be plugged into a receptacle.

2.30 CONTROL AND ACCESSORY WIRING

A. Sized for load, type MTW/AWM (Machine tool wire/appliance wiring material) as set forth in Article 310 and 670 of the National Electrical Code, Schedule 310-13 and

NFPA Standard 79 for flame retardant, moisture, heat and oil resistant thermoplastic, copper conductors in compliance with NMTBA and as listed by Underwriters' Laboratories (AWM), except where accessories are furnished with a manufacturer supplied UL approved rubber cord and plug.

2.31 LIGHTING

A. There shall be one or more two-tube, 40 watt per tube, rapid start, enclosed and gasketed, forty-eight (48) inch minimum length fluorescent light fixtures installed within the equipment enclosure, as shown on the plan for this item. One (1) light fixture shall be located directly over the main control panel. The light switch shall be of the night glow type and be located conveniently adjacent to the door. Open fluorescent or incandescent fixtures **will not** be accepted.

2.32 DEHUMIDIFIER

A. One (1) each installed as shown.

B. Capacity 25 pints per 24 hours (AHAM Standard DH-1).

C. Compressor rated 1/5 HP, 4.1 amps, 400 watts.

D. Condensate piped direct to day light.

E. 120 volt A.C. operation by dial-controlled adjustable humidistat.

F. UL listed rubber cord.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All equipment shall be installed in accordance with the manufacturer's recommendation. A factory representative shall supervise installation and provide start-up assistance for the Contractor.

3.02 FACTORY START-UP SERVICE

A. Start-up service technician shall be a regular employee of booster station manufacturer.

B. As part of the submittal covering this equipment, list the factory service manager, his employee number, his telephone number with extension and his number of years with the company. List also each start-up service technician, his employee number and years of service with the company.

C. Verify that one (1) or more of the service technicians listed above will perform the required start-up service on the equipment covered in the submittal.

D. One (1) full day at job site for start-up and training.

E. Start-up service report attested to by start-up technician and representative of owner or engineer.

F. Contractor must coordinate for all parties to attend start-up including manufacturer representative, electrical subcontractor, engineer, and owner. If for any reason start-up is unsuccessful or needs to be rescheduled the contractor will be responsible to compensate all parties for additional time.

G. Service report distributed to:

1. Manufacturer's File

2. Engineer's File

3. Contractor's File

4. Owner's File

SECTION 11240 - CHEMICAL FEED EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish, install and place into service all chemical feed systems as described in the Drawings and Specifications.

1.02 SUBMITTALS

A. Submit product literature, material specifications, dimension prints, and installation recommendations for Engineer review.

1.03 CHEMICAL FEED SYSTEMS

A. All components of the Chemical Feed Systems shall be mounted in the same configurations as shown on the schematics unless otherwise indicated in the Drawings or Specifications. The systems shall be compatible with each respective chemical and be complete with all appurtenant piping, valves, fittings, equipment, and controls.

B. Refer to Drawings for all locations of chemical feed tap locations.

1.04 GUARANTY

A. The Contractor shall guarantee and warrant that the equipment furnished and installed is free from defects of design, material and workmanship, and will operate satisfactorily. In the event the equipment fails to perform as specified, and after the Owner has given due notice, the Contractor or Supplier, at their own expanse, shall promptly repair or replace the defective equipment without any additional cost to the Owner.

B. The guaranty period shall be one year from the date of start-up. In the event that the manufacturer's guarantee period exceeds that as stated, the manufacturer's guarantee period will stay in effect and shall not be replaced by that previously stated.

PART 2 - PRODUCTS

2.01 CHEMICAL METERING PUMPS

A. Chemical metering pumps shall be of the positive displacement, non-hydraulic, solenoid-driven, diaphragm-type. Output shall be hot rated at operating temperature, and adjustable while pumps are in operation. Positive flow shall be ensured by a minimum of four ball type check valves and a 5 function valve for pressure relief, back pressure, anti-syphon, air bleed and discharge drain. Control functions shall be manual with external pulse input and stop. Turndown ratio shall be 100:1. The metering pumps shall be Chemtech or equal.

B. The following accessories shall be provided with the metering pumps:

1. Sight-flow Indicator

2. Discharge Connection for Rigid Pipe

C. The Chemical Feed Equipment specified herein shall be factory-piped and wired and require only the connecting of the utilities. Chemical Feed pumps shall be provided according to the following schedule:

System	Chemtech Model No.	Capacity
Caustic Soda Pretreatment	100 Series	15 gpd @ 100 psi
Liquid Chlorine	200 Series	20 gpd @ 150 psi
Fluoride	200 Series	20 gpd @ 20 psi
Aqua Mag	Single Head	3gpd @ 100 psi

2.02 CHEMICAL SOLUTION TANK

A. The polyethylene or polyolefin solution tank shall be suitable for use with a 40% solution of caustic soda. The minimum capacity shall be 55 gallons. The tank shall be provided with connections for the chemical metering pump, 2" piping for the supply, a 2" drain, and a level indicator. Refer to the Contract Drawings for piping connections.

2.03 FLUORIDE DRUM SCALE

A. One (1) Drum Scale of 55 gallon capacity shall be provided.

2.04 FLUORIDE ANALYZER

A. Contractor shall furnish and install one (1) continuous fluoride monitoring system with all appurtenances to measure and record fluoride concentration. The monitoring system shall be wall-mounted in the Chemical Building as shown on the Drawings.

B. The analyzer shall be a Wallace and Tiernan Depolox 3 Residual Analyzer for potable water. It amperometrically analyzes a continuous sample of treated water for fluoride-ion concentration. It shall display the concentration and provide a proportional 4-20 mA analog output. Microprocessor-based electronics and a fluoride sensing electrode measuring probe shall provide continuous on-line analysis of fluoride, sensitive to 0.01 mg/L. The analyzer shall be wall mounted with a digital readout. Installation requires piping sample to the unit and providing a drain and power outlet. Calibration accuracy is 5% of residual reading. Operating range is 10:1; measurement range is 0.2 - 2.0 mg/L.

2.05 CORPORATION COCK MAIN CONNECTIONS

A. The Contractor shall furnish and install 3/4" PVC corporation cock main connections with check valves for the chemical feed systems, where indicated on the Drawings.

2.06 CHLORINE FEED SYSTEM

A. All components of the Chlorine Feed System shall be wall mounted in the same configuration as shown on the schematics unless otherwise indicated in the Drawings or Specifications. The system shall be compatible with liquid Chlorine and be complete with all appurtenant piping valves, fittings, equipment, and controls.

B. Continuous Chlorine Residual and pH Analyzer

Contractor shall furnish and install one (1) continuous chlorine residual and pH monitoring system with all appurtenances to measure and record free chlorine residual and pH. The monitoring system shall be wall-mounted in the Chemical Building as shown on the Drawings.

The analyzer shall be a Wallace and Tiernan Depolox 3 Residual Analyzer for potable water. It amperometrically analyzes a continuous sample of treated water for free chlorine residual and pH. It shall display the residual and pH and provide a proportional 4-20 mA analog output. Microprocessor-based electronics and a residual sensing electrode measuring cell shall provide continuous on-line analysis of residual chlorine sensitive to 0.01 mg/L. The pH sensor is hydrogen-ion selective in conjunction with a silver-silver chloride reference electrode. The analyzer shall be wall mounted with a digital readout. Installation requires piping the treated water sample to the unit and providing a drain and power outlet. Calibration accuracy is 5% of residual reading. Operating range is 10:1; residual-measurement ranges are 0.5, 0-1.0, 0-2.0 , 0-5, 0-10, 0-19.99 mg/L. One (1) plug-in module in the chlorine arrangement shall be supplied in which the continuous grit bombardment cleans the residual-sensing electrode automatically. The pH measurement range is 4-10.

C. Corporation Cock Main Connections: The Contractor shall furnish and install two (2) 3/4" PVC corporation cock main connections with check valves for the chlorine feed system. One (1) corporation cock shall be installed for pre-chlorine feed in the Raw Water line at the Chemical Building. The other corporation cock shall be installed for post-chlorine feed on the Filter Effluent Pipe in the Chemical Building.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

3.02 TECHNICAL ASSISTANCE

A. The Contractor shall furnish the services of an experienced and qualified manufacturer's technician to supervise installation and start up of the chlorination system and Chemical Feed Systems as specified herein and shown on the Drawings. In addition, the manufacturer's technician shall instruct the plant operating personnel in the operation and maintenance of the chlorination and Chemical Feed Systems.

SECTION 11290 - INTERIOR PROCESS PIPING

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install all plant process piping as shown on the Drawings and specified herein.

1.02 SUBMITTALS

B. A notarized certification shall be furnished for all pipe and fittings which verifies compliance with all applicable specifications.

PART 2 - PRODUCTS

2.01 DUCTILE IRON PIPE/DUCTILE IRON FITTINGS

A. Unless otherwise noted or required, all inside ductile iron piping shall be flanged pipe with threaded flanges in accordance with AWWA C 115. All piping flanges shall have ring gaskets, 1/8-inch thick.

B. All exposed iron pipe to be field painted shall be furnished with an external coating of rust inhibitive primer, Koppers Pug Primer, Tnemec 77 Chem-Prime, Degraco #91453 Phenolic Primer, or equal. Pipe manufacturer shall be responsible for compatibility of shop applied coatings with the field paint systems and products. Do not apply asphalt or bituminous coatings on pipe to be painted.

C. The interior of all ductile iron pipe shall be cement-mortar lined with bituminous seal coat in accordance with AWWA C 104. Thickness of the lining shall be as set forth in Section 4.8.1 of the aforementioned specification unless otherwise directed by the Engineer.

D. Ductile iron fittings shall conform to AWWA C 110 with flanges faced and drilled 125-pound. Fittings shall have interior lining and exterior coating same as the pipe.

2.02 POLYVINYL CHLORIDE (PVC) PLASTIC PRESSURE PIPE

A. PVC Pressure Pipe, 3" and Smaller: Polyvinyl chloride plastic pipe shall be ASTM D 1785 Schedule 80 or F441 CPVC, Schedule 80 with solvent weld joints. Fittings shall be ASTM D 2467 Schedule 80 socket type. All socket type connections shall be made with PVC solvent cement complying with ASTM D 2564 PVC solvent cement shall be furnished from the same supplier as the PVC pipe. Provide socket-threaded adapters for connection to threaded appurtenances where required.

2.05 WALL PIPE AND SLEEVES

A. All wall pipe shall be furnished with cast or welded collar water stops in the positions shown on the Drawings. Welding of water stop collars on pipe shall be accomplished by the wall pipe manufacturer in their shop. All centrifugally cast wall pipe shall be ductile iron meeting the requirements of AWWA C151 for the pipe barrel, conforming to the pressure rating of the pipeline in which installed, and in no case be lighter than Class 53.

B. All statically cast wall pipe shall be ductile iron meeting the requirements of AWWA C110 for fittings. Mechanical joint end and cast-on flange end wall pipe shall conform to AWWA C110 and threaded flange wall pipe shall conform to AWWA C115. Where flanged or mechanical joint bell ends are flush with the wall, they shall be drilled and tapped for stud bolts which are to be of 300 Series stainless steel.

C. The length of all wall pipe shall be not less than the thickness of the wall in which installed. Wall pipe shall have the same pressure rating as connecting pipe. All wall pipe shall be cement-mortar lined per AWWA C104. The outside of wall pipes shall be left uncoated and shall be field primed for painting on the portion exposed, uncoated where embedded and field coated with standard bituminous coated where buried.

D. Contractor may have the option to install wall pipe flush face-to-face of wall in lieu of the dimensioned length wall pipe shown on the Drawings, in order to eliminate form penetrations. This option will be subject to Engineer`s review at each wall pipe location and covers both flanged and mechanical-joint bell-end wall pipe. Embedded flanged and M.J. bell-end bolt holes shall be tapped for stud bolts; tapped bolt holes in embedded flanges shall be plugged for protection during concrete pouring.

E. All pipe wall sleeves shall be plain end galvanized steel pipe of diameter noted on Drawings and length to fit flush face-to-face of wall.

2.06 INTERLOCKING LINK PIPE SEALS

A. In all locations indicated on the Drawings, interlocking link pipe seals shall be used in lieu of lead packing a pipe wall sleeve. Seals shall be modular mechanical type, consisting of interlocking synthetic rubber links shaped to continuously fill the annular space between the pipe and wall sleeve. Links shall be loosely assembled with bolts to form a continuous rubber belt around the pipe with a pressure plate under each bolt head and nut. After the seal assembly is positioned in the sleeve, tightening of the bolts shall cause the rubber sealing elements to expand and provide an absolutely water-tight seal between the pipe and wall sleeve. Seals shall be "Link-Seal" as manufactured by Thunderline Corporation, Wayne, Michigan, or approved equal.

B. The Contractor shall determine the required diameter of each individual wall opening according to the manufacturer's recommendations before ordering and installing the seal. Pipe shall be accurately centered in the sleeve and the link seals shall be sized, installed and tightened in accordance with the manufacturer's instructions.

2.07 COUPLINGS AND ADAPTERS

A. Flexible couplings shall be of the sleeve type with a middle ring, two round-wedge shaped rubber gaskets at each end, two following rings together and compress the gasket against the pipe. Flexible couplings shall be steel with minimum wall thickness of the middle ring or sleeve installed on pipe being 5/16-inch for pipe smaller than 10 inches, 3/8-inch for pipe 10 inches or larger. The minimum length of the middle ring shall be 5-inches for pipe sizes up to 10 inches and 7 inches for pipe 10 inches to 30 inches. The pipe stop shall be removed. Gaskets shall be suitable for 250 psi pressure rating or at rated working pressure of the connecting pipe. Couplings shall be harnessed and be designed for 250 psi.

B. Flanged adapters shall have one end suitable for bolting to a pipe flange and the other end of flexible coupling similar to that described hereinbefore. All pressure piping with couplings or adapters shall be harnessed with full threaded rods spanning across the couplings or adapters. The adapters shall be furnished with bolts of an approved corrosion resistant steel alloy, extending to the adjacent pipe flanges. Flanges on flanged adapter (unless otherwise indicated or required) shall be faced and drilled ANSI B16.1 Class 125.

C. Flexible couplings and flanged adapters shall be as manufactured by Dresser, Rockwell, or equal, per the following, unless otherwise specified and/or noted on the Drawings:

1. Steel couplings for joining same size, plain-end, steel, cast iron, and PVC plastic
pipe -

Dresser	Rockwell
Style 138	4II

2. Transition couplings for joining pipe of different outside diameters-

Dresser	Rockwell
Style 162 (4"-12")	413 steel (2"-24")
Style 62 (2"-24")	415 steel (6"-48")
	433 cast (2"-16")
	435 cast (2"-12")

3. Flanged adapters for joining plain-end pipe to flanged pipe, fittings, valves and equipment.

Dresser	Rockwell
Style 127 cast (3"-12")	912 cast (3"-12")
Style 128 steel (3"-48" C.I. Pipe)	913 steel (3" and C.I. Pipe)
Style 128 steel (2"-96" steel pipe)	

2.08 FLANGED JOINTS

A. Flange bolts and nuts shall be ASTM A 307, Grade B and shall have hexagonal heads. All bolts, nuts and studs for flanged pipe in submerged locations shall be

of 300 Series stainless steel. The flanges shall be drawn together until the joint is perfectly tight, with bolts of a length such that they will not project greater than 1/4-inch from the nut nor fall short of the end of the nut when drawn up. No washers shall be used. Gaskets shall be carefully fabricated prior to installation and must be suitable for pressure rating for the pipe for which it is used.

B. All flanges (unless otherwise indicated or required) shall be faced and drilled ANSI B16.1 125-pound for ductile iron and ANSI B16.5 150-pound for steel.

C. At the Contractor's option, and at no additional expense to the Owner, the following patented SBR flange gaskets or approved equal may be substituted for standard sheet packing ring gaskets in ductile iron flanged pipe:

1. TORUSEAL by American Cast Iron Pipe Company

2. FLANGE-TYTE by United States Pipe & Foundry Company

When using such gaskets, flange bolts shall be torqued to manufacturer's recommended torque values.

2.09 METAL PIPE SUPPORTS AND HANGERS

A. The Contractor shall furnish and install all pipe hangers, inserts, brackets, plates, anchors, and other supports not specifically included under other items. Generally pipe supports are not shown on the Drawings, but shall be supplied as specified herein. However, any bracing or support details shown on the Drawings shall be followed.

B. Prior to installation, the Contractor shall submit to the Engineer for review, manufacturer's data sheets on all catalogued items to be used and sketches covering all specially designed hanger and support assemblies and fabrications.

C. Supports and hangers shall be as manufactured by Grinnell, Elcen, or Fee & Mason, or equal or fabricated by the Contractor. Field fabricated supports may be used only for special conditions where manufactured items may not be suitable. In such cases, details of proposed supports shall be submitted to the Engineer for review. All such supports shall be galvanized.

D. Except as shown on the Drawings or as directed by the Engineer, supports and hangers shall be as follows:

1. Pipes with centerlines less than 24 inches from a wall shall be supported by a typical wall support bracket. Pipes with centerlines less than 6 feet above a floor shall be supported from below. All other pipes shall be hung from above. Piping shall be supported at no greater than 10 feet 0 inches on centers.

2. Pipe supported from underneath shall have adjustable pipe saddle supports on properly sized pipe stanchions. The saddle assembly shall be of cast iron. Standard pipe stanchions with hold-down "U" bolts shall be Grinnell Fig. 259, Elcen Fig. 49, Fee & Mason Fig. 2595, or equal.

3. Hangers are to be suspended from concrete work. Hangers shall be supported from approved metal inserts placed in concrete before the

concrete is placed. Standard concrete inserts shall be Grinnell Fig. 28l or 282, Elcen Fig. 86 or 65, Fee & Mason Fig. 186 or 2570, or equal. If special support from overhead concrete is necessary due to unusually heavy loads, support shall be as detailed on the Drawings. In no case shall standard concrete inserts be used where pipe load exceeds the manufacturer's recommended load for the insert, or where the hanger rod exceeds 7/8" diameter.

4. All pipe hangers, inserts, clamps, supports and other like items shall be submitted for review by the Engineer prior to installation.

5. All inside horizontal flanged piping shall be supported with approved split ring type adjustable hangers of malleable iron with suitable hanger rods unless shown otherwise on the Drawings. Special supports shall be constructed in accordance with details shown on the Drawings. Wall supports and/or hangers shall be placed not over 10 feet apart. All piping shall be rigidly supported to prevent loosening under vibration.

6. Pipe, valve operating stems, fixtures and conduits shall be bracketed or suspended from walls, ceilings, and beams at or near valves and fittings and where needed for firm support, by standard brackets, rods, turnbuckles, and rings made especially for pipe of sizes supported. Perforated strap iron and/or copper will not be acceptable.

7. Clevis hangers for "iron pipe size" O.D. pipe shall be Grinnell Figure 65, Elcen Figure l2, Fee & Mason Figure 239, or equal. Clevis hangers for Cast Iron O.D. pipe shall be Grinnell Figure 260, Elcen Figure 12C, Fee & Mason Figure 104, or equal. All clevis hangers shall be galvanized.

8. Turnbuckles shall be forged steel. Rods shall be of black steel, machine threaded of following sizes:

Pipe Size	Rod Diameter
1/2" - 2"	3/8"
2 1/2" - 3"	1/2"
4" - 5"	5/8"
6"	3/4"
8" - 12"	7/8"
14" - 16"	1"
18"	1 - 1/8"
20" - 24"	1 - 1/4"

9. Brackets shall be of standard castings of fabricated steel and shall be reviewed by the Engineer. Standard catalogued bracket shall be medium duty Grinnell Fig. 195, Elcen Fig. 57, Fee & Mason Fig. 151, or equal, galvanized, size as noted on Drawings. Provide light or heavy duty brackets if specifically noted on Drawings. "U" bolts shall be Grinnell Fig. 137, Elcen Fig. 68 or 68A, Fee & Mason Fig. 176, or equal.

10. Column type pipe supports shall consist of pipe columns of size required to carry the full pipe and standard cast iron bases and saddles as required. Saddles shall be of proper size to fit the pipe being supported.

2.10 INSULATION AND HEAT TRACING

Where indicated on the Contract Drawings or stated in the specifications, process piping shall be
provided with insulation and heat tracing cables.

A. Insulation shall be one-piece fiberglass section insulation (K=0.23 at 75 degrees F.) with factory applied white reinforced kraft/foil vapor barrier jacket. Longitudinal jacket laps and butt joints shall be self-sealing using 3" wide lap strips. Insulation shall be one of the following:

1. Owens/Corning "Fiberglass 25 ASJ/SSL".

2. Knauf "Fiberglass 850 Degree Snap-On".

Insulation shall be 2" thick, minimum.

B. Finishing Materials:

1. Acceptable manufacturers, 0.16" Embossed Aluminum Jacket:

a. RPR

b. ITW

2. Acceptable manufacturers, Aluminum premolded covers:

a. RPR

b. GasCo.

C. Heat tracing system shall be suitable for use on CPVC or stainless steel pipe, as applicable, and for a temperature range of 40 degrees to 102 degrees. Components of the heat tracing system shall be coordinated as to type, wattage and quantity of cables, type and thickness of insulation, type and diameter of pipe per manufacturer's recommendation.

PART 3 - EXECUTION

3.01 INSTALLATION OF PIPING

A. Materials shall be new and of the best grade and quality; workmanship shall be first class in every respect.

B. Each piece of iron pipe and each fitting shall be plainly marked at the foundry with class number and weight.

C. Where indicated on the Drawings, plain-end pipe shall be joined by means of flanged adapters or flexible couplings which shall be Rockwell, Dresser, or equal.

D. All pipe couplings shall be designed to safely withstand the operating pressure of the lines in which they are installed. All couplings shall be shop primed with an approved rust inhibitive primer.

E. Taps and connections to piping shall be made as required to connect equipment, sample lines, etc., and where otherwise shown on the Drawings.

F. Piping shall be installed straight and true, parallel or perpendicular to walls, with approved offsets around obstructions. Standard pipe fittings shall be used for changing direction of piping. No mitered joints or field fabricated pipe bends are permitted unless accepted by the Engineer.

G. All piping, fittings, valves and other accessories shall be thoroughly cleaned of dirt, chips and foreign matter before joint connections are made.

H. All plastic pipe shall be adequately supported and braced. Support spacing shall not exceed the recommendations of the Plastics Pipe Institute.

I. Teflon tape shall be used on all plastic pipe threaded connections.

J. Field cut male threads on plastic pipe shall be made with plastic pipe threading dies.

K. The annular space of plain wall sleeves shall be packed tight with lead wool to within 3/4" of wall face and then patch grouted flush to wall face with non-staining nonshrink grout, Masterflow 713 by Master Builders, Sonogrout by Sonneborn-Contech, or equal.

L. All pipe sleeves passing through walls or floors of chlorine feed and storage areas shall be provided with gas tight seals.

M. All pipe threads shall conform to ANSI B2.1.

N. Piping shall be erected to provide for expansion and contraction.

O. Screwed or soldered unions shall be provided in all small piping as required to permit convenient removal of equipment, valves and piping accessories from the piping system.

P. Dielectric insulating couplings or brass adapters shall be used whenever the adjoining materials being connected are of dissimilar material such as connections between copper tubing and steel pipe.

3.02 INSTALLATION OF PIPELINE INSULATION

A. Piping:

Butt all joints firmly together and secure all "self-seal" jacket laps with lap adhesive. Seal all butt joints with joint strips furnished with insulation. Install aluminum jacketing.

B. Fittings and valves:

1. Hot lines 2" and smaller: Valves, unions, and flanges shall not be insulated.

2. Hot and cold lines 2-½" and larger and cold lines 2" and smaller: Valves, unions, and flanges shall be insulated as follows, but insulation shall be removable to facilitate maintenance.

3. Insulate with molded fiberglass fitting segments of pipe covering, or with firmly compressed fiberglass blanket. Secure in-place with 20 gauge galvanized steel wire and finish with a smooth coating of insulating cement. Pipe sizes under 4" may be insulated with hydraulic cement. All thicknesses shall be equal to that of adjoining pipe insulation.

4. Finish insulation with two (2) 1/16" thick coats of mastic, applied at not more than 15 sq. ft. per gallon and reinforced with white glass fabric embedded between the coats. (Use breather mastic on hot pipe lines and vapor barrier mastic on cold pipelines). Lap the glass fabric on itself and on adjoining pipe insulation.

5. Option: Factory premolded PVC fitting covers may be used. Premolded covers shall overlap the adjoining pipe insulation and jackets and shall be secured at all edges with vapor barrier adhesive on cold pipes. Secure ends of all covers with pressure sensitive vinyl tape which shall overlap both the jacket and the cover at least 1". On fittings where temperature exceeds 250 degrees F., two layers of insulation shall be applied with a few wrappings of twine on the first layer to eliminate any voids or hot spots.

3.03 HEAT TRACING SYSTEM INSTALLATION

A. Heat tracing system shall be coordinated and installed per manufacturer's recommendations.

SECTION 11295 - INTERIOR PROCESS VALVES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish and install all new valves as shown on the Drawings and/or specified herein

1.02 SUBMITTALS

A. Descriptive literature, catalog cuts, and dimensional prints clearly indicating all dimensions and materials of construction, shall be submitted on all items specified herein to the Engineer for review before ordering.

B. At the time of submission, the Contractor shall, in writing, call Engineer's attention to any deviations that the submittals may have from the requirements of the Engineer's Contract Drawings and Specifications.

PART 2 - PRODUCTS

2.01 PLUG VALVES

A. Plug valves shall be non-lubricated eccentric type with resilient faced plugs and flanged ends faced and drilled ANSI B16.1 125-pound. Valves shall be furnished with corrosion resistant metal seats complying with AWWA C 507-73 Section 7.2; replaceable sleeve type bearings in the upper and lower journals, complying with AWWA C 507-73 Sections 8.1, 8.3, and 8.4; and shaft seals complying with AWWA C 507-73 Section 10. Valves shall provide drip-tight shutoff up to the full pressure rating. All plug valves shall be provided with limit stops and rotate 90° from fully opened to fully closed.

B. All in-plant plug valves shall be manually operated, with worm gear operator handwheel (4" and larger) or lever (3" and smaller). Plug valves located 6 feet or more above the floor shall be furnished with chain wheel operators.

C. Plug valves shall be as manufactured by DeZurik, or approved equal, and shall open to 100% of the corresponding pipe diameter.

2.02 GATE VALVES

A. Gate valves 4" and larger shall conform with AWWA C-509 standard, and shall be of the resilient seat type, iron body, fully bronze mounted, non-rising stem and have a design working pressure of 200 psi. Valves shall be of standard manufacturer and of the highest quality both as to materials and workmanship.

B. Valves ends shall be flanged and shall conform to ANSI B16.1 class 125 and be handwheel operated, unless otherwise shown on the Drawings or specified hereinafter.

C. An epoxy coating conforming to AWWA C-550 shall be applied to the interior and exterior ferrous surfaces of the valve except for finished or seating surfaces.

D. All gate valves shall have the name or monogram of the manufacturer, the year the valve casting was made, the size of the valve, and the working water pressure cast on the body of the valve.

E. Gate valves shall be as manufactured by Mueller Co., M&H, Clow, American Valve & Hydrant, Kennedy, or equal.

2.03 CHECK VALVES

A. The valve is a counterweighted, rubber seated check valve with attached cushion chamber whose function is to permit flow in only one direction, close tightly when its discharge side pressure exceeds its inlet pressure, and to close without a slam or bang.

B. The swing check valve shall be constructed with heavy cast iron or cast steel body with a bronze or stainless steel seat ring, a non-corrosive shaft for attachment of weight and lever, and complete non-corrosive shockless chamber.

C. It shall absolutely prevent the return of water, oil or gas back through the valve when the inlet pressure decreases below the delivery pressure. The valve must be tight seating, and must be shockless in operation. The seat ring must be renewable.

D. The cushion chamber shall be attached to the side of the valve body externally and so constructed with a piston operating in a chamber that will effectively permit the valve to be operated without any hammering action. The shock absorption shall be by air, and the cushion chamber shall be so arranged that the closing speed will be adjustable to meet the service requirements.

E. The valve disc shall be of cast iron or cast steel and shall be suspended from a non-corrosive shaft which will pass through a stuffing box and be connected to the cushion chamber on the outside of the valve.

F. All material and workmanship shall be first class throughout and the purchaser reserves the right to inspect this valve before shipment.

G. The valves will be Golden-Anderson Industries, Inc. Fig. No. 250-D, 125# or equal.

2.04 SILENT CHECK VALVES

A. Silent check valves shall have a semi-steel body, 150 psi pressure class and flanged drilled ANSI B16.1, Class 125. Plug, seat and guide bushings shall be ASTM B 143. Stainless steel helical spring shall be ASTM A276.

B. The plug which shall be guided at both ends with through integral shaft will be opened by the velocity flow and closed by a stainless steel helical spring, which returns the plug to the seat before the reversal of flow occurs.

C. To permit regrinding of seat in the field, the seat, plug and guide bushing shall all be easily removable and replaceable without the need for any special training and without the need for any tools unless provided by the manufacturer with the valve.

D. Silent check valves shall be Apco Series 600 as manufactured by Valve & Primer Corporation, or approved equal.

2.05 SLOW CLOSING AIR AND VACUUM VALVES FOR VERTICAL TURBINE PUMPS

A. Slow Closing Air & Vacuum Valve **4-inch and larger** shall have two (2) independent valves bolted together. The Air & Vacuum Valve must have all stainless steel float, guided on both ends with stainless steel shafts. The Air & Vacuum Valve seat must be Buna-N to insure drop tight closure. The Buna-N seat shall be fastened to the cover with stainless steel shoulder screws in a manner to prevent distortion of the seat. The float shall be guided at both ends with stainless steel bushings.

1. The valve cover shall have a male lip designed to fit into the body register for accurate alignment of the float into the Buna-N seat. The valve cover shall have a flanged outlet connection.

2. The Surge Check Valve shall be bolted to the inlet of the Air & Vacuum Valve and consist of a body, seat, disc and compression spring. A surge check unit shall operate on the interphase between the kinetic energy and relative velocity flows of air and water, so that after air passes through, and water rushes into the surge check, the disc starts to close, reducing the rate of flow of water into the air valve by means of throttling orifices in the disc to prevent water hammer in the air valves. The surge check orifices must be adjustable type for regulation in the field to suit operating conditions.

3. The complete Slow Closing Air & Vacuum Valve shall have been flow tested in the field, substantiated with test data to show reduction of surge pressure in the valve.

4. All materials of construction shall be certified in writing to conform to ASTM specifications as follows:

   a. Air Valve Cover, Body and Surge Check Body: Cast Iron; ASTM A126 GR. B

   b. Float: Stainless Steel; ASTM A240 T304

   c. Surge Check Seat & Disc: Bronze; ASTM B584 C83600

   d. Air Valve Seal: Buna-N

   e. Spring: Stainless Steel; ASTM A276 T316

   f. Exterior Paint: Phenolic Primer Red Oxide; FDA Approved for Potable Water Contact

B. Air valves **3-inch and smaller** shall consist of a body, cover, baffle, float, seat and water diffuser. The baffle shall shield float from direct impact of air and water to prevent premature closure of float. The seat shall slip fit into the baffle and lock in place without distortion, but be easily removable. The discharge orifice shall be fitted with a double-acting throttling device to regulate and restrict air venting. When pumps stop the double-acting throttling device shall automatically open allowing full line unrestricted air re-entry to prevent any measure of vacuum to forming the pump column. Air and Vacuum Valves for Vertical Turbine Pumps shall vent large quantities of air out through the orifice when pumps start, close tight when water enters the valve body, permit large quantities of air to re-enter through the orifice when pumps stop to prevent a vacuum from forming in the pump column.

1. The valve body and cover shall be made of cast iron ASTM A126 Grade B. The baffle shall be made of cast iron ASTM A48. The float shall be stainless steel ASTM A240 and be center guided (not free floating) for positive seating and rated for 1000 psi non-shock service. The seat shall be made of Buna-N elastomer. The entire baffle and float assembly shall be shrouded with the water diffuser, to prevent water slamming the float shut. The water diffuser shall be made of brass ASTM B16. All outlets shall be threaded (NPT).

2. Air and Vacuum Valves for Vertical Turbine Pumps shall be installed with a bronze shutoff ball valve. Bronze ball valves shall be in accordance with Division 15.

C. 3-inch and smaller Air and Vacuum Valves for Vertical Turbine Pumps shall be Series 140DAT as manufactured by APCO Valve and Primer Corporation, Schaumburg, Illinois, or equal.

2.06 BUTTERFLY VALVES

A. All butterfly valves shall be manufactured in strict accordance with the latest revision of AWWA C504, class 150B and conform to NSF Standard 61. Butterfly valves shall be of the tight closing, rubber (or synthetic rubber) seat type. Valves shall be bubble tight at the rated pressure in either direction and shall be satisfactory for applications involving throttling service and/or frequent operation and for applications involving valve operation after long periods of inactivity. All valves under this specification, unless indicated otherwise on the Drawings, shall be rated for 150 psi.

B. The valve disc shall rotate 90° from the full open position to the shut tight position. The valve disc shall be constructed of cast iron ASTM A-126, class B or ASTM A48, class 40. The cast iron disc shall have a continuous (non-segmented) type 316 stainless steel edge. The valve disc shall be connected to the shaft by type 316 stainless steel pins or torque screws.

C. Valve bodies shall be constructed of cast iron ASTM A-126, class B, and shall have flanged ends in accordance with ANSI B16.1 class 125. Valve bodies shall have rubber seats, be of one-piece construction, and be simultaneously molded and bonded to the valve body. The method used for bonding shall be tested in

accordance with ASTM D429 method A or B. No metal-to-metal seating surfaces will be permitted. Valves shall meet the full structural requirements of AWWA C 504. The valve manufacturer shall recommend the type of rubber seat to be used and shall be suitable for its intended service.

D. The shafts shall be turned, ground and polished. Valve shafts shall be a one piece unit extending completely through the valve disc and body. Valve stems shall be constructed of type 304 stainless steel with their diameters per AWWA C504, Class 150B.

E. The shaft seals shall be provided to prevent leakage into the bearing chest areas. Shaft seals shall be made of a rubber suitable for the intended service and shall be a packing gland utilizing a self-compensating "V" type packing.

F. Valves shall have upper and lower (each side of disc) shaft bearings. Shaft bearings shall be of a self-lubricating, non-metallic construction. The valve manufacturer shall recommend the type of bearing to be used and shall be suitable for its intended service.

G. All surfaces of the valve shall be clean, dry and free from grease before painting. The valve surfaces except for disc, seating and finished portions shall be evenly coated at the factory with a suitable rust inhibitive primer. Hydrostatic and leakage tests shall be conducted in strict accordance with AWWA C 504.

H. Butterfly valves shall be as manufactured by the Henry Pratt Company, DeZurik or engineer approved equal.

I. Butterfly Valve Operators

Valves shall be positioned to provide for the most convenient possible installation position for the valve actuator.

1. Manual Valve Operators

Manually operated valves shall be operated using a cast iron housed handwheel or chain wheel, as required, available in standard weatherproof construction. All units shall have adjustable open and close position stops, with provisions to prevent accidental adjustment changes. The operating shaft shall be supported, axially and radially, at the input end by permanently lubricated bronze thrust and sleeve bearings. All units shall be provided with a pointer assembly for valve position indication.

Manual valves located six (6) feet or more above finished floor level shall be furnished with chain wheel operators operators. Chains shall extend to within four (4) feet off the floor. All NRS floor stands and geared operators shall be indicating type.

2. Electric Motor Valve Operators

a. General: Electric motor operators shall be designed to move the valve from fully open to fully closed with operating speeds such that no undue surge or water hammer occurs when electrical power is applied, and hold the valve disc in any intermediate position between fully open to fully closed without creeping or

fluttering. Valve, gear, reducer, electric motor operator and accessories shall be furnished complete, ready for installation.

b. Actuator and Gearing: The actuator shall be of worm and gear, single reduction design with provision for input spur or bevel gear assemblies to meet a given rim pull or input torque requirement. The input shaft of the manual shall be an extension of the worm shaft, which is a hardened alloy steel. The mating worm gear shall be alloy bronze, accurately cut by hobbing machines. All gearing shall be greased lubricated. Ball or roller bearings shall be used to provide smooth rotation of the worm shaft.

All units shall be provided with a pointer assembly for valve position indication.

All units shall be readily field adaptable to motor operation without disassembly of the manual actuator.

The actuator shall comply with AWWA C-504 specifications.

c. Mechanical Stops: The actuator shall house an adjustable mechanical stop device to prevent travel beyond the valve requirement. The stop shall allow valve travel of 90° with a minimum adjust ability of +5°. All stops shall be of steel material.

d. Output Drive: The actuator shall have a removable splined adapter which shall be machined to accept the valve shaft. This adapter material shall be of carbon steel.

e. Electric Actuator: The electric valve actuator shall include the motor, operator unit gearing, limit switch gearing, limit switches, torque switches, stem nut, declutch lever, and auxiliary handwheel, as a self-contained unit. The actuator shall meet AWWA-C-504-87 specifications.

f. Enclosure: The valve actuator motor and all electrical enclosures shall be NEMA 4X, weatherproof, with a 120 volt heater. Unit shall be furnished with a reversing contactor suitable for mounting at any angle. Local control to be provided by a three position selector switch, OPEN-OFF-CLOSE, and a padlockable REMOTE-OFF-LOCAL selector switch. Controls shall be in a remote enclosure separate from the actuator.

g. Motor: The motor shall be specifically designed to operate on 460 volt three phase for valve actuator service and shall be of high starting torque, totally enclosed, nonventilated construction. Motor leads shall be brought into the control compartment or limit switch compartment without external piping or conduit boxes. Motor insulation shall be a minimum NEMA Class B with winding thermostat and a 15 minute rating without exceeding temperature rise.

The motor shall be of sufficient size to open or close the valve against the maximum expected differential pressure within 60 seconds when voltage of the motor terminals is 10 percent above

or below nominal voltage. The motor duty rating shall be 15 minutes without exceeding its temperature rating. The motor shall be prelubricated and all bearings shall be of the anti-friction type.

h. Electric Actuator Gearing: The actuator shall be a double reduction unit with the capability of changing the output speed with a relatively fast, simple gear change. The power gearing shall consist of spur or helical gears and worm gearing. The spur or helical gearing and work shall be of hardened alloy steel and the worm gear shall be alloy bronze. All gearing shall be accurately cut with hobbing machines. All power gearing shall be grease lubricated. Ball or roller bearings shall be used throughout.

i. Position Limit Switch: Position limit switches and associated gearing shall be an integral part of the valve actuator. Limit switch gearing shall be of the intermittent type, made of bronze or stainless steel, grease-lubricated, and enclosed in its own gear case to prevent dirt and foreign matter from entering the gear train. Switches shall be adjustable, allowing for trip points from fully open to fully closed positions of valve travel. They shall not be subject to breakage or slippage due to over travel.

Limit switches shall be of the heavy duty, open contact type with a rotary wiping action.

Each valve actuator shall have a minimum of eight heavy duty contacts with two or four rotor-type switch assemblies. Limit switches shall shut-off the actuator once a desired valve disc location is reached in position seat application.

The gear limit switch and torque switch shall carry a standard pilot duty rating as tabulated below:

Voltage	**Normal Current**	**In Rush Current**
460 A.C.	1.75 Amps	7.5 Amps

j. Torque Switch: Each valve actuator shall be equipped with a double torque switch which is responsive to loads encountered in both the opening and closing direction. Each side of the switch shall have a graduated dial and shall be adjustable. A calibration tag shall be mounted near each switch correlating the dial setting with the unit output torque. The torque switch shall operate during the complete valve cycle without the use of auxiliary relays, linkages, latches, or other devices. The torque switch shall be designed to shut off the actuator motor in the event that abnormally high torque is realized in either direction of travel. The torque switch is utilized as a protective device in valve applications requiring position seating.

k. Manual Operation: A handwheel shall be provided for manual operation. The handwheel shall not rotate during motor operation. A fused motor shall not prevent manual operation. When in manual operating position, the unit will remain in this position. The actuator will remain in motor position when the motor is

energized. The actuator will remain in motor position until handwheel operation is accomplished by a positive declutching lever which disengages the motor and related gearing mechanically but not electrically. It shall not be possible for the unit to be simultaneously in manual and motor operation.

l. Electrical Requirements: The actuator shall be powered by a clearly defined 460 volt, 3-phase power, and all controls shall function on a stated control source and voltage. Electrical controls to be supplied by the actuator manufacturer as indicated in the specifications.

m. Manufacturer: Electric motor operators shall be as manufactured by Auma, Rotork, or equal.

3. Modulating Valve Operators

a. The valve operators are to be as manufactured by "Auma," "Rotork," or equal, and shall consist of motors, gearing, limit switches, torque switches, handwheel, control equipment and electrical connections, motor electrical connections, and related components as specified in the following paragraphs. Keystone actuators are unacceptable.

b. All motors, gearing switches, wiring terminals, and electrical connections shall be completely sealed against the environment and protected against the ingress of water, humidity, and dust. The enclosure shall be O-ring sealed at all interfaces and rated NEMA 4. Bolts on all cores shall be captive to prevent loss when disconnected. Switches (both limit and torque) shall be NEMA 4 so that no dirt, dust, water, etc., may interfere with the contacts when the limit switch compartment cover is removed.

c. The drive motor shall be of sufficient size to open or close the valve against maximum differential pressure when voltage to the terminals is 90 percent of nameplate rating. The drive motor shall be specifically designed for operator service. Motors shall be totally-enclosed, non-ventilated construction, and suitable for use in Class I, Division 2, hazardous locations, with permanently lubricated ball bearings. Insulation shall be Class F, tropicalized, anD suitable for temperatures of up to 310□F. Motors shall be thermally protected, with at least 2 thermal switches embedded in the windings to ensure safe motor shut-down during high current/high temperature conditions. Motors shall be capable of starting against rated load. Motors shall meet NEMA standards and shall have an enclosure of aluminum, die cast with cooling fins.

d. The operators shall be equipped with travel limit switches for the purpose of de-energizing the drive motor at variable, adjustable, open and close positions. Limit switches shall be of the double pole, double throw, double break type. A minimum of 8 silver contacts rated at 10 A at 115 VAC shall be provided for each operator (2 NO, 2 NC for opening and 2 NO, 2 NC for closing). The limit switch drive is to be of counter gear design consisting of

bronze gearing of the intermediate open type and shall be in step with the operator output drive in both the motor drive and manual (handwheel) modes. Limit switches and the limit switch drive mechanism shall be an integral part of the operator. Limit switches shall be so designed that they can be adjusted to change state at any point between or behind the fully open and fully closed positions. Limit switch assemblies are to have easy set declutch, so tripping cam can be rotated with no more than 10 revolutions of the cam screw. All contacts on the limit switch assembly are to be sealed in NEMA 4 closures to maintain the integrity of the contacts. There shall be no exposed connections. Limit switch adjustment shall be clearly marked.

e. Each operator shall have an opening torque switch and a closing torque switch. Torque switches shall have a range of adjustment and be responsive to opening or closing loads such that switches operate to protect the valve and operator from damage when there is a valve obstruction or overload during openings or closing. Torque switches are to be calibrated and directly readable in torque units. All contacts shall be sealed to maintain the integrity of contacts. Torque switches shall be single pole, single throw, double break type with contacts rated 10 A at 115 VAC. The adjustment range shall be blocked to prevent stalling of the motor. All travel limit and torque switches shall have a manual trip knob to test phase rotation for purposes of preventing damage to the valve.

f. A continuous reading mechanical dial position indicator shall be furnished as an integral part of the actuator to indicate valve position. Also, a 4-20 mAdc output valve position transmitter shall be provided to transmit valve position to a receiver.

g. All gearing shall be designed to withstand without failure the stall torque of the motor. The final drive shall be of the self-locking worm and wheel type to prevent creeping of the valve disk in intermediate positions. Gear boxes are to be of cast iron construction and completely filled with lubricant, allowing operator to be installed in any position.

h. The drive nut shall be separable from the gear assembly to facilitate rapid mounting of the operator on the valve. The drive nut shall be splined to allow mounting on the valve at 90 degree intervals in order that the valve/operator combination can be mounted to minimize interference with adjacent facilities and equipment.

i. Stops shall be furnished to mechanically restrict the movement of the valve disc from passing through the seat. The stops shall be adjustable from 80-120□ in order that accurate seating can be achieved.

j. A permanently attached handwheel shall be furnished to allow manual operation of the operator. The handwheel shall not turn during motor operation and the motor shall not turn during

handwheel operation. A fused motor shall not prevent manual operation.

k. Electrical terminals and connections shall be of the plug and socket design so removal of cover simultaneous disconnects all electrical wiring from the actuator. The terminal compartment is to be separate from the limit switch/torque switch compartment and shall include the terminals for the motor leads. Two conduit entries shall be provided and cover bolts shall be captive.

l. The operator shall contain an electronic control module to control the speed of the a-c motor. The control module shall be designed to accept a 4-20 mAdc input signal from a remote source. The control module shall have span, zero, gain, and deadband adjustments to allow for positive valve tuning and prevent "hunting." The control module shall be equipped with a feedback potentiometer for use in balancing the control circuit. The position feedback potentiometer shall be provided with anti-backdash gearing or shall be operated directly from the valve shaft as required to minimize hysterics to within one degree. The valve control shall be provided with a selector switch to allow operation by means of push-button or automatic modulating control from the remote 4-20 mAdc signal.

m. The operator housings shall be equipped with space heat to drive off moisture.

n. All valve operator controls shall be housed in a NEMA 4 enclosure, remote-mounted from the valve, for installation in the pump control panel.

o. A 460 volt, a-c three phase, 60 Hz power feed shall be provided to power each valve/control assembly.

2.07 PUMP CONTROL VALVES

B. Pump control valve system shall be Pratt "Check-Mate" with "Standard Elector-Check" controls, or equal.

C. Butterfly Valves: Butterfly valve shall be a Pratt Model 2FII for the 14", and an XR-70 for the 24" with cast iron body, ASTM A-126, Class B, cast iron disc with 316 stainless steel disc edge, 304 Type 18-8 valve shaft, and Buna N valve seat. Valve operator shall be an MDT series duracyl, hydraulic double acting cylinder designed for operation with water as the operating media, complete with a surge pump control system. For information purposes, the pump data is as follows:

	Well Pumps	**Booster Pumps**
Shut-off head	96 feet	172 feet
Operating head	86 feet	149 feet
Design flow	100 gpm	150 gpm

D. Controls: The control system for the pump control check valves shall consist of operated solenoids for opening and closing the butterfly valve, speed control valve for adjustment of rate of valve movement, and manual hydraulic operation system for both automatic and manual. System shall be capable of throttling in the manual mode.

1. Independent adjustable rates of valve opening and closing operations.

2. Independent adjustable closure rate resulting from an electric power failure or other operational signal eliminating power to the system.

The system shall be provided with a single solenoid four-way valve for the normal open and close function. Two solenoid operated two-way valves shall be provided for emergency closure, bypassing the single solenoid four-way valve. Separate adjustable speed control valves shall be furnished for open, close and emergency operation. The system shall be provided with a manual override for the normal open and close function.

The required speeds of operation shall be as follows:

Normal open	-	60 seconds minimum 300 seconds maximum
Normal Close	-	60 seconds minimum 300 seconds maximum
Emergency close	-	10 seconds minimum 20 seconds maximum

The control system shall be fully piped and wired, and contained within a NEMA XII cabinet with a hinged access door. All fittings and tubing shall be brass and copper. Electrical wiring shall terminate in a separate NEMA IV junction box within the control cabinet.

The pump check valve should be furnished with three limit switches. One each for the full open or full closed positions, and the third switch shall provide momentary interruption of the pump motor control to initiate pump shutdown prior to 100% valve closure to minimize hydraulic surge.

E. Electric Control Panel: In addition to the pump check valve hydraulic controls, an electric control panel shall be supplied containing all necessary relays, timers, buttons and lights to interface the pump controls with the pump check valve controls. The Panel shall provide for:

1. Visual indication of valve position with red and green indicating lights.

2. Visual indication of alarm conditions with amber flashing lights.

3. Emergency shut down of pump and valve by an external button.

4. Pump system lockout after an alarm condition. System to be started again only after the reset button is pressed.

The alarm function of the panel shall include an adjustable solid state timing relay, lockout relay, lockout relay flashing light and reset button. The controls shall be housed in a continuous hinge NEMA 4 cabinet suitable for wall mounting. Each alarm relay shall have a set of contacts wired to the terminal strip for remote indication.

F. The pump check control shall be Pratt "Check-Mate" with standard "Elector-Check" control system.

2.08 VALVE OPERATORS

A. Valve operators shall be as shown on the plans and specified herein and in Section 13420. Special operators where shown on the plans shall be furnished under this item and Section 13420. Valves shall be positioned to provide for the most convenient position of the actuator possible.

B. Valves located six (6) feet or more from floor level shall be furnished with chain wheel operators or chainlevel operators. Chains shall extend to within four (4) feet off the floor. All NRS floor stands and geared operators shall be indicating type.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All valves shall be installed in accordance with the manufacturer's recommendations.

SECTION 13

SECTION 13202 – GROUND STORAGE TANK

PART 1 - GENERAL REQUIREMENTS

1.01 SCOPE OF WORK

A. The Contractor shall be responsible for all labor, materials and equipment necessary for the design, fabrication, construction, painting, disinfection and testing of a welded carbon steel water storage tank built at grade level on a concrete foundation. Design and construction of the Water Storage Tank shall conform to all requirements of AWWA D100 Standard for Welded Carbon Steel Tanks for Water Storage, except as modified by the requirements of these contract documents. The Contractor may use Section 14 of the AWWA D100 as a part of the design. Tanks designed on this basis must incorporate all the provisions of this section. The requirements of Section 3 of the AWWA D100 are superseded by any differing requirements of Section 14.

1.02 QUALIFICATION OF MANUFACTURER

A. The design and construction of the Ground-Supported Flat-Bottom Water Storage Tank shall only be undertaken by a Contractor with a minimum of five years experience with tank construction. The Contractor must be able to demonstrate experience through the design and construction of at least five Ground-Supported Flat-Bottom Water Storage Tanks.

1.03 SUBMITTALS

A. A preliminary drawing of the tank showing major dimensions and plate thickness upon which the bid is based, tank diameter, the high water level and the dimensions of the supporting foundation.

B. A foundation design drawing showing preliminary dimensions and approximate quantities of concrete and reinforcing steel.

1.04 STANDARD SPECIFICATIONS

A. All work on the water storage tank shall fully conform to the requirements of the Of the latest published editions of the following specifications.

1.1.1. AWWA (American Water Works Association) D100 Standard for Welded Carbon Steel Tanks for Water Storage.
1.1.2. AWWA D102 - Standard for Painting Steel Water Storage Tanks.
1.1.3. AWWA C652 - Standard for Disinfection of Water Storage Facilities.
1.1.4. AWS (American Welding Society) D1.1
1.1.5. NSF (National Sanitation Foundation) 61 - Materials in contact with Potable Water.
1.1.6. Steel Structures Painting Council Manual - Volume 1 - Good Painting Practice,
1.1.7. Steel Structures Painting Council Manual - Volume 2 - Systems and Specifications.
1.1.8. ACI 318 - Building Code Requirements for Reinforced Concrete
1.1.9. ACI 301 – Standard Specification for Structural Concrete

1.05 TANK DETAILS

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

1. The minimum operating capacity of the storage tank will be 150,000 US gallons

2. The tank diameter will be 35 feet.

3. The height of the tank, top of foundation to High Water Level, shall be 20 feet

1.06 PERMITS, EASEMENTS, ELECTRICAL LINES AND UTILITIES

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

The site plan or specifications shall clearly indicate the approximate location of all overhead or underground electrical lines and other utilities and piping. .

1.07 WORKING DRAWINGS

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

PART 2 - DESIGN

2.01 GENERAL

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

1. Foundations – AWWA D100 and ACI 318 -- Building Code Requirements for Reinforced Concrete

2. Steel Tank - AWWA D100

3. The Contractor may use Section 14 of the AWWA D100 as a part of the design. Tanks designed on this basis must incorporate all the provisions of this section. The requirements of Section 3 of the AWWA D100 are superseded by any differing requirements of Section 14.

4. Steel Tank Painting – AWWA D102

2.02 SEISMIC LOAD

A. Seismic Design shall be performed in accordance with Section 13 of AWWA D100-05. Structures located in regions where the mapped spectral response acceleration at 1-second period S_1 is less than or equal to 0.04g and the mapped short-period spectral response acceleration S_S is less than or equal to 0.15g do not require design for seismic loads. All other structures that will require seismic design shall have the following parameters defined. Note that these parameters have a significant bearing on design and, hence, the final cost:

1. Seismic Use Group - A classification assigned based on the tanks intended and expected performance.

2. Per AWWA D100, Seismic Use Group III shall be used for tanks that provide direct services to facilities that are deemed essential for post-earthquake recovery and essential to life, health and safety of the public, including post-earthquake fire suppression.

3. For tanks that provide direct service to facilities that are deemed important to the welfare of the public Seismic Use Group II shall be used.

4. For tanks not assigned to Seismic Use Group III or II, Seismic Use Group I shall be used

5. (Seismic Use Group is used to assign the Seismic Importance Factor AWWA D100 recommends Use Group III as a default value, corresponding to the Seismic Importance Factor IE value of 1.5, the most severe case.)

6. Site Class The Geotechnical Engineer shall determine the Site Class based on local soil conditions in the upper 100 feet of site soil profile (AWWA D100 Table 25). Sites with a soil profile F require site specific response spectra as defined in Section 13.2.8.1 of AWWA D100-05.

7. Latitude & Longitude Exact location of the tank site in Latitude and Longitude, or at least the USPS Zip Code values. These parameters are needed for determining the mapped acceleration parameters.

8. Mapped Accelerations Along with the site class, defined above, the Geotechnical Engineer shall provide:

   S_S Mapped maximum considered response acceleration, 5 percent damped, at 0.2 second period, and S_1 Mapped maximum considered response acceleration, 5 percent damped at 1 second period.

2.03 WIND LOAD

A. Wind pressure shall be determined in accordance with AWWA D100-05, Section 3.1.4. For tanks located in coastal regions, Owner's Engineer shall consider use of increased wind load as appropriate.

2.04 SNOW LOAD

A. Snow load shall be determined in accordance with AWWA D100-05, Section 3.1.3.1for 25 psf minimum loading. Owner's Engineer shall specify a higher snow load, as appropriate, if required in a high snow region

2.05 FOUNDATION

A. A copy of the boring report is included with the Contract Documents. Recommendations for the foundation and allowable bearing capacities are defined in this report. The concrete foundation shall be designed and constructed by the Contractor based upon the recommendations contained in the boringl report. The report must provide the allowable soil bearing pressure with appropriate factors of safety, the active and passive earth pressure coefficients, the angle of soil internal friction, its cohesion, unit weight and recommendations for bearing depth and backfill requirements.

2.06 STEEL TANK

1.1.10. **General**

The materials, design, fabrication, erection, welding, testing and inspection of the steel tank shall be in accordance with the applicable sections of AWWA D100 except as modified in this document.

1.1.11. **Minimum Plate Thickness**

The minimum thickness for any part of the structure shall be 3/16 inch for parts not in contact with water and 1/4 inch for parts in contact with water.

1.1.12. **Tank Roof**

The tank roof shall be designed as per the project drawings. All interior lap joints will be sealed by means of caulking or continuous seal welding. The interior lap joints shall be defined to include roof plate laps. If roof is supported by rafters, the rafter shall be welded to the roof plates as required structurally. Any unwelded rafter to plate joints shall be sealed by caulking. All penetrations of roof accessories inside the tank. The minimum thickness for roof plates not in contact with water will be 3/16".

PART 3 - CONSTRUCTION

3.01 Concrete Foundation

A.The foundation shall be designed and constructed to safely and permanently support the structure. The basis of the foundation construction shall be consistent with the soils investigation data included herein at the end of these specifications. The concrete foundation shall be constructed in accordance with ACI 301. Minimum concrete compressive strength shall be as specified in "Cast-In-Place Concrete Section".

3.02 STEEL TANK CONSTRUCTION

A. General -The erection of the steel tank shall comply with the requirements of Section 10 of AWWA D100 except as modified by these documents.

B. Welding - All field welding shall conform to AWS and Section 10, AWWA D100. The contractor shall ensure welders or welding operators are qualified in

accordance with ASME Section IX or ANSI/AWS B2.1.

C. Fabrication - All fabrication and shop assembly shall conform to the requirements of AWWA D100, Section 9, Shop Fabrication.

D. Erection - Plates subjected to stress by the weight or pressure of the contained liquid shall be assembled and welded in such a manner that the proper curvature of the plates in both directions is maintained. Plates shall be assembled and welded together by a procedure that will result in a minimum of distortion from weld shrinkage.

Joints in bottom of tank shall be continuously lap welded on top side only. The bottom ring of the tank wall shall be continuously welded to the floor plate both inside and outside.

3.03 INSPECTION AND TESTING

A. Inspection and Testing - Inspection of shop and field welds shall be in accordance with AWWA D100, Section 11, Inspection and Testing. All inspection shall be performed prior to interior and exterior field painting. Radiographic inspection shall be performed by an independent testing agency with all cost included in the Contractor's bid and paid by the Contractor.

3.04. PAINTING AND DISINFECTION

A. Surface preparation and coating of all steel surfaces shall be in accordance with section 13203 "Coating System for Steel Water Storage Tanks".

PART 4 – ACCESSORIES

4.01 GENERAL

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

4.02 LADDERS

A. An exterior tank ladder shall be attached to the tank shell extending from Approximately 8' above top of foundation to the top of the shell.

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

4.03 FALL PROTECTION

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

4.04 OPENINGS

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

B. Tank Vent - The tank vent shall be centrally located on the tank roof above the maximum weir crest elevation. The tank vent shall have an intake and relief capacity sufficiently large that excessive pressure or vacuum will not develop during maximum flow rate. The vent shall be designed, constructed and screened so as to prevent the ingress of wind driven debris, insects, birds and animals. The vent shall be designed to operate when frosted over or otherwise clogged. The screens or relief material shall not be damaged by the occurrence and shall return automatically to operating position after the blockage is cleared.

C. Shell Access Manhole - One 30 inch diameter and one 24 inch diameter shell manhole shall be provided near grade level to allow access to the tank interior. The manholes are to be location 180 degrees apart. The manhole lid shall be Hinged or otherwise self-supported and open outward.

4.05 RIGGING

A. A painter's rail attached to the roof, pipe couplings with plugs in the roof or other Attachments that provide complete acce3ss for painting shall be furnished.

4.06 PIPING

A. Inlet/Outlet Piping - The vertical inlet/outlet pipe connection to the bottom of the tank shall be standard weight carbon steel pipe with appropriate transition to a base elbow of the same diameter. The vertical pipe shall be attached through the bottom of the tank as near to the shell wall as feasible. The connection from the piping to the tank floor shall be a watertight connection.

B. Overflow -The overflow pipe shall be designed to carry the maximum design flow 110 GPM. The 6" inch steel overflow pipe shall have a minimum wall thickness of ¼". A suitable weir shall be provided inside the tank with the crest located at High Water Level. The overflow pipe shall extend from the weir and down the exterior of the tank terminating approximately 1 to 2 feet above grade and discharge onto a concrete splash pad. The point of discharge shall have a 45 degree bend and be equipped with a stainless steel screen.

4.07 IDENTIFICATION PLATE

A. A tank identification plate shall be mounted above a shell manhole. The identification plate shall be corrosion resistant and contain the following

information.

1.1.13. Tank Contractor
1.1.14. Contractor's project or file number
1.1.15. Tank capacity
1.1.16. Tank diameter and height to High Water Level
1.1.17. Date erected

4.08 GURANTEE

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

B. All guarantees obtained by the tank Contractor from the manufacturer or installer of paint, equipment or accessories not manufactured by tank Contractor shall be obtained for the benefit of the Purchaser.

SECTION 13203 – GROUND WATER STORAGE TANK PAINT

PART ONE – GENERAL REQUIREMENTS

1.01 SCOPE OF WORK

A. General: All paint shall be applied only under favorable conditions and by skilled painters. All surfaces to which paint is applied shall be clean and dry to the satisfaction of the Engineer. No paint shall be applied during wet or foggy weather, or when the temperature of the air is below 50° F. All painting shall be done strictly in accordance with the paint manufacturer's instructions and performed in a manner satisfactory to the Engineer. All coatings shall be in accordance with current EPA Standards.

B. Quality of Paint: The paints and paint products of the manufacturer mentioned in the following specifications are set up as standards of quality and the bid for this Contract shall be based on providing the products of the manufacturer mentioned hereinafter. The products of other manufacturers comparable in quality and type to those specified will be acceptable if said paints are offered by the Contractor with satisfactory data on past performance on water storage tanks, composition, directions for use and other information required, and if approved by the Engineer. All materials shall be brought to the job site in the original sealed and labeled containers of the paint manufacturer and shall be subject to inspection by the Engineer's inspector on the job. All materials shall be of same manufacturer's system. In no case shall the products of more than one manufacturer be applied to the same surface.

The Contractor shall submit to the Engineer, immediately upon completion of the job, certification from the manufacturer indicating that the quantity of each coating purchased was sufficient to properly coat all surfaces. Such certification shall make reference to the square footage figures provided to the manufacturer by the Contractor.

C. Application of Paint: The painter shall apply each coating at the rate, and in the manner, specified by the manufacturer. If the material has thickened or must be diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material. The finish coating shall be completely without defects permitting moisture penetration when tested according to the low voltage wet-sponge method. Deficiencies in film thickness shall be corrected by the application of an additional coat of paint. The paint applicator shall have available on the project site a paint film thickness measuring device similar to the Nordson (elcometer) Dry Film Coating Thickness Gage 0-23 mil range Part No. 790 031, or equal.

D. Coating Procedures:

1. All coating work shall meet the requirements of the coating manufacturer.

2. All surfaces to be coated shall be in the proper condition to receive the specified coatings before any coatings are applied. Do not sandblast any more surfaces than can be primed within the same working day that the sandblasting is done. Round off all sharp edges and rough welds. Remove all burrs and weld splatter. Remove oil, grease and heavy deposits if surface contaminants by solvent or detergent cleaning. All surfaces shall be clean, dry and free of any dirt, dust, grease, oils, salts , and other deleterious substances before coatings are applied.

3. Whatever metal is cleaned during a working day shall be coated with primer on the same working day.

4. Coat all interior and exterior weld seams surfaces by the brush method on field prime coat and field intermediate coats.

5. Coatings shall be applied in such a manner to produce as uniform a thickness of coat and as complete coverage as possible, free of lap marks.

6. Each coat shall have air-drying period of at least 24 hours.

7. The dry film thickness specified shall be obtained. Additional coats shall be applied at the Contractor's expense, if required to achieve the specified dry film thickness.

8. Only good, clean brushes and equipment shall be used. Clean all brushes, rollers, buckets and spray equipment at the end of each coating period.

9. Do not start filling the coated tank with water before the coatings have properly dried or cured. The minimum drying or curing time allowed shall not be less than three (3) days at 75 degrees F.

E. Painting System:

1. Prior to the application of the prime coat, all steel surfaces shall be prepared as in Steel Structures Painting Council SSPC-SP 10 "Near-White Blast Cleaning." After blast cleaning, all surfaces shall be thoroughly and completely cleaned of all traces of residue and dust.

2. All interior and exterior steel surfaces shall be given a primer coat as specified hereinafter. The primer coat shall be applied the same day as the blast cleaning or pickling is completed. Spray all surfaces within two inches of the edge with one coat, to a dry film

thickness as specified. The cleaning and application of the primer are to be done by the fabricator.

3. After the tank is erected and the welding completed, the weld seams, abraded areas, and all unprimed surfaces, both interior and exterior, shall be thoroughly cleaned to a near-white grade in accordance with the procedures specified in Steel Structures Painting Council SSPC-SP 10 "Near-White Blast Cleaning," and the shop primed surfaces shall be cleaned of all dirt and foreign matter. All unprimed or abraded areas shall then be spot primed and retouched, wherever necessary, using the same primer to air dry at least 24 hours before recoating. The dry coating thickness of the primer so applied shall be same as specified for shop primer.

4. Interior floor of the tank shall be completely swept clean of all debris, dirt, and loose particles prior to field surface preparation and painting.

5. Interior rough irregular weld seams, weld deposits, and other surfaces which have not been ground smooth, shall receive a brush coat application of primer thinned 20 percent and worked into the irregular surfaces.

6. The interior final field finish coat shall be as specified hereinafter. Spray all interior surfaces with one complete coat to a dry film thickness as specified. The total dry film thickness for the two-coat system shall be as specified. Curtains and sags will not be acceptable. Total dry film build shall not vary more than 2 $\pm$ mils throughout the interior of the tank.

7. The interior of the tank is to have forced ventilation and circulating air continually for a period of 24 hours supplied by an exhaust fan capable of circulating air at 25,000 CFM, or of adequate size in relation to the size of the tank. The tanks also shall be allowed to dry at least seven to ten days at atmospheric temperatures of 60□ F. or higher to allow proper curing of the completed coating system before it is disinfected and filled with water. During this period, access and ventilation manholes in the tanks shall be left open.

8. The exterior intermediate coat shall be as specified and shall be sprayed on all steel surfaces as specified for the primer and intermediate coats. Allow intermediate coat to dry a minimum of 24 hours before recoating.

9. The exterior final finish coat shall be applied to all steel surfaces to a dry coating thickness as specified.

10. The Paint System shall be as scheduled below:

INTERIOR

The interior coatings shall be as follows:

COAT	COATING TYPE	SPECIFICATION
Primer	Aromatic Zinc-Rich Urethane	Tnemec 91H20 Zinc 2000 (2.5 - 3.5 mils dry)
Intermediate	Polyamide Epoxy	Tnemec 40LT (4.0 - 6.0 mils dry)
Finish	Polyamide Epoxy	Tnemec 40LT (4.0 - 6.0 mils dry)

EXTERIOR

The exterior coatings shall be as follows:

COAT	COATING TYPE	SPECIFICATION
Primer	Aromatic Zinc-Rich Urethane	Tnemec 91H20 Zinc 2000 (2.5 - 3.5 mils dry)
Intermediate	Polyamide Epoxy	Tnemec 40LT (2.0 - 3.0 mils dry)
Finish (1st coat)	High Build Acrylic Polyurethane	Tnemec 74 (2.0 - 3.0 mils dry)
Finish (2nd coat)	High Build Clear Polyurethane	Tnemec 76 (1.5 - 2.0 mils dry)

Exterior color shall be as selected by the Owner

Note: The paint names and numbers given above for this painting system are those of the Tnemec Company of North Kansas City, Missouri. An equal alternate paint system may be submitted for approval.

F. Workmanship and Materials: Workmanship, procedures, and materials shall in general comply with the requirements of AWWA D102 where applicable.

G. Product Delivery, Storage And Handling:

1. The Contractor shall be responsible for the delivery, storage and handling of coating products.

2. Deliver all materials to the job site in original, new unopened packages and containers bearing manufacturer's name and label.

3. Provide labels on each container with the following information:

a) Name or title of material;
b) Manufacturer's stock number;
c) Manufacturer's name;
d) Contents by Volume, for major pigment and vehicle constituents;
e) Expiration date after which the material should not be used;
f) Thinning instructions; and
g) Application instructions.

4. Store coating products in sealed and labeled containers. Properly store coatings to prevent degradation of the coating products. Do not use coating products that have been damaged during storage, which have not been applied prior to the applicable expiration date, or which do not otherwise comply with the specifications. Promptly remove damaged coating products from the job site.

5. Restrict storage to coating materials and related equipment. Store materials in an area protected in accordance with NFPA Bulletin 101.

6. Product delivery, storage and handling shall meet the requirements of safety, health and fire regulations. Remove used rags from the job site and take all necessary steps to prevent spontaneous combustion.

H. Inspection Equipment:

The Contractor shall furnish the following for purposes of inspection.

1. Pictorial surface preparation standards as provided by the Steel Structures Painting Council (SSPC - Vis 1) or the American Society for Testing and Materials (ASTMD 2200);

2. Wet film thickness measurement gage;

3. Dry film thickness measurement gage;

4. Certified thickness calibration standards;

5. Steel temperature gages;

6. Wet bulb and dry bulb temperature - measuring equipment psychometric tables;

7. Low voltage wet sponge instrument; and

8. "Tooke" gages.

I. Additionally, the Contractor shall provide any necessary rigging to facilitate the inspection of all tank areas. Proper coordination with the Engineer is intended to prevent extensive re-rigging by the Contractor. Therefore, it is the responsibility of the Contractor to keep the Engineer fully informed on the status of the painting operation.

SECTION 13210 - CROSSLINKED POLYETHYLENE CHEMICAL STORAGE TANKS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment and services required to furnish, install and place into service all chemical storage tanks as described in the Drawings and Specifications.

1.03 SUBMITTALS

A. Descriptive literature, catalog cuts, dimension prints, shop drawings, and installation instructions shall be submitted to the Engineer for review before shipment. The data shown on the shop drawings shall be complete with respect to dimensions, materials of construction and the like, to enable the Engineer to review the information as required. Shop drawing shall comply with the provisions of 01340.

B. At the time of submission, the Contractor shall, in writing, call the Engineer's attention to any deviations that the Drawings may have from the requirements of the Engineer's specifications.

1.04 GENERAL

A. The tanks shall be rotationally molded from high-density crosslinked polyethylene.

B. The tanks shall have the capacities as required and covers with buttress threads made of polyethylene (no metal). Openings and fittings shall be provided as shown on drawings and described herein.

1.05 MANUFACTURER'S EXPERIENCE

A. The tank manufacturer shall have been regularly engaged in the design and manufacture of crosslinked polyethylene tanks for at least seven (7) years. The manufacturer's experience shall include at least fifteen (15) tank installations, of equal or larger capacities than specified herein, which have been in operation for at least four (4) years. The manufacturer shall submit references for a minimum of five (5) installations where the equipment has been used to store specified chemicals for at least three (3) years.

PART 2 - PRODUCTS

2.01 GENERAL

A. Acceptable Products - The tanks specified in this section shall be manufactured by Poly Processing Company, A Division of Abell Corporation, or equal.

B. The tanks provided under this specification shall be constructed of high-density crosslinkable polyethylene using the rotational molding process.

C. UL Listing/Classification -- The manufacturer shall have a UL structural compatibility listing for vertical aboveground tanks. The UL Listing/Classification shall be in accordance with the Flammable & Combustible Liquids Code, NFPA 30, paragraph 2.2.1 (b) 1, which permits the storage of liquids rated Class IIIB or higher (flammability).

D. UL Listed tanks shall also have UL chemical compatibility listing labels for individual chemicals for which UL testing has been completed.

E. Design wall thickness – The minimum required wall thickness of the cylindrical shell shall be determined per ASTM D1998-93 Section 6.1, Cylinder Shell (unsupported portion of tanks). The maximum design hoop stress used for the wall thickness calculation shall be 600 psi.

F. In applications for the storage of Sodium Hypochlorite, tanks designed for 1.90 specific gravity are required. At the option of Poly Processing Company, the 1.90 specific gravity design can be obtained by tank wall thickness or by the use of a support skirt around the base of the tank. Either of these designs will limit sidewall deflection and add support in the higher stressed areas.

G. The tank supplier must supply as-built wall thickness as well as ASTM D1998-93 required thickness.

H. Wall thickness calculations shall assume that tank contents have a specific gravity greater than 1.35 and less than 1.65 for heavy wall thickness. For contents with a specific gravity greater than 1.65, an extra heavy wall is required.

I. Fittings shall be bulkhead or bolted flange fittings. Gasket material shall be suitable for continuous immersion in all specified chemicals. No metals shall be exposed to tank contents. All fittings shall be connected to corresponding pipes with flexible telescoping-type expansion joints.

PART 3 - EXECUTION

3.01 HANDLING AND INSTALLATION

A. Contractor shall follow the manufacturer's recommendations for handling and installing tanks.

3.02 COORDINATION OF CONNECTIONS AND EQUIPMENT INSTALLATION

A. Contractor shall coordinate all piping connections by field measurements and/or field installation in order to insure the accuracy of the locations of penetrations of tanks.

3.03 FIELD TESTING

A. After installation of tanks and all fittings, the tanks shall be water tested by filling the entire tanks with water and monitoring the tanks as well as all fitting connections for at least seven (7) days. The test shall compensate for the difference in specific gravity between the test water and chemical stored to simulate actual maximum operating pressures. Test methods may include adding a 2.5 psi air pad to a filled tank or filling the tank with standpipes, raising the maximum water surface approximately 5 feet higher than the normal maximum tank level. Any leaks shall be corrected prior to acceptance. Following successful field tank testing, the tanks shall be completely emptied and dried.

SECTION 13410 - BASIC MEASUREMENT AND CONTROL INSTRUMENTATION MATERIALS AND METHODS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The CONTRACTOR shall furnish all materials, labor, tools, equipment, supplies and services necessary to install all process control and instrumentation equipment complete as specified herein and shown on the Drawings. The CONTRACTOR shall be responsible for the expense of changing Drawings or structures, or any other expense necessitated by reason of installing alternative equipment. The CONTRACTOR will assume the responsibility for the satisfactory operation of any and all equipment offered.

B. The following equipment specification is included to establish the quality of equipment to be obtained. It is the intent of these Specifications to obtain industrial quality instrumentation and control equipment. Equipment furnished shall be accepted by the ENGINEER, prior to purchase by the CONTRACTOR.

C. Auxiliary and accessory devices necessary for system operation or performance, such as transducers or relays to interface with existing equipment or equipment provided under other Sections of this Specification, shall be included whether specified or not, at no extra cost.

D. In order to ensure proper integration and compatibility of the plant instrumentation and control systems, the systems must be supplied by a single provider of instrumentation and control equipment. This is not to say that all equipment being supplied shall be manufactured by a single manufacturer, but rather that a single provider of instrumentation and control equipment shall be responsible for supplying the complete system. To facilitate the OWNER'S future operation and maintenance, products performing the same function shall all be of the same manufacturer, type, and model number.

E. Substitutions on functions or equipment specified will not be acceptable. In order to ensure the interchangeability of parts, the maintenance of quality, the ease of interfacing between the various subsystems, and the establishment of minimums with regard to ranges and accuracy, strict compliance with the above requirements shall be maintained. In order to ensure compatibility between all equipment, it shall be the responsibility of the system supplier hereunder to coordinate all interface requirements with mechanical and electrical system suppliers and furnish any signal isolation devices that might be required.

F. Equipment shall be fabricated, assembled, installed, and placed in proper operating condition in full conformity with detail drawings, specifications, engineering data, instructions and recommendations of the equipment manufacturer as accepted by the ENGINEER.

G. The instrument supplier for this Contract shall be responsible for making the modifications shown on the Drawings and for recalibrating all instruments (existing and new) and placing them in proper working order.

1.02 QUALITY ASSURANCE

A. The system supplier shall be required to demonstrate a minimum of 5 years recent, past experience in the design, manufacture, and commissioning of instrumentation and control systems of comparable size, type, and complexity to the proposed project. Further, the manufacturer must have at least 10 similar systems in operation currently. The system supplier shall be required to have his own in-house capability to handle complete system engineering, fabrication, and testing. In lieu of 5 years experience, system suppliers shall provide direct to the CONTRACTOR a 5 year performance bond in an amount equal to the installed cost of the system. The CONTRACTOR shall include a copy of the executed bond in the shop drawings submittal books.

B. The system supplier shall have in his employ the capable personnel for detail engineering, coordination, drafting, procurement and expediting, scheduling construction, testing inspection, installation, start-up service for calibration and commissioning, and warranty compliance for the period specified.

1.03 REFERENCES

A. The CONTRACTOR is referred to Standards and Practices for Instrumentation published by the Instrument Society of America (latest edition), for terminology, symbols, methods and practices used or described herein or on the Drawings.

1.04 SUBMITTALS

A. General

1. A preliminary proposal shall be submitted to the ENGINEER prior to the bid date. Preliminary Drawings will be checked for metering and control equipment and methods only and not for details such as flow range, line size, etc.

2. Complete detail Drawings of the instrumentation and control systems and all components shall be submitted in 3 copies in a 3-ring loose-leaf cardboard reinforced vinyl binder to the ENGINEER for preliminary review. They shall include installation instructions, operation and maintenance instructions, descriptive literature, connection drawings, and parts list for each item as well as individual control schematic drawings for each item.

3. The CONTRACTOR shall make any corrections or changes required by the ENGINEER, within the scope of the Drawings and Specifications, and return copies in 3-ring loose-leaf cardboard reinforced vinyl binders for final review and distribution. Number of copies shall be as specified in Special conditions and as agreed at the pre-construction conference.

4. Should any system submitted in the shop drawings not meet with the ENGINEER'S acceptance as to conformity with requirements of the Drawings and Specifications, it shall be the responsibility of the successful CONTRACTOR to make whatever changes are necessary for acceptance at no extra cost to the OWNER.

B. Detailed Requirements - Instruments/Hardware

1. Detailed information for each instrument or control device shall be submitted, including manufacturer's descriptive literature and a specific data sheet for each device which shall include as a minimum:

   a. Tag number assigned by the manufacturer.

   b. Product (item) name used herein and on the Contract Drawings.

   c. Manufacturer's complete model number.

   d. Location of the device.

   e. Input - output characteristics.

   f. Range, size, and graduations.

   g. Physical size with dimensions, enclosure NEMA classification, and mounting details.

   h. Materials of construction of all components.

   i. Instrument or control device sizing calculations where applicable.

   j. Certified calibration data on all flow metering devices.

2. Submit a detailed loop diagram, for each monitoring or control loop, each on a single 8 ½ in. X 11 in. sheet. The format shall be the Instrument Society of America, Standard for Instrument Loop Diagrams, ISA-S5.4.

3. The data sheets shall be provided with an index and proper identification and cross-referencing. Partial submittals will be rejected.

4. Submit detailed drawings concerning control panels and/or enclosures including:

   a. Cabinet assembly and layout drawings to scale.

   b. Fabrication and painting specifications.

   c. Point to point wiring diagrams depicting wiring within the panel as well as connections to external devices.

   d. Color samples for paint selection by the ENGINEER and/or OWNER.

5. Exceptions to the Specifications or Drawings shall be clearly defined by the system supplier. Data shall contain sufficient details so a proper evaluation may be made by the ENGINEER.

6. Prior to final acceptance, the final shop drawing submittal, which is to include Installation, Operation, and Maintenance instructions, shall be

updated to reflect "As Constructed" status, and shall provide at least the following as a minimum:

a. A comprehensive index.

b. A complete "As Constructed" set of accepted shop drawings.

c. A complete list of the equipment supplied, including serial numbers, ranges, and pertinent data.

d. Full specifications on each item.

e. System schematic drawings "As Constructed", illustrating all components, piping and electrical connections of the systems supplied under this Section.

f. Detailed service, maintenance, and operation instructions for each item supplied.

g. Special maintenance requirements particular to this system shall be clearly defined, along with special calibration and test procedures.

h. The operating instructions shall also incorporate a functional description of the entire system, with reference to the systems schematic drawings and instructions.

i. Complete parts lists with stock numbers and name, address, and telephone number of the local supplier.

C. Detailed Requirements - Software

1. The software submittal shall be included in a singular all inclusive submittal which shall include but not be limited to:

a. Complete description of the standard application software programs, operating system and utility program to be furnished, including modifications and explanation of how the specific functional requirement will be met. A cross-reference between the Specifications and the software submittal shall be provided in order to provide the ENGINEER the ability to identify how each specified section or function is being met by the CONTRACTOR.

b. A complete set of all available software algorithms.

c. A complete set of control strategies which depict all monitoring and control functions on a loop by loop basis.

d. An English language narrative of each data acquisition or control loop mission and anticipated action. Narratives shall enumerate the signal point name, signal descriptor, associated PLC or RTU number, associated graphic displays, system functions activated by the signal (i.e., interlocks, alarms, logs, etc.).

e. A complete set of module configuration sheets depicting each loop linkage.

f. A complete listing of the SCADA system database for each data point with relevant parameters, such as range, active state, contact orientation, limits, incremental limits, I/O card type, I/O hardware address, and PLC/RTU assignment. The list shall be divided and grouped by PLC/RTU and/or remote I/O rack, for in-plant and remote sites, and divided into type of I/O.

In addition to the active I/Os, the list shall also include implemented spare I/Os. Final format shall be approved by the ENGINEER.

g. Detailed descriptions of procedures used to implement and modify control strategies and database construction.

h. One complete set of all workstation accessible displays which are unique to this Project, complete with color conventions and labeling conventions. These displays shall be full size color graphic format arranged in hierarchical order.

2. After all Shop Drawing submittals required herein have been accepted by the ENGINEER, and prior to start of system testing, the CONTRACTOR shall submit the following items:

a. All workstation displays (both graphic displays and trend displays). The submittals shall be in full color as they will appear on the CRT. This submittal shall be prepared after requisite Graphics meeting specified in Section 13450.

b. Each display shall be uniquely titled. Locations for process data shall be clearly identified either through the use of simulated data or by showing variables on the displays and providing a reference list describing those variables. All dynamic points shall be identified by tag number as a minimum and their operation shall be described on separate sheets (color change, symbol change, etc.). Three sets of submittals (with screen prints in color) are required for review by the ENGINEER. One set shall be returned with comments. All other copies of the submittals required may be provided in black and white.

c. All periodic reports for the entire SCADA system. Locations for process data shall be clearly identified, either through the use of simulated data or by showing variables on the report and providing a reference list describing those variables. This submittal shall be prepared after requisite Reports meeting specified in Section 13450.

3. The following software requirements shall be implemented as part of the Instruction, Operation and Maintenance manuals specified herein:

a. Submittal shall include all software manuals supplied by the manufacturer(s) with the standard software packages.

b. All original program disks supplied by the manufacturer(s) with the standard software packages, including any program revisions or updates issued by the manufacturer(s) during the construction period.

c. All PLC/RTU program and workstation configuration program files stored on labeled disks (or CD). The RTU program and workstation configuration file disks shall also be updated as required if any changes or corrections are required in this programming prior to Project completion.

d. A change of ownership registration form for each standard software package supplied under this Project, to allow the OWNER to register the software with the manufacturer.

D. Operator's Reference Manual

1. The CONTRACTOR shall prepare and submit a Users reference manual for the workstation system for use by Plant operators. This manual shall be bound in a soft cover folder and contain the following:

a. An index.

b. A list of workstation display screens, trends, and reports, with display names and descriptions.

c. A list of the control screens with the display names and description. It shall also provide a summary of possible commands and operator inputs to these screens, including setpoints. All control actions shall be included.

d. A SCADA system block diagram with names and locations of all major components.

e. Instructions for manually printing screens or reports, both real time and historical as applicable.

f. A summary of security levels and their privileges and limitations.

g. Spaces for operators to make notes.

2. A copy of this manual shall be provided to each operator during training on the workstation operations. The training class shall include a review of this manual with the operators in addition to more detailed instruction on the workstation configuration and its use.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Shipping Precautions:

1. After completion of shop assembly, factory test, and acceptance, all equipment, cabinets, panels, and consoles shall be packed in protective

crates and enclosed in heavy-duty polyethylene envelopes or secured sheeting to provide complete protection from damage, dust, and moisture. Dehumidifiers shall be placed inside the polyethylene coverings. The equipment shall then be skid-mounted for final transport. Lifting rings shall be provided for moving without removing protective covering. Boxed weights shall be shown on shipping tags together with instructions for unloading, transporting, storing, and handling at the job site.

2. Special instructions for proper field handling, storage and installation required by manufacturer for proper protection, shall be securely attached to each piece of equipment proper to packaging and shipment.

B. Identification:

1. Each component shall be tagged to identify its location, tag number and function in the system. Identification shall be prominently displayed on the outside of the package.

2. A permanent stainless steel or other non-corrosive material tag firmly attached and permanently and indelibly marked with the instrument tag number, as given in the tabulation, shall be provided on each piece of equipment supplied under this Section.

C. Storage:

1. Equipment shall not be stored out-of-doors. Equipment shall be stored in dry permanent shelters including in-line equipment, and shall be adequately protected against mechanical injury. If any apparatus has been damaged, such damage shall be repaired by the CONTRACTOR at his own cost and expense. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and put through such tests as directed by the ENGINEER. This shall be at the cost and expense of the CONTRACTOR, or the apparatus shall be replaced by the CONTRACTOR at his own expense.

1.06 DEMOLITION

A. All existing instrumentation equipment presently installed in existing structures is to be abandoned and removed as shown on the Drawings. Unless otherwise noted, all removed instruments, materials and equipment shall be removed from the jobsite by the CONTRACTOR for disposal. Only existing structures to be modified under this contract are to have the existing instruments removed.

1.07 WARRANTY (MAINTENANCE CONTRACT)

A. A written total instrument maintenance contract shall be provided to the OWNER, executed by the system supplier as a part of the work under this Section. The maintenance contract shall include all labor, parts, and emergency calls providing on-site response within 48 hours, to provide complete instrument system maintenance for a period of one year after the date of final acceptance of the system. The maintenance contract shall also include a minimum of 2 semi-annual preventive maintenance visits by a qualified serviceman of the supplier

who is familiar with the type of equipment provided for this project. Each preventive maintenance visit shall include routine adjustment, calibration, cleaning, and lubrication of all system equipment and verification of correct operations. Emergency maintenance procedures or plant visits may coincide with a scheduled preventive maintenance visit, however, they shall not replace the work intended to be performed during a preventive maintenance visit. The system supplier shall have full responsibility for the preventive and corrective maintenance including replacing of defective components, maintaining sufficient spare parts on-site, and complete calibration of all components under this section, all at no cost to the OWNER. The maintenance contract shall not begin until both the instrumentation training course and the system acceptance test have been successfully completed, at which time the OWNER shall be capable of performing necessary preventive maintenance, and all instruments shall be functional.

B. During the one-year maintenance period, observation of maintenance operations by designated OWNER personnel, and the instruction of said personnel in the details of the maintenance work being performed shall be provided.

C. A complete written report, shall be furnished the ENGINEER and OWNER after each scheduled and unscheduled visit, giving problems corrected, systems needing recalibration, and recommendations to prevent recurrence, if applicable.

D. The costs for the one-year maintenance service contract shall be included in the Contract price.

E. See Section 13450 for additional warranty requirements related to SCADA (Supervisory Control And Data Acquisition) systems.

1.08 TRAINING

A. A training program shall be set up and conducted by the major equipment manufacturer furnishing the instrumentation package. The training session shall be a for a minimum period of 2 days uninterrupted and shall be conducted at the treatment plant.

B. A course outline showing the material to be covered shall be submitted to the ENGINEER for review. The training program shall include both classroom and "hands-on" instruction for each instrument supplied under this group of the Specifications and shall furthermore include operational training, maintenance training, and training on use of calibration equipment.

C. As the equipment installed at the plant shall be used for the "hands-on" training, the training program shall not be conducted until all of the systems are operational, and operational related "punch list" items are corrected.

D. Training on equipment supplied by a manufacturer other than the major equipment manufacturer shall be by the original equipment manufacturer, and shall be scheduled in the training programs by the major equipment manufacturer. Exceptions may be granted if the instructor demonstrates adequate knowledge on the care and operation of the other manufacturers' equipment.

E. The training programs shall be conducted at a time mutually agreeable to the ENGINEER, OWNER, CONTRACTOR, and Supplier. The OWNER shall decide how many of his personnel shall attend the training. A representative of the ENGINEER may observe the training in progress. The OWNER shall have the right to videotape all training as it is conducted.

F. The supplier shall make use of audio-visual aids in the training courses and shall provide the OWNERS staff his undivided attention (i.e., shall not conduct his company business during training hours) for the full 2 days. The supplier shall furnish training participants with written handouts, preferably copies of the shop drawing submittal books, up to a maximum of 6 copies, for purposes of familiarization with the shop drawings, and to assist in explanations.

PART 2 - PRODUCTS

2.01 GENERAL

A. The bid shall be for furnishing instrumentation and control equipment of the following suppliers:

Foxboro
Allen Bradley
Data-Linc
MJK

1. Bids are desired on control equipment manufactured and supplied by the above names, or equal. Only one bid will be acceptable from a manufacturer and that is through the local factory authorized representative.

B. All instrumentation supplied shall be of the manufacturer's latest design and shall produce or be activated by signals which are established standards for the water industry.

C. All electronic instrumentation shall be of the solid-state type and shall utilize linear transmission signals of 4 to 20 mAdc (milliampere direct current), however, signals between instruments within the same panel or cabinet may be 0-10 V.d-c (volts direct current), or other manufacturer standard.

D. Outputs of equipment that are not of the standard signals as outlined, shall have the output immediately raised and/or converted to compatible standard signals for remote transmission. No zero based signals will be allowed for remote transmission.

E. All instruments shall be provided with mounting hardware and floor stands, wall brackets, or instrument racks as shown on the Drawings or as required.

F. All indicators and LED readouts shall be linear, direct reading in process units, unless otherwise noted. Percentage scales and indicators are prohibited.

G. All transmitters shall be provided with either integral indicators or conduit mounted indicators in process units, accurate to two percent, unless otherwise noted.

H. Electronic equipment shall be of the manufacturer's latest design, utilizing printed circuitry and suitably coated to prevent contamination by dust, moisture and fungus. Solid-state components shall be conservatively rated for their purpose, to assure optimum long-term performance and dependability over ambient atmosphere fluctuations and 0 to 95 percent relative humidity. The field mounted equipment and system components shall be designed for installation in dusty, humid, and slightly corrosive service conditions.

I. All equipment, cabinets and devices furnished hereunder shall be heavy-duty type, designed for continuous industrial service. The system shall contain products of a single manufacturer, in-so-far as possible, and shall consist of equipment models which are currently in production. All equipment provided shall be of modular construction and shall be capable of field expansion.

J. All equipment shall be designed to operate on a 60 Hertz alternating current power source at a nominal 115 volts, plus or minus 10 percent, except where specifically noted. All regulators and power supplies required for compliance with the above shall be provided between power supply and interconnected instrument loop. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.

K. All analog transmitter and controller outputs shall be 4-20 milliamperes into a load of 0-750 ohms, unless higher load capacity is required.

L. All switches shall have double-pole double-throw contacts rated at a minimum of 600 VA, unless specifically noted otherwise.

M. Materials and equipment used shall be UL listed (or other independent lab listed) wherever such listed equipment and materials are available.

N. All equipment shall be designed and constructed so that in the event of a power interruption, the equipment specified hereunder shall resume normal operation without manual resetting when power is restored.

O. All circuit boards in instruments mounted in damp locations or mounted outdoors shall be fungus proofed. All field transmitters mounted outside shall be equipped with sunshields and shall be capable of operation to -20° Fahrenheit.

P. Equipment installed in a hazardous area shall meet Class, Group and Division as shown on the contract drawings, to comply with the National Electrical Code. All power supply and signals coming from and going to hazardous areas shall have intrinsic safety barriers provided.

2.02 INSTRUMENTS AND ACCESSORY EQUIPMENT

A. Refer to other Division 13 Instrumentation Specification Sections for equipment requirements for field mounted primary devices, transmitters and secondary instruments, receivers and central control equipment.

PART 3 - EXECUTION (NOT APPLICABLE)

SECTION 13420 - INSTRUMENTS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The CONTRACTOR shall furnish and install all primary devices, transmitters, primary and secondary receivers, analyzers and accessory items as shown on the Contract Drawings and as specified herein.

PART 2 - PRODUCTS

2.01 INSTRUMENTS AND ACCESSORY EQUIPMENT

A. Product Descriptions

1. Loop Isolator/Signal Converter:

   a. Loop isolators or signal converters shall be furnished and installed where indicated, to isolate signals or to increase the load capacity of a system required to have many devices in the loop. Isolators shall provide 3 way isolation, and shall have a power supply voltage of 115 VAC unless otherwise indicated. 2 wire style isolators are not acceptable. Isolators shall be Moore SCT, AGM, RIS, or equal, enclosed as appropriate for the application, or as indicated.

2. Transient/Lightning Suppressors:

   a. Lightning protectors shall be of 2 types - those for protecting d-c wires (current protectors) and those for protecting a-c wires.

   b. The d-c protectors shall be of the fast-acting metal oxide varistor type (MOV) designed to fit and protect all typical 4-20 mA, field mounted transmitters from damaging transients induced by lightning or heavy electrical equipment, and shall provide protection each line to ground, and line-to-line.

   c. The a-c protectors shall be the fast-acting MOV type in combination with a gas tube type secondary protector designed to provide protection against lightning and other high voltage surges for any a-c line-to-ground system.

   d. The lightning protectors shall be installed at each end of each metering loop, and on all power supplies, as shown on the Drawings.

3. Altitude and Pressure Gauges:

a. All indicating gauges are pipe mounted with male and brass threaded pipe connections. Gauges shall be 4 1/2 inch liquid filled for maximum vibration and corrosion protection. Gauges shall have phosphor bronze Bourdon tubes, white laminated phenol dials. Gauges shall have micrometer adjustment of pointers and black phenol, black cast iron, brass, or aluminum case and ring, original rotary gear design, corrosion resistant, stainless steel movement, blowout protection, and bronze socket with wrench flats. Accuracy shall be within 1/2 of 1 percent of the scale range. They shall be as manufactured by Helicoid Gage Division, "410"; James P. Marsh Corporation, "Master Gauge"; Marshalltown; Ashcroft; U.S. Gauge; or equal.

b. All gauges shall be piped with provisions for venting pressure to allow calibration (zero) checks. Valves for gauge shutoff and zeroing shall be 1/4 turn ball valves with lever handle, corrosion-resistant.

c. Liquid filled diaphragm seals shall be installed on all gauges. Diaphragm seals shall be of the continuous duty type, 3 piece construction with 1/4 inch flushing connection, 1/4 inch fill connection, 316 stainless steel lower housing and diaphragm material 1/4 inch gauge connection and 1/2 inch lower connection. Housing bolts shall also be stainless steel. Acceptable models are Marsh 42-01, Helicoid 100H, or equal. Viton diaphragms are required on low range pressure applications (less than 15 psig). Diaphragm seals shall be "permanently" attached to gauges by installation of a lead sealed wire connecting the two. This is to prevent accidental loss of fill fluid. Fill fluid shall be factory installed silicone. All gauges shall be precalibrated, as an assembly with the seal.

4. Gate Modulating Operators

a. The valve operators are to be as manufactured by "Biffi," "Auma," "Rotork," or equal, and shall consist of motors, gearing, limit switches, torque switches, handwheel, control equipment and electrical connections, motor electrical connections, and related components as specified in the following paragraphs.

b. All motors, gearing switches, wiring terminals, and electrical connections shall be completely sealed against the environment and protected against the ingress of water, humidity, and dust. The enclosure shall be O-ring sealed at all interfaces and rated NEMA 4. Bolts on all cores shall be captive to prevent loss when disconnected. Switches (both limit and torque) shall be NEMA 4 so that no dirt, dust, water, etc., may interfere with the contacts when the limit switch compartment cover is removed.

c. The drive motor shall be of sufficient size to open or close the gate against maximum differential pressure when voltage to the terminals is 90 percent of nameplate rating. The drive motor shall be specifically designed for operator service. Motors shall be

totally-enclosed, non-ventilated construction, and suitable for use in Class I, Division 2, hazardous locations, with permanently lubricated ball bearings. Insulation shall be Class F, tropicalized, an suitable for temperatures of up to 310□F. Motors shall be thermally protected, with at least 2 thermal switches embedded in the windings to ensure safe motor shut-down during high current/high temperature conditions. Motors shall be capable of starting against rated load. Motors shall meet NEMA standards and shall have an enclosure of aluminum, die cast with cooling fins.

d. The operators shall be equipped with travel limit switches for the purpose of de-energizing the drive motor at variable, adjustable, open and close positions. Limit switches shall be of the double pole, double throw, double break type. A minimum of 8 silver contacts rated at 10 A at 115 VAC shall be provided for each operator (2 NO, 2 NC for opening and 2 NO, 2 NC for closing). The limit switch drive is to be of counter gear design consisting of bronze gearing of the intermediate open type and shall be in step with the operator output drive in both the motor drive and manual (handwheel) modes. Limit switches and the limit switch drive mechanism shall be an integral part of the operator. Limit switches shall be so designed that they can be adjusted to change state at any point between or behind the fully open and fully closed positions. Limit switch assemblies are to have easy set declutch, so tripping cam can be rotated with no more than 10 revolutions of the cam screw. All contacts on the limit switch assembly are to be sealed in NEMA 4 closures to maintain the integrity of the contacts. There shall be no exposed connections. Limit switch adjustment shall be clearly marked.

e. Each operator shall have an opening torque switch and a closing torque switch. Torque switches shall have a range of adjustment and be responsive to opening or closing loads such that switches operate to protect the gate and operator from damage when there is a gate obstruction or overload during openings or closing. Torque switches are to be calibrated and directly readable in torque units. All contacts shall be sealed to maintain the integrity of contacts. Torque switches shall be single pole, single throw, double break type with contacts rated 10 A at 115 VAC. The adjustment range shall be blocked to prevent stalling of the motor. All travel limit and torque switches shall have a manual trip knob to test phase rotation for purposes of preventing damage to the valve.

f. A continuous reading mechanical dial position indicator shall be furnished as an integral part of the actuator to indicate gate position. Also, a 4-20 mAdc output valve position transmitter shall be provided to transmit valve position to a receiver.

g. All gearing shall be designed to withstand without failure the stall torque of the motor. The final drive shall be of the self-locking worm and wheel type to prevent creeping of the valve disk in

intermediate positions. Gear boxes are to be of cast iron construction and completely filled with lubricant, allowing operator to be installed in any position.

h. The drive nut shall be separable from the gear assembly to facilitate rapid mounting of the operator on the valve. The drive nut shall be splined to allow mounting on the valve at 90 degree intervals in order that the valve/operator combination can be mounted to minimize interference with adjacent facilities and equipment.

i. A permanently attached handwheel shall be furnished to allow manual operation of the operator. The handwheel shall not turn during motor operation and the motor shall not turn during handwheel operation. A fused motor shall not prevent manual operation.

j. Electrical terminals and connections shall be of the plug and socket design so removal of cover simultaneous disconnects all electrical wiring from the actuator. The terminal compartment is to be separate from the limit switch/torque switch compartment and shall include the terminals for the motor leads. Two conduit entries shall be provided and cover bolts shall be captive.

k. The operator shall contain an electronic control module to control the speed of the a-c motor. The control module shall be designed to accept a 4-20 mAdc input signal from a remote source. The control module shall have span, zero, gain, and deadband adjustments to allow for positive valve tuning and prevent "hunting." The control module shall be equipped with a feedback potentiometer for use in balancing the control circuit. The position feedback potentiometer shall be provided with anti-backdash gearing or shall be operated directly from the valve shaft as required to minimize hysterics to within one degree. The valve control shall be provided with a selector switch to allow operation by means of pushbutton or automatic modulating control from the remote 4-20 mAdc signal.

l. The operator housings shall be equipped with space heat to drive off moisture.

m. All valve operator controls shall be housed in a NEMA 4X enclosure.

n. A 115 volt, a-c single phase, 60 Hz power feed shall be provided to power each valve/control assembly.

5. Magnetic Flowmeter

a. Meter sizes larger than 4 inch shall be obstructionless, short form, characterized coil design, and the output signal produced shall be directly proportional to the liquid flow rate. The metering tube shall be steel with 150 pound ANSI flanged end connections and

polyurethane liner. The electrodes shall be bullet nosed 316 stainless steel , and shall be field replaceable. The coils which generate the field shall be inside the pipe wall and shall be encapsulated in epoxy plastic and encased within the flow meter lining material. Laying length shall not exceed 1 ½ times the meter size. The meter shall have complete zero stability.

b. The temperature of the process shall not exceed 135 degrees Fahrenheit and the meter primary shall be capable of accidental submersion. The meter shall be provided with 115 V, 60 Hz, single phase AC power and dripproof enclosure with provisions for electrical connections.

c. The signal converter (transmitter) shall be designed for use in connection with the magnetic flowmeter primary devices supplied and shall receive its signal from the primary device and convert it to a corresponding pulse and current signal. A linear output meter and 8 digit non-reset register shall be provided on the converter (when indicated in the loop descriptions this section).

d. The signal converter shall be constructed for field mounting in a 2 piece die cast aluminum housing which shall be weatherproof and splashproof. The housing shall have a gasketed cover with window for reading the horizontal output meter and 8 digit non-reset flow register. The converter shall be of solid state, printed circuit construction with a continuously adjustable range from 0-3 to 0-30 ft./sec., requiring no zero adjustment. The transmitter shall utilize a pulsed DC technique to drive the flux producing coils of the primary, converting he low level, high impedance pulsed DC signal to a 4-20 mADC current output directly proportional to flow rate.

e. Liner voltage and frequency variations of □10% shall have no effect on instrument calibration.

f. The scaled pulse output signal shall be inhibited when the flow rate is 2 percent or less of the maximum flow setting.

g. The accuracy, including the primary, shall be □1% or rate or □5% of full scale for a span setting of 3-30 ft./sec.

h. All magnetic flow meters shall be provided with grounding rings. All interconnecting signal cable between the magnetic flowmeter and signal converter, shall be provided by the meter manufacturer and be of sufficient length as required for the installation as shown on the Drawings. Any special cable terminations/fittings to replace the meter body should removal be necessary.

6. RF Capacitance Flowmeter (Parshall Flume)

a. The sensing probe shall be a thin, flexible element that is easily removed from a track mounted in the flow channel. The track shall have an engraved scale to indicate the head. The probe and

track shall not extend into the flow channel more than 1/4 inch, in order to reduce flow disturbance. Both the track and the probe shall be corrosion resistant and the probe shall be unaffected by sludge buildup on its surface.

b. All interconnecting cable between the probe and the transmitter shall be provided by the manufacturer and be potted to the head of the probe, providing a watertight seal against flooding.

c. The probe shall be characterized to produce a linear output of level that is directly proportional to flow, without using any cams or linkages. The probe shall be Drexelbrook Cote Shield, or equal.

d. The oscillator/amplifier (transmitter) and other electronic components and accessories needed for proper operation of the system shall be Owner furnished, mounted in a NEMA 4X non-metallic watertight enclosure suitable for handrail mounting. The enclosure shall contain an indicator of flow, visible without opening the door, with a scale calibrated in engineering units.

e. The flowmeter transmitter shall be relocated from the existing wastewater treatment plant to the new plant and a new probe provided as specified herein, to work with the new Parshall flume.

7. Programmable Logic Controllers

a. General Specifications

(1) This specification has been developed to establish minimum requirements for a solid-state programmable controller designed to provide high reliability in industrial applications. The internal wiring of the controller is to be fixed, with the logic functions it must perform in a given application to be programmed into its memory. The controller shall be supplied with the CPU, input/output scanner, inputs, outputs, memory, power supply, battery, and all power and interface cables necessary to function as a complete and operable programmable controller system. The PLC's shall be Allen-Bradley CompactLogix L23 or equal.

b. Service

(1) The supplier shall provide operating instruction manuals with adequate information pertaining to the following:

(i) System specifications

(ii) Electrical power requirements

(iii) Application considerations

(iv) Assembly and installation procedures

(v) Power up procedures

(vi) Troubleshooting procedures

(vii) Programming procedures

(viii) Explanation of internal fault diagnostics

(ix) Shut down procedures

(x) Recommended spare parts list

(2) The supplier shall provide a copy of all working programs on Compact Discs as well as a printed program listing.

(3) The supplier shall provide a network of field sales and support personnel located in key cities throughout the United States and internationally. The supplier shall also provide a field service department with experienced representatives stationed in major cities with the capability to provide telephone consultation, prompt on-site service, and field replacement stock.

(4) The supplier shall provide product application assistance by trained and experienced Owner to assist the customer with program and system development through telephone consultation and on-site check-out, debug, and start-up assistance.

(5) The supplier shall provide an Owner training program designed to teach the Owner's personnel in the understanding and application of the programmable controller. The training program shall include training manuals and "hands-on" programming experience on a programmable controller of a type similar to that provided by the supplier.

c. Assembled Systems

(1) The supplier shall assume single source responsibility for system assembly. An assembled system may include mounting and wiring of relays, motor starters, transformers, and disconnecting means, or other control devices as specified herein.

(2) The supplier shall provide mounting and wiring of the programmable controller system in a NEMA type 12 enclosure.

(3) The supplier shall wire all programmable controller inputs and outputs to terminal blocks.

(4) The assembled system shall include fuse blocks as sized by the application.

(5) Within the enclosure all I/O racks, processor racks, and power supplies shall be grounded to meet the manufacturer's specifications.

(6) All cables (with associated plugs, connectors and receptacles) requiring user field installation, shall be designed for commercial use to withstand an industrial environment.

(7) Shop drawings shall include a mechanical layout detailing the overall external dimensions of the enclosure. The drawings shall include such pertinent information as location of door handles, windows, lifting lugs, and enclosure mounted items such as tachometer or current meters, cooling fans, etc.

(8) The supplier shall provide documentation detailing the mounting of the processor, I/O racks, motor starters, disconnect switch, fuse blocks, wireways, etc. All materials shall be labeled to provide easy cross-reference to the Bill of Material listing.

(9) Electrical prints detailing all hardwiring, done by the supplier, to devices such as relays, motor starters, disconnect switches, fuse blocks, etc. shall be provided with individual wire numbers and relay contact cross-reference designations.

(10) Sections describing inputs shall designate input modules by name, slot, module, and terminal location.

d. Design Description

(1) A major consideration of the programmable controller system shall be its modular, field expandable design allowing the system to be tailored to the Owner's process control application. The capability shall exist to allow for expansion of the system by the addition of hardware and/or user software.

(2) The processor plus input and output circuitry shall be of a modular design with interchangeability provided for all similar modules.

(3) Modules are defined herein as devices which plug into a chassis and are keyed to allow installation in only one direction. The design must prohibit upside down insertion of the modules. The programmable controller system must be able to determine the correctness of the module and chassis configuration prior to executing the user program.

(4) The programmable controller shall have downward compatibility whereby all new module designs can be interchanged with all similar modules in an effort to reduce obsolescence.

(5) All hardware of the programmable controller shall operate at an ambient temperature of 0° to 60°C (32° to 140°F), with an ambient temperature rating for storage of - 40° to + 85°C (- 40° to + 185°F).

(6) The programmable controller hardware shall function continuously in the relative humidity range of 5% to 95% with no condensation.

(7) The programmable controller system shall be designed and tested to operate in the high electrical noise environment of an industrial plant.

(8) The CPU shall have the capability of addressing up to 4096 input and 4096 output points.

(9) Each input and output module shall be a self-contained unit.

(10) The programmable controller system shall include the capability of addressing remote input and output modules up to 10,000 cable feet from the processor with an optional module. The communication link between the module and any remote input and output distribution chassis shall be via a 20 AWG tinned copper twin axial cable with braided and foil shields. The communications baud rate to the remote locations shall be at least 57.6 Kbaud and user selectable on a per module basis. If the maximum distance is reduced to 5000 cable feet, the communications speed shall be increased to 115.2 Kbaud. For racks located on a link of less than 2500 cable feet, the speed shall be increased to 230.4 Kbaud. These communication rates shall translate into I/O rack scan rates of 10, 6, and 4 milliseconds per adapter or logical rack, respectively.

(11) The programmable controller shall use multiple independent scans designated for processing of input and output information, program logic, and background processing of other processor tasks. Discrete input and output modules located in the same backplane (slots 1-30) as the CPU should be scanned in under 32 microseconds per module. The processing of a typical logic program shall not exceed 0.5 to 2 milliseconds for 1024 instructions with a maximum overhead of 0.6 milliseconds.

(12) The Programmable Controller shall have one dedicated serial port which supports RS-232-C signals. It shall be accessible in ladder logic and provide support for Point to Point and Slave SCADA communication protocol systems. Alternatively, it must be usable for programming purposes or for access to remote programmers via modems.

(13) The Programmable controller shall execute boolean conditional instructions (or contacts) within 0.45 milliseconds each. The Programmable controller shall execute boolean output instructions (or coils) within 0.64 milliseconds each. The Programmable controller shall execute 3 operand (x 16 bit) Add and Subtract instructions within 1.71 milliseconds each. The Programmable controller shall execute 2 operand (x 16 bit) comparison (=, /=, <, < or =, >, > or =) instructions within 1.26 milliseconds each. The Programmable controller shall execute 3 operand (x 16 bit) circular comparison (or limit) instructions within 1.96 milliseconds each. The Programmable controller shall execute 2 operand (x 16 bit) Move instructions within 1.26 milliseconds each.

e. Main Frame Hardware

(1) The CPU shall be a self-contained unit, and will provide Ladder Rung program execution and support remote or local programming. This device will also supply I/O scanning and inter- processor and peripheral communication functions.

(2) The operating system shall be contained in permanently mounted yet reprogrammable devices which allow for easy field upgrades without the need of tools.

(3) In a single chassis system all system and signal power to the CPU, support modules shall be distributed on a single motherboard or backplane. No interconnecting wiring between these modules via plug-terminated jumpers shall be acceptable.

(4) The CPU within the system shall perform internal diagnostic checking and give visual indication to the user by illuminating a "green" indicator when no fault is detected and a "red" indicator when a fault is detected.

(5) All system modules, main and expansion chassis shall be designed to provide for free air flow convection cooling.

(6) The main chassis front panel shall include indicators showing the following status information:

(i) Non-Run or Run mode of the CPU

(ii) The fault status of the CPU

(iii) Battery status

(iv) Communications status for channels 0 and 1

(v) Forces Present/Active

(7) Processor mode shall be selected by a keyswitch mounted on the front panel of the CPU. The key shall select the following modes: RUN - No ladder edits possible, program always executing; PROGRAM - Programming allowed, program execution disabled; and REMOTE - Programming terminal can make edits and change processor mode, including TEST mode, whereby the logic executes and inputs are monitored, but output states are not changed.

(8) Non-volatile memory shall store the operating system information to protect against loss in the case of power loss or system shut-down. Only at the time of a hardware change shall this configuration status be altered or re-entered.

f. Power Supplies

(1) The programmable controller shall operate in compliance with an electrical service of 120 VAC, single phase, in the frequency range from 47 to 63 Hz, 240 VAC, single phase, in the frequency range from 47 to 63 Hz.

(2) The manufacturer shall provide as standard equipment a system power supply capable of converting 120 VAC line power to the DC power required to operate the programmable controller system.

(3) A single main power supply shall have the capability of supplying power to the CPU and local input/output modules. Auxiliary power supplies shall provide power to each expansion chassis.

(4) The power supply shall automatically shut down the programmable controller system whenever its output current is detected as being excessive.

(5) When the power supply is wired to utilize 120 VAC power, the system shall function properly within the range of 85 to 132 VAC. The power supply shall provide surge protection, isolation, and outage carry-over of at least 1 cycle of the AC line.

(6) Design features of the programmable controller power supply shall include diagnostic indicators mounted in a position to be easily viewed by the user. These indicators shall provide the operator with the status of AC and DC power applied.

(7) At the time of power-up, the power supply shall inhibit operation of the processor and I/O modules until the DC voltages are within specifications.

(8) Nicad batteries and charger shall be provided to operate the PLC for a minimum of two continuous hours upon loss of normal power. Submit battery calculations to support selected size.

g. Program Storage

(1) The program storage medium shall be of a solid state battery backed RAM type.

(2) The programmable controller system shall be capable of addressing up to 32 K words, where each word is comprised of 16 data bits.

(3) Memory shall be available in 28 K with additional 4 K data word segments of RAM memory.

(4) Memory shall contain battery back-up capable of retaining all stored program data through a continuous power outage for 12 months at 60°C (104°F) under worst case conditions. The capability shall exist to replace the CPU's battery without incurring a loss of user program. A low battery condition must be detectable in ladder logic, but shall not automatically generate a major fault.

(5) The programmable controller system should provide the capability to use EEPROM or CompactFlash as a backup for volatile memory up to the full capacity of the controller.

(6) The operator should be able to backup volatile memory, including data and program logic onto either a compact disc or hard disk, at their option.

(7) All user memory in the processor not used for program storage shall be allocatable from main memory for the purpose of data storage. The programmable controller system shall be capable of storing the following data types:

(i) External Output Status

(ii) External Input Status

(iii) Timer Values

(iv) Counter Values

(v) Signed Integer Numbers (16 bit)

(vi) Binary Numbers

(vii) BCD Numbers

(viii) Direct and Indexed addressing

(ix) Internal Processor Status Information

(x) ASCII Character Data: The above listed data types shall be distinguishable to the CPU by the addressing format. Management of the data types into memory subsections shall be an automatic function of the CPU operating system. Any data can be displayed in Binary, Octal, Hexadecimal, Decimal, or ASCII radices. Function-specific data types such as PID, Message, or Processor Status shall have dedicated displays available annotating the meaning of specific control bits and words within them and allowing for selective control where appropriate.

(8) If contacts or entire rungs are intentionally deleted from an existing logic program, the remaining program shall be automatically repositioned to fill this void. Whenever contacts or entire rungs are intentionally inserted into an existing program, the original program shall automatically be repositioned to accommodate the enlarged program.

(9) To reduce the effective scan time in order to detect short pulse duration inputs, it shall be possible to program a select logic rung more than once into memory.

(10) The number of times a normally open (N.O.) and/or normally closed (N.C.) contact of an internal output can be programmed shall be limited only by the memory capacity to store these instructions.

(11) Ladder logic programs shall have immediate access to the subelements of control structures by address and subelement mnemonic, such as timer accumulator value or timer done bit.

h. Input and Output - General

(1) Each input or output module shall be a self-contained unit housed within an enclosure.

(2) Isolation shall be used between all internal logic and external power circuits. This isolation shall meet the minimum specification of 500 VRMS.

(3) It shall be possible to replace any 16 or 32 point input or output module without disturbing field wiring.

(4) Each I/O module shall contain a visual indicator to display ON/OFF status of individual input or output points.

(5) All field wiring to I/O modules shall be through a heavy-duty terminal strip. Pressure-type screw terminals shall be used to provide fast, secure wire connections.

(6) All 16 point, 32 point, and specialty input/output modules shall be color coded and titled with a distinctive label.

(7) All input modules shall have a specified filter time constant to limit the effects of voltage transients.

i. Input and Output Modules

(1) The programmable controller manufacturer shall offer discrete input/output hardware consisting of the following types:

Inputs:

AC/DC input for devices which operate at 24 VAC, 50/60 Hz. or 24 VDC.

AC input for devices which operate at 120 or 240 VAC, 50/60 Hz.

DC input for devices which operate at 5 to 30 VDC .

TTL (5 volt DC) input for transistor-transistor logic with low true logic, compatible with input devices such as solid state control and measuring equipment.

Outputs:

AC output for devices which operate at 120 VAC, 50/60 Hz.

AC output for devices which operate at 220/240 VAC, 50/60 Hz.

AC output for devices which operate at 24 VAC, 50/60 Hz.

DC output for devices which operate at 10 to 60 VDC.

Isolated Contact output which provides eight (8) isolated outputs capable of switching 120 VAC, 220 VAC, or 24 VDC power.

TTL (5 volt DC) output which provides transistor-transistor logic with low true logic, compatible for operating 5 VDC level electronic devices.

Combination Contact Output and 120 VAC Input available in two (2) in two (2) out, four (4) in four (4) out, or six (6) in six (6) out configuration.

(2) Analog I/O modules of the following types shall be offered by the manufacturer:

Analog input which accepts analog signals and converts them to sixteen (16) bit binary values. Digital resolution shall be available in 1 part in 65536 voltage or 1 part in 32767 current . Analog inputs shall be differential. Analog inputs shall be available in the following ranges:

Voltage range: -10 to +10 VDC.

Current range: 0 to +20 mA.

Analog output which converts a fifteen (15) bit current or sixteen (16) bit voltage binary number (14 bit resolution) into an equivalent single-ended analog output signal. Analog outputs shall be available in the following ranges:

Voltage range: -10 to +10 VDC.

Current range: 0 to +20 ma.

(3) I/O modules shall be provided to accept points as called out on the Drawings.

j. Interfacing and Peripherals

(1) The programming means shall be an IBM or compatible PC located on the Ethernet/IP network.

(2) The terminal keyboard shall allow for loading of the program format and ASCII characters.

(3) The manufacturer shall offer a multi-point communication network providing a data transfer path for up to 64 programmable controllers and/or

mini/micro-computers. The communicating stations shall be distributed anywhere along a single bus that extends a maximum of 10,000 cable feet in length. The communication network shall support the following features:

(i) Token passing system

(ii) Peer-to-peer communication

(iii) Message error checking

(iv) Retries of unacknowledged messages

(v) Diagnostic checks on other stations

(vi) Interface to more than one network

(vii) A user-oriented command language for manipulation of data structures of variable size and organization, such as setting or resetting bits, word and file transfers, and program loading.

(viii) Bi-directional communication between the programmable controllers and the communication network via a standard modem interface. The protocols shall meet EIA RS-232-C electrical standards and ANSI standard communication protocols.

(ix) The ability to communicate with all other models of programmable controller manufactured by said manufacturer.

(x) The ability to monitor the status of any processor remotely via the network.

k. Programming Techniques

(1) The programming format shall be traditional relay ladder diagram.

(2) It shall be possible to program a maximum instruction matrix containing as many as 128 instructions.

(3) The capability shall exist to change a contact from normally open to normally closed, add instructions, change addresses, etc. It shall not be necessary to delete and reprogram the entire rung.

(4) It shall be possible to insert relay ladder diagram rungs anywhere in the program, even between existing rungs,

insofar as there is sufficient memory to accommodate these additions.

(5) A single program command or instruction shall suffice to delete an individual ladder diagram rung from memory. It shall not be necessary to delete the rung contact by contact.

(6) It shall be necessary to issue a two part command in order to delete all relay ladder rungs from memory. This will provide a safeguard wherein the operator must verify their intentions before erasing the entire program.

(7) A clock/calendar feature shall be included within the CPU. Access to the time and date shall be from the programming terminal, user program, or message generation.

(8) Latch functions shall be internal and programmable.

(9) The system shall have the capability to address software timers and software counters in any combination and quantity up to the limit of available memory. All management of these instructions into memory shall be handled by the CPU. Instructions shall permit programming timers in the "ON" or "OFF" delay modes. Timer programming shall also include the capability to interrupt timing without resetting the timers. Counters shall be programmable using up-increment and down-increment.

(10) The programmable controller shall have support for integer signed math functions consisting of addition, subtraction, multiplication, division, and square root.

(11) When using modules such as analog where multiple channels are terminated on one module, it shall be possible to transfer the current status of all channels to the CPU upon execution of one program instruction. This instruction shall be bidirectional to include data transfer from the CPU to the module or from the module to the CPU.

(12) Instructions shall be provided for grouping contiguous 16 bit data words into a file. The system shall address up to 256 files with up to 256 words per file. File manipulation instructions such as high speed "file copy" and "file fill", "file to file" move, "element to file" move, "file to element" move, and "first in-first out" shall be supported by the system. The four function math instructions and instructions for performing "logical OR", "logical AND", "exclusive OR", and comparison instructions such as "less than", "greater than", and "equal to" shall be included

within the system. All instructions shall execute on either single words or files.

(13) The system shall contain instructions which will construct synchronous 16 bit word shift registers. Additional instructions shall be provided to construct synchronous bit shift registers.

(14) The programmable controller shall have a jump instruction which will allow the programmer to jump over portions of the user program to a portion marked by a matching label instruction.

(15) In applications requiring repeatable logic rungs it shall be possible to place such rungs in a subroutine section. Instructions which call the subroutine and return to the main program shall be included within the system. It shall be possible to program several subroutines and define each subroutine by a unique label. The processor will support nesting of subroutines up to eight levels deep. The program format as displayed on the LCD shall clearly define the main program and all subroutines.

(16) The program format shall display all instructions on a LCD programming panel with appropriate mnemonics to define all data entered by the programmer. The system shall be capable of providing a "HELP" instruction which when called by the programmer will display on the LCD a list of instructions and all data required to enter an instruction into the system memory.

(17) At the request of the programmer, data contained in system memory shall be displayed on the LCD programming panel. This monitoring feature shall be provided for input/output status, timer/counter data, files, and system status. Ladder logic rungs shall be displayed on the LCD with rung numbers in sequential order.

(18) The system shall have the capability to enter rung comments above ladder logic rungs. These comments may be entered at the same time the ladder logic is entered.

(19) The capability shall exist for adding, removing, or modifying ladder logic rungs during program execution. When changes to ladder logic are made or new logic rungs are added, it shall be possible to test the edits of such rungs before removal of the prior logic rung is executed.

(20) It shall be possible to manually set (force) either on or off all hardwired input or output points or Analog values from the LCD programming panel or the main chassis front panel. Removal of these forced I/O points shall be either individually or totally through selected keystrokes. The programming terminal shall be able to display forced I/O points.

(21) The execution of the program logic shall be accelerated by scanning the rung only until a positive decision as to the state of the outputs has been made. In many cases this will mean skipping over logic elements if the output condition has been predetermined.

(22) A means to program a fault recovery routine shall exist. When a major system fault occurs in the system, the fault recovery routine shall be executed and then the system shall determine if the fault has been eliminated. If the fault is eliminated, program execution resumes. If the fault still exists, the system will shut down.

(23) An interrupt routine shall be programmable such that the routine shall be executed regularly. The interval at which the routine is executed shall be user-specified in the range of 1 to 32767 milliseconds. This routine must be able to close an asynchronous control loop consisting of 32 Input points, 32 output points, 100 contact/coils, 10 addition instructions, 10 subtraction instructions and 32 circular comparison (Limit) instructions while never exceeding a 2 millisecond interval. The measurement of this interval is from the Input filter delay time to the time that the physical output transitions.

(24) An instruction shall be supported to incorporate closed loop control systems. The "proportional", "integral", and "derivative" elements shall be accessible to the user in order to tune a closed loop system.

(25) The CPU shall support indexed addressing of inputs and outputs, along with all data table words (integer, binary, timers, and counters) for the software instruction set.

(26) The system shall support both bit and word level diagnostic instructions.

(27) To facilitate conditional event detection programming, output instructions shall include a "one shot" instruction which may be triggered on the low-to-high (rising) rung condition.

(28) The processor shall support Master Control Reset (Relay) type functionality to selectively disable sections of relay ladder logic.

(29) An interrupt routine shall be programmable such that the routines shall be executed based upon the input conditions of up to eight discrete hardware inputs in the processor chassis. The routine will be executed within 500 microseconds of the detection of the input signals. The 8 inputs will be repetitively examined/scanned within a 100 microsecond time period.

8. Submersible Level Transducer

a. The tank level monitor shall be a submersible pressure transducer. The instrument shall be suspended by the cable, with a strain relief cable grip. The transducer shall be an Ametek model 575. Cable shall be as long as necessary to be continuous into the building to the remote indicator.

b. A remote loop power supply, signal converter, and indicator shall be provided inside the lower level of the pump station as shown on the Drawings

c. The remote indicator enclosure shall be watertight NEMA 4X. Power supply shall be 115 volt a-c.

d. A 4-20 madc signal output shall be provided for inputting this level to the SCADA system.

e. Sensing port shall be snub nose. Other characteristics and calibrated range shall be as specified on the Drawings.

PART 3 – EXECUTION (NOT APPLICABLE)

SECTION 13440 - INDICATORS, RECORDERS AND CONTROLLERS

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The CONTRACTOR shall furnish and install all indicators, recorders and controllers and accessory items as shown on the Contract Drawings and as specified herein.

PART 2 - PRODUCTS

2.01 INSTRUMENTS AND ACCESSORY EQUIPMENT

A. Product Descriptions

1. Electronic Recording Receiver:

a. The receiver shall be a digital recorder capable of receiving 1, 2, 3, 4 or more inputs.

b. Alarm switches shall be provided as described in the monitoring/control loop descriptions and/or as shown on the Drawings. The receiver shall meet the following specifications:

Display	320 x 240 pixels
Accuracy	125 ms
Operating Temperature Range	0-50°C

c. The recorder shall be Foxboro 6100AF Paperless Recorder, or equal.

PART 3 – EXECUTION (NOT APPLICABLE)

SECTION 13490 - MEASUREMENT AND CONTROL COMMISSIONING

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The CONTRACTOR shall furnish and install all instrumentation equipment and accessory items as shown on the Contract Drawings and as specified herein.

PART 2 – PRODUCTS (NOT APPLICABLE)

PART 3 - EXECUTION

3.01 SEQUENCE OF CONSTRUCTION

A. The existing SCADA system shall be kept operational throughout the construction of the new SCADA system to be installed under this Contract.

3.02 INSTALLATION/APPLICATION/ERECTION

A. Instrumentation and accessory equipment shall be installed in accordance with the manufacturer's instructions. The locations of equipment, transmitters, alarms and similar devices shown on the Drawings are approximate only. Exact locations shall be as accepted by the ENGINEER during construction. Obtain in the field all information relevant to the placing of process control work, proceed as directed by the manufacturer and furnish all labor and materials necessary to complete the work in an acceptable manner.

B. The instrumentation installation details on the Drawings indicate the designed installation for the instruments specified. Where specific installation details are not specified or shown on the Drawings, the manufacturer's recommended practice shall be followed.

C. All work shall be executed in full accordance with codes. Should any work be performed contrary to said codes and/or regulations, the CONTRACTOR shall bear full responsibility for such violations and assume all costs arising therefrom. All equipment used in areas designated as hazardous shall be designed for the Class, Division, and Group as required on the Drawings for the locations.

D. Unless specifically shown in the Contract Documents, direct reading or electrical transmitting instrumentation shall not be mounted on process piping. Instrumentation shall be mounted on instrument racks or stands. All instrumentation connections shall be provided with shutoff and drain valves.

E. All piping to and from field instrumentation shall be provided with necessary unions, test tees, couplings, adaptors, and shut-off valves.

F. Field instruments requiring power supplies shall be provided with local electrical shut-offs and fuses as required.

G. Brackets and hangers required for mounting of equipment shall be provided. They shall be installed in a workmanlike manner and not interfere with any other equipment.

H. The system supplier shall investigate each space in the building through which equipment must pass to reach its final location. If necessary, the system supplier shall be required to ship his material in sections sized to permit passing through restricted areas in the building. The system supplier shall also investigate, and make any field modifications to the allocated space for each cabinet, enclosure and panel to assure proper space and access (front, rear, side).

I. The shield on each process instrumentation cable shall be continuous from source to destination and be grounded as directed by the manufacturer of the instrumentation equipment but in no case shall more than one ground point be employed for each shield.

J. Lifting rings shall be removed from cabinets/assemblies. Hole plugs shall be provided for the holes of the same color as the cabinet.

K. The system supplier, acting through the CONTRACTOR, shall coordinate the installation, the placing and location of system components, their connections to the process equipment panels, cabinets and devices, subject to the ENGINEER'S acceptance. He shall be responsible to ensure that all field wiring for power and signal circuits are correctly done in accordance with best industry practice and provide for all necessary system grounding to ensure a satisfactory functioning installation. The CONTRACTOR hereunder shall schedule and coordinate his work under this Section with that of the electrical work specified under applicable Sections of Division 16.

3.03 FIELD QUALITY CONTROL

A. After equipment and materials have been shipped to the job site, the Supplier shall furnish the services of a factory-trained service technician or engineer to assist and advise the CONTRACTOR during installation and to provide programming/ calibration/adjustment at initial startup. A minimum period of 5 calendar days on the job site is required, and expenses associated with additional days necessary shall be at no cost to the OWNER.

B. Following installation, checkout, and final adjustment of all panels, instruments, meters, monitoring, and control devices, the CONTRACTOR shall schedule a performance test in the presence of the ENGINEER on all equipment. The CONTRACTOR shall furnish the services of the system supplier's servicemen, all special tools, calibration equipment, and labor to perform the tests.

C. Meters shall be tested at 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent of scale, if possible. All status and alarm switches as well as all monitoring and control functions shall also be checked, including logging at printers and change of state on graphics. Testing shall be done from the signal

source to the final element or device including all field wiring. Results of all testing shall be submitted to the ENGINEER in writing.

D. As much as possible, points shall be checked "end-to-end". For example, valve status inputs shall be checked by stroking the valve, and a pump start output shall be checked by using it to start to start the pump. Simulated testing shall be allowed only when no practical alternative exists. Workstation displays shall be verified for correctness at the same time. An I/O checklist shall be used to record test results and a copy provided to the ENGINEER upon completion. During system testing, the CONTRACTOR shall have a representative onsite continuously who is capable of troubleshooting and modifying SCADA system configuration programming.

E. If, during running of the tests, one or more points appear to be out by more than the system accuracy statement, or fails to perform in accordance with agreed strategies, the system supplier's servicemen shall make such adjustment or alterations as are necessary to bring equipment/programming up to specification performance. Following such adjustment, the tests shall be repeated for all specified points to ensure compliance.

3.04 PERFORMANCE TEST

A. Subsequent to the full system implementation, the CONTRACTOR shall conduct a successful 30 day final acceptance test for the SCADA system furnished and installed under this Contract. In this test, the entire SCADA system must operate continuously for 24 hours per day, 7 days per week during the test period, with zero downtime resulting from system failures. If a system failure occurs, the 60 day test period will be repeated, starting over at time zero, from the time that the system failure is repaired. The CONTRACTOR shall repeat the test until it is satisfactorily completed. The SCADA system will only be acceptable to the OWNER after all equipment ad software has satisfied the performance test requirements.

B. Downtime resulting from the following shall be considered system failures:

1. If a component failure cannot be repaired/replaced within 2 hours.

2. Downtime of any component (exclusive of I/O) whose failure results in the inability of the operator to monitor and manipulate control loops from the associated workstations, using standard workstation interface procedures.

3. Downtime resulting from concurrent failure of any CRT, keyboard, or mouse associated with the server workstations.

4. Downtime in excess of 2 hours resulting from any I/O component failure.

5. Downtime resulting from concurrent failure of 2 or more I/O components in a single PLC/RTU.

6. Downtime of any component/peripheral associated with the LAN, if the failed component results in a disabling of the historical functions and the failed component is not repaired or replaced in 8 hours.

C. The CONTRACTOR shall submit a final acceptance test completion report which shall state that all Contract requirements have been met and which shall include a summary of maintenance/repair efforts that were required during the test period. Final acceptance of the system by the OWNER until this has occurred.

3.05 SCADA SYSTEM DOCUMENTATION

A. Subsequent to system configuration or configuration updates, all information which defines the hardware, control and display configuration of the SCADA system shall be stored in mass memory within the workstations. The workstations shall be provided with all the intelligence and printing/plotting capabilities to enable the automatic generation of system documentation. All documentation shall be printed/plotted in both a text and graphic format. All documentation shall be accessible in report formats. It is not acceptable to use screen prints as a documentation report method. The workstation shall provide the means to produce the following documentation:

1. Current control system databases (including tags, descriptors, alarm limits, engineering units, associated alarm priority, logical states, etc.), control loops and ladder logic.

2. Definition of the current hardware configuration, including locations and associated PLC/RTU numbers.

3. Definition of the current display hierarchy and all displays currently in the system.

B. This information may be provided as a part of the Operators Reference Manual required as a part of Specification 13410, under Submittals.

3.06 ADJUSTING AND CLEANING

A. All equipment furnished under this Section of the Specifications shall be adjusted/calibrated as defined elsewhere this Section/Division.

B. All instruments and equipment shall be left free from shipping stickers, paint splatter, dirt, grease, etc., and shall be clean and in like new condition at final acceptance. Touch-up paint shall be furnished as needed to repair blemishes and scratches in finish paint on panels and enclosures, which shall be corrected by the CONTRACTOR.

SECTION 15

SECTION 15135 - METERS AND GAUGES

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section includes meters and gauges used in mechanical systems.

B. Related Sections: Division 15 piping Sections contain requirements that relate to this Section.

1. Meters and gauges furnished as part of factory-fabricated equipment are specified as part of the equipment assembly in other Division 15 Sections.

1.02 SUBMITTALS

A. General: Submit the following according to the Conditions of the Contract and Division 1 Specification Sections.

B. Product data for each type of meter, gauge, and fitting specified. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit a meter and gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gauge.

1.03 QUALITY ASSURANCE

A. Comply with applicable portions of American Society of Mechanical Engineers (ASME) and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

B. Design Criteria: The Drawings indicate types, sizes, capacities, ranges, profiles, connections, and dimensional requirements of meters and gauges and are based on the specific manufacturer types and models indicated. Meters and gauges having equal performance characteristics by other manufacturers may be considered, provided that deviations do not change the design concept or intended performance as judged by the Engineer. The burden of proof for equality of meters and gauges is on the proposer.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Liquid-in-Glass Thermometers:

   a. Marsh Instrument Co.
   b. Marshalltown Instruments, Inc.
   c. H.O. Trerice Co.
   d. Weiss Instruments, Inc.
   e. Weksler Instruments Corp.
   f. Or Approved Equivalent

2. Pressure Gauges:

   a. AMETEK, U.S. Gauge Div.
   b. Ashcroft by Dresser Industries, Instrument Div.
   c. Marsh Instrument Co.
   d. Marshalltown Instruments, Inc.
   e. H.O. Trerice Co.
   f. Weiss Instruments, Inc.
   g. Weksler Instruments Corp.
   h. WIKA Instruments Corp.
   i. Or Approved Equivalent

3. Test Plugs:

   a. Flow Design, Inc.
   b. MG Piping Products Co.
   c. Peterson Equipment Co., Inc.
   d. Sisco Co., Spedco, Inc.
   e. H.O. Trerice Co.
   f. Watts Regulator Co.
   g. Or Approved Equivalent

2.02 THERMOMETERS, GENERAL

A. Scale Range: Temperature ranges for services listed as follows:

1. Domestic Hot Water: 30 to 240 deg. F, with 2-degree scale divisions (0 to 115 deg. C, with 1-degree scale divisions).

2. Domestic Cold Water: 0 to 100 deg F, with 2-degree scale divisions (minus 18 to 38 deg. C, with 1-degree scale divisions).

3. Hydraulic geothermal piping 0 to 100 deg. F, with 2-degree scale divisions.

B. Accuracy: Plus or minus 1 percent of range span or plus or minus one scale division to maximum of 1.5 percent of range span.

2.03 LIQUID-IN-GLASS THERMOMETERS

A. Description: ASTM E 1, liquid-in-glass thermometer.

B. Case: Die-cast and aluminum-finished in baked-epoxy enamel, glass front, spring secured, 9 inches (230 mm) long.

C. Adjustable Joint: Finished to match case, 180-degree (3.1rad) adjustment in vertical plane, 360-degree (6.3rad) adjustment in horizontal plane, with locking device.

D. Tube: Red-reading mercury-filled with magnifying lens.

E. Scale: Satin-faced nonreflective aluminum with permanently etched markings.

F. Stem: Copper-plated, steel, aluminum, or brass for a separable socket of length to suit installation.

2.04 THERMOMETER WELLS

A. Description: Brass thermometer well.

B. Pressure Rating: Not less than piping system design pressure. SELECT STEM

C. Stem Length: To extend to center of pipe.

D. Extension for Insulated Piping: 2 inches (50 mm) nominal, but not less than thickness of insulation.

E. Threaded Cap Nut: With chain permanently fastened to well and cap.

2.05 PRESSURE GAUGES

A. Description: ASME B40.1, Grade A phosphor-bronze Bourdon-tube pressure gauge, with bottom connection.

B. Case: Drawn steel, brass, or aluminum with 4-1/2-inch (115mm) -diameter glass lens.

C. Connector: Brass, 1/4-inch (8mm) NPS.

D. Scale: White-coated aluminum, with permanently etched markings.

E. Accuracy: Plus or minus 1 percent of range span.

F. Range: Conform to the following:

1. Fluids Under Pressure: 2 times operating pressure.

2.06 PRESSURE-GAUGE ACCESSORIES

A. Snubbers: 1/4-inch (8mm) brass bushing with corrosion-resistant porous-metal disc of material suitable for system fluid and working pressure. Install on pumps only.

2.07 TEST PLUGS

A. Description: Nickel-plated brass-body test plug in 1/2-inch (15mm) fitting.

B. Body: Length as required to extend beyond insulation.

C. Pressure Rating: 500 psig (3450 kPa) minimum.

D. Core Inserts: 2 self-sealing valve types, suitable for inserting a 1/8-inch (3mm) outside-diameter probe from a dial thermometer or pressure gauge.

E. Core Material: According to the following for fluid and temperature range:

1. Air, Water, Oil, and Gas: 20 to 200 deg F (minus 7 to 93 deg C), neoprene rubber.

2. Air and Water: Minus 30 deg to 275 deg F (minus 35 to 136 deg C), ethylene-propylene-diene-terpolymer (EPDM) rubber.

F. Test-Plug Cap: Gasketed and threaded cap, with retention chain.

G. Test Kit: Provide test kit consisting of 1 pressure gauge and gauge adapter with probe, 2 bimetal dial thermometers and a carrying case.

H. Pressure Gauge and Thermometer Ranges: Approximately 2 times systems operating conditions.

PART 3 - EXECUTION

3.01 METER AND GAUGE APPLICATIONS

A. General: Where indicated, install meters and gauges of types, sizes, capacities, and with features indicated.

3.02 METER AND GAUGE INSTALLATION, GENERAL

A. Install meters, gauges, and accessories according to manufacturers' written instructions for applications where used.

3.03 THERMOMETER INSTALLATION

A. Install thermometers and adjust vertical and tilted positions.

B. Install in the following locations and elsewhere as indicated:

1. Where indicated on the Drawings.

C. Thermometer Wells: Install in vertical position in piping tees where thermometers are indicated.
1. Install wells with stem extending to center of pipe.

3.04 PRESSURE GAUGE INSTALLATION

A. Install pressure gauges in piping tee with pressure gauge valve located on pipe at most readable position.

B. Install in the following locations and elsewhere as indicated:

1. Where indicated on the Drawings.

C. Pressure Gauge Valves: Install in piping tee with snubber.

3.05 TEST PLUG INSTALLATION

A. Install test plugs in piping tees where indicated, located on pipe at most readable position. Secure cap.

SECTION 15784 - PACKAGED TERMINAL AIR-CONDITIONING UNITS

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. This Section includes mini-split HVAC units.

1.03 SUBMITTALS

A. Product Data: Include rated capacities, weights, furnished specialties, and accessories for each model indicated.

B. Shop Drawings: Detail layout and installation of wall penetrations.

1. Wiring Diagrams: Detail wiring for power, signal, and control systems and differentiate between manufacturer-installed and field-installed wiring.

C. Maintenance Data: For equipment to include in the maintenance manuals specified in Division 1.

D. Warranties: Special warranties specified in this Section.

1.04 QUALITY ASSURANCE/WARRANTIES

A. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Code for Mechanical Refrigeration."

B. Energy Efficiency Ratio: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

C. Coefficient of Performance: Equal to or greater than prescribed by ASHRAE 90.1, "Energy Efficient Design of New Buildings except Low-Rise Residential Buildings."

D. Listing and Labeling: Provide electrically operated components specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in the National Electrical Code, Article 100.

2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

3. Warranty Period, Compressors: Manufacturers standard, but not less than 5 years after date of Substantial Completion.

4. Warranty Period, Heat Exchangers: Manufacturers standard, but not less than 10 years after date of Substantial Completion.

1.05 COORDINATION

A. Coordinate layout and installation of units and wall construction where unit penetrates wall or is supported by it.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Product manufactured by Mitsubishi Electrical and locally supplied by Triangle Enterprises or equal.

B. Product Model Name:

1. Outdoor Unit: MYZ-8B48NA, One (1) 4 ton unit required

2. Branch Box Unit: PAC-AKA51BC, One (1) unite required

3. Indoor united to be sized per room. Five (5) required.

2.02 SOURCE QUALITY CONTROL

A. Sound-Power Level Ratings: Factory test to comply with ARI 270, "Sound Rating of Outdoor Unitary Equipment."

B. Unit Performance Ratings: Factory test to comply with ARI 310/380, "Packaged Terminal Air-Conditioners and Heat Pumps."

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install units according to manufacturer's written instructions.

B. Coordinate installation of wall sleeves in finished wall assembly; seal and weatherproof.

3.02 CLEANING

A. After completing system installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris, and repair damaged finishes including chips, scratches, and abrasions.

3.03 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel as specified below:

1. Train Owner's maintenance personnel on procedures and schedules related to startup and shutdown, troubleshooting, servicing, and preventive maintenance.

2. Review data in the maintenance manuals. Refer to Division 1 Section "Contract Closeout."

3. Review data in the maintenance manuals. Refer to Division 1 Section "Operation and Maintenance Data."

4. Schedule training with Owner, through Engineer, with at least 7 days' advance notice.

SECTION 15850 – LOUVERS AND EXHAUST FAN

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment, and services required to furnish and install the louvers as shown on the Drawings and specified herein.

1.02 SUBMITTALS

A. Submit manufacturer's technical product data, assembly-type shop drawings, and maintenance data in conformance with Section 01340 of these specifications.

1.03 QUALITY ASSURANCE

A. AMCA Compliance: Test and rate louvers and dampers in accordance with AMCA Standard 500, provide Certified Ratings Seal on each unit.

PART 2 - PRODUCTS

2.01 LOUVERS

A. Fabrication, General: Fabricate louvers and accessories to comply with requirements indicated for design (blade angle, blade profile, blade spacing), metal type and form, sizes, depth, arrangement, and metal thicknesses indicated or required for performance and use intended.

B. Structural Performance: Design, engineer, fabricate and install units capable of withstanding the effects of loads and stresses from wind and normal thermal movement without evidencing permanent deformation of components, metal fatigue or noise from louver blade rattle or flutter, and permanent damage to fasteners or anchors.

C. Preassemble units in shop.

D. Manufacturer: Subject to compliance with requirements, provide products manufactured by Greenheck and provided locally by Triangle Enterprise or equal.

E. The GCI-402 combination weather louver and gravity intake damper protects air intake openings in building exterior walls. This design incorporates drainable head, J style blades, gravity damper blade, sloped sill and high free area to provide maximum resistance to rain and weather:

1. Frame: 0.081

2. Blade: Stationary front section 0.081" . Adjustable blade thickness 0.063

3. Frame: Frame depth 4.0. Frame type Channel.

4. Louver: Lover material aluminum.

5. Booster Pump Room 24X12X10
   Chemical Rooms 10X12X10
   Storage Room 10X12X10

6. Bird Screen: 1/4" sq. mesh, 0.063 inch diameter.

2.02 EXHAUST FAN

A. Fan Panels – Galvanized Steel

B. Blade – Aluminum

C. Heavy gauge welded wire motor supports

D. Fan guard zinc plated

E. Motor mounted to supports guard with neoprene isolators.

F. Corrosion resistant fasteners

G. Size
   1. Booster pump room
      a. Dimension 14" X 14"
      b. Volume 480 CFM
      c. Motor RPM 1550
   2. Storage room and chemical rooms
      a. Dimension 12" X 12"
      b. Volume 200 CFM
      c. Motor RPM 1650

H. Product manufactured by Greenheck and locally supplied by Triangle Enterprises or equal.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Install louvers in accordance with manufacturer's written instructions and in accordance with recognized industry practices to insure that products serve intended functions.

B. Locate and place louver units plumb, level, and in proper alignment with adjacent work.

C. Use concealed anchorages where possible. Provide brass or lead washers fitted to screws where required to protect metal surfaces and to make a weather tight connection.

D. Form closely fitted joints with exposed connections accurately located and secured.

E. Provide perimeter reveals and openings of uniform width for sealants and joint fillers, as indicated.

F. Repair finishes damaged by cutting, welding, soldering, and grinding operations required for fitting and jointing. Restore finishes so there is no evidence of corrective work. Return items which cannot be refinished in field to shop, make the required alterations and refinish entire unit, or provide new units.

G. Protect nonferrous metal surfaces from corrosion or galvanic action by application of a heavy coating of bituminous paint on surfaces which will be in contact with concrete, masonry, or dissimilar metals.

H. All louvers shall be supplied by the same manufacturer.

I. Install electrical connections for power, controls, and devices.

J. Electrical power and control wiring and connections are specified in Division 16 Sections.

Date:		**Project No.:**	
Project Title:		**Client:**	
Funding Agency:			
Submitted By:		**Project Manager:**	

Date:		**Project No.:**	
Project Title:		**Client:**	
Funding Agency:			
Submitted By:		**Project Manager:**	

SECTION 16

SECTION 16232 - STANDBY POWER GENERATOR SYSTEMS – MANUAL TRANSFER SWITCH

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Provide all labor, materials, equipment, and services required to install a manual transfer switch for the existing Empire engine generator set as shown on the Contract Drawings and as specified herein.

EXISTING GENERATOR INFORMATION:

- Brand: Empire
- Model #: 450DJW-8E
- 240V, 3 Phase, 135 Amps, 4 Wire, 45 kW, 56.25 kVA, 0.8 P.F.
- Engine: 354CID, Crank Pulley-Flywheel hsg, head-pan
- Starter: 12 Volt
- Battery: 95 A.H. 12 Volt
- Tank: 13 Gallon w/float switch (300 Gallon Underground Tank)
- Prime Power is 100% of Standby Rating

1.02 MANUAL TRANSFER SWITCH

A. The installation of the manual transfer switch shall include new and current design equipment consisting of:

1. Manual transfer switch enclosure shall be NEMA Type 12, constructed of continuous seam-welded and powder coated. Access shall be through an interlocked, hinged door that extends the full length of the enclosure. Enclosures shall be powder coated after fabrication. Size and locations for conduit/fittings openings shall be as shown on contract drawings.
2. Manual Transfer Switch shall be 200A, 3-Pole, 60Hz, 240VAC, with 24VDC Starting Battery.
3. Contractor shall furnish and install UL listed hubs for each conduit entry on the manual transfer switch.
4. The manual transfer switch interlocking mechanism shall be integrated with the access door. The mechanism shall prevent connections from being energized unless the access door is closed.
5. Manual Transfer Switch shall be manufactured by Cutler Hammer or approved equal.

1.03 ASSEMBLY

A. Phase, neutral, and ground lugs shall be sized to accept wire sizes as shown on contract drawings.
B. A hinged cover is to be located over the incoming generator cable access openings to prevent entry of debris or unauthorized access. This cover is to be interlocked with the main access door, such that when no cables are inserted, the hinged cover

is in the closed position and the access door is closed, the hinged cover cannot be opened.

1.04 SUBMITTALS

A. Pre-bid submittals shall be submitted in accordance with Special Conditions.

B. Shop drawings and other items needed to establish compliance with the Drawings and these Specifications shall be submitted to the Engineer in accordance with Section 01300 - Submittals.

C. O&M instructions and Common List Replacement Parts shall be submitted.

PART 2 - EXECUTION

2.01 INSTALLATION/APPLICATION/ERECTION

A. Installation shall be in accordance with Drawings, accepted Shop Drawings, these Specifications, and manufacturer's recommendations.

2.02 TESTING

A. The Contractor shall perform an operating test at each site where it is proposed for the generator to be used. The manufacturer's field technical representative shall actually conduct the test. The generator must be able to carry the available load at all sites up to its ratings.

B. Checking and adjustment of phase rotation shall be performed at all sites to make generator output conform to utility configuration. It is unacceptable to isolate a motor and look at its rotation - a phase sequence indicator shall be utilized.

2.03 START-UP AND TRAINING

A. Start-up service technician shall be a regular employee of the manufacturer.

B. As part of the submittal covering this equipment, list the factory service manager, his employee number, his telephone number with extension and his number of years with the company. List also each start-up service technician, his employee number and years of service with the company.

C. Verify that one (1) or more of the service technicians listed above will perform the required start-up service on the equipment covered in the submittal.

D. One (1) full day at job site for start-up and training.

E. Start-up service report attested to by start-up technician and representative of owner or engineer.

F. Contractor must coordinate for all parties to attend start-up including manufacturer

representative, electrical subcontractor, engineer, and owner. If for any reason start-up is unsuccessful or needs to be rescheduled, the contractor will be responsible to compensate all parties for additional time.

G. Service report distributed to:

1. Manufacturer's File

2. Engineer's File

3. Contractor's File

4. Owner's File

APPENDIX

GEOTECHNICAL EXPLORATION REPORT

PROPOSED GROUND STORAGE – POTABLE WATER
RACETRACK DRIVE
SYMSONIA, KENTUCKY

Prepared For:

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Austin Engineering
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Paducah, Kentucky 42001

Prepared By:

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ENGINEERING & TESTING, INC.
500 SOUTH 17TH STREET
PADUCAH, KY 42003

January 5, 2012

Table of Contents

1.0 Objective

The purpose of this geotechnical study is to explore the subsurface conditions present at the site and to determine pertinent engineering properties of the materials encountered.

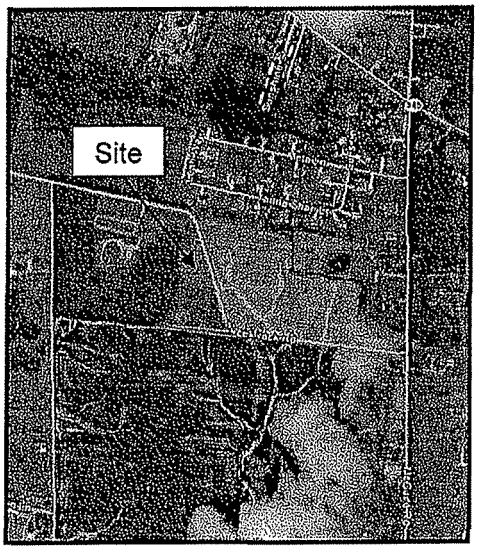
2.0 Project Information

Based on the available project information, the project includes the construction of a 150,000-gallon potable water tank approximately 35 feet in diameter and 20 feet in height at the Symsonia Water Treatment Plant.

2.1 Site Description

A site reconnaissance was conducted on December 9, 2011. Observations made during the site visit were used to aid in interpreting topographic, geologic and other conditions that may affect proposed construction.

The project site lies along the west side of Racetrack Drive in the town of Symsonia, Graves County, Kentucky. The site currently consists of vacant grass covered land, approximately 0.85 acres in size and lies within an area predominantly characterized with residential and agricultural property usage.



The site is located within the United States Geologic Survey, Symsonia, KY 7.5-Minute Quadrangle. The general topography of the project area is gently rolling with a downward slope in topography towards the south/southwest. Surface water drains across the site into Bear Creek to the south, which flows into the west fork of the Clarks River. The approximate elevation of the site ranges from approximately 395 to 410 feet above sea level (National Geodetic Vertical Datum of 1929).

2.2 Exploratory Method

The procedures used by BFW, Inc. for field and laboratory sampling and testing are in general accordance with ASTM procedures, and established engineering practice. During the geotechnical drilling activities, a series of 3 soil test borings were advanced at the site within the footprint of the proposed structure. The soil test borings were advanced to approximately 60 feet below ground surface (bgs). The soil test boring locations and surface elevations were established in the field by BFW, Inc., representatives.

A CME-75 truck mounted rotary-drilling rig was used to advance the soil test borings and to obtain soil samples for laboratory evaluation. The test borings were advanced in accordance with geotechnical investigative procedures outlined in ASTM D-1452.

Disturbed samples were retrieved during Standard Penetration tests (ASTM D-1586) using an automatic hammer assembly at various depths in the underlying stratum. The Standard Penetration test consists of driving a 2-inch outside diameter split-barrel sampler (split-spoon) into the soil with a 140-pound weight falling freely through a distance of 30 inches. The sampler was driven in three successive 6-inch increments, with the number of blows per increment being recorded. The number of blows required to advance the sampler the last 12 inches is termed the Standard Penetration Resistance (N). Seamless steel "Shelby Tubes" were advanced in two of the soil test borings at depths of approximately 4 to 6 feet bgs to obtain undisturbed samples for soil classification and unconfined compression analysis.

Our project manager observed and directed the drilling operations and visually classified soil samples obtained in accordance with Unified Soil Classification System and ASTM D-2488 guidelines. Records of the conditions encountered and visual soil classification were prepared and incorporated in Subsurface Boring Logs included in the report appendix.

The Subsurface Boring Logs represent our interpretation of the conditions encountered within the soil test borings. It should be noted that strata changes may vary from those encountered within the soil test borings, transitions may be gradual or abrupt, and conditions may vary significantly at other locations. The groundwater information listed represents conditions at the time of drilling and at least 24-hours after drilling activities. Representative soil samples obtained from the boring were preserved in plastic bags, sealed and taken to the laboratory for testing.

3.0 Subsurface Conditions

3.1 Stratigraphy

Three soil test borings were advanced near the central portion of the site within the proposed ground storage tank footprint. The lithology encountered within the test borings is laterally consistent with minimal changes in soil characteristics.

The area is covered with a 6 – 8 inch layer of topsoil, which is underlain by a light grayish brown silty clay (Recent alluvial/loess deposits) with medium plasticity and firm consistency. This clay transitions with depth into a coarser-grained material with reddish brown iron oxide staining and intermixing fine-grained sands. SPT tests within the silty clays yielded "N" values ranging from 5 to 10. At approximately 22 – 25 feet bgs, the soil transitions to a loose, fine-grained light grayish brown silty sand (SPT "N" values ranging from 6 – 10) which continues to approximately 32 feet bgs, where the subsurface material changes to a

well graded dense sandy gravel (SPT "N" values ranging from 22 – 50+). This gravel (Tertiary deposits) was typically encountered to the boring completion depth of 60 feet bgs; however in soil test boring B-3, a poorly graded dark brown gravelly sand with firm consistency (SPT "N" values ranging from 16 – 17) was encountered from approximately 52 feet bgs, and continuing downwards until the boring was completed.

3.3 Groundwater

Groundwater measurements were taken in each of the soil test borings immediately following drilling activities. The soil test borings remained open for at least 24-hours after drilling activities to obtain additional groundwater data. Groundwater was identified within each of the soil test borings at the time of drilling activities ranging from 39.0 to 43.0 feet bgs. Groundwater was identified 24-hours after drilling activities at depths ranging from 21.0 feet in soil test boring B-3 to 29.0 feet bgs in soil test boring B-1; soil test boring B-2 was dry after a 24-hour period.

During drilling activities, it should be noted that some subsurface material was injected into the hollow-stem augers while drilling below the potentiometric surface (typically referred to as "heave"). Heaving usually occurs in confined aquifer conditions with positive hydraulic head where aquifer material is injected up into the boring through the auger bit. Heaving is typically mitigated by applying counter-pressure into the drill stem while drilling, usually with water or drilling fluids. No more than one foot of heave was encountered during this investigation. Each of the soil test borings were backfilled with soil cuttings at the completion of the subsurface investigation or the collection of 24-hour readings.

4.0 Laboratory Testing

Laboratory soil tests were conducted in accordance with applicable ASTM Standards. Natural moisture contents were determined for all samples collected. Liquid and Plastic Limits tests were conducted for selected soil samples to verify field classification of the soils. In addition, these tests evaluate the potential for volumetric changes in the soil. Laboratory test results are tabulated in Appendix D.

4.1 Laboratory Results

4.1.1 Natural moisture contents

Natural moisture contents were determined for the soil samples collected. Samples from 0.0 – 1.5 feet deep ranged from 24.8 to 28.3 percent. Samples from 1.5 – 3.0 feet deep ranged from 22.9 to 30.5 percent. Samples from 4.0 – 6.0 feet deep ranged from 20.3 to 22.6 percent. Samples from 8.5 – 10.0 feet deep ranged from 19.3 to 25.9 percent. Samples from 13.5 – 15.0 feet deep ranged from 16.3 to 27.0 percent. Samples from 18.5 – 20.0 feet deep ranged from 18.9 to 27.2 percent. Samples from 23.5 – 25.0 feet deep ranged from 13.1 to

15.3 percent. Samples from 28.5 – 30.0 feet deep ranged from 11.2 to 20.4 percent. Samples from 33.5 – 35.0 feet deep ranged from 6.3 to 12.2 percent. Samples from 38.5 – 40.0 feet deep ranged from 12.7 to 13.9 percent. Samples from 43.5 – 45.0 feet deep ranged from 16.2 to 16.5 percent. Samples from 48.5 – 50.0 feet deep ranged from 15.2 to 22.3 percent. Samples from 53.5 – 55.0 feet deep ranged from 12.0 to 25.8 percent. Samples from 58.5 – 60.0 feet deep ranged from 17.5 to 23.7 percent. Exact moisture contents for all samples are tabulated in the Appendix.

4.1.2 Atterberg Limits (Index Tests)

Atterberg Limits testing was conducted on samples collected from various borings. From the test results, liquid limit and plastic limit values were obtained. A plasticity index was then calculated using the liquid and plastic limit values. Using the results from the Atterberg Limits tests, the soils were classified using the Unified Soil Classification System.

One samples collected from soil test boring, B-3 (4.0'-6.0') was classified as a silty clay (CL) of low to medium plasticity with a plasticity index (PI) of 8.

A designation of CL includes gravelly clays, sandy clays, silty clays, and lean clays. Soil samples that have a Plasticity Index >20 have a potential for soil volume change due to changing moisture contents.

4.1.3 Standard Penetration Tests

Field and laboratory tests were conducted to evaluate the soil strength characteristics on site. Standard Penetration Tests (SPTs) conducted in the field in the upper fill soils and upper silty clays produced low "N" values (blow counts) in the range of 5 to 10. SPTs produced "N" values (blow counts), in the range of 22 to 50+ in the lower sandy gravels.

The "N" values are roughly correlated with the average soil consistency and an unconfined compressive strength. The "N" values indicate that the consistencies are firm to stiff in the upper silty clays. The "N" values indicate that the lower gravelly clays / clayey gravels are very firm to very dense in consistency. SPT results are provided on the Subsurface Boring Logs located in the appendix.

4.1.4 Unconfined Compression Tests

Unconfined compressive strength analysis was conducted on usable undisturbed samples collected from the 4 – 6 foot depth interval across the site. Unconfined compressive strength tests ranged from 2,237 (boring B-2) to 3,156 (boring B-3) pounds per square feet (psf).

5.0 Geotechnical Considerations and Recommendations

Based on the results of the subsurface exploration, current site conditions observed, and laboratory results, items of geotechnical interest and considerations are discussed in the following sections.

5.1 Basis for Recommendations

The following recommendations are based on data from this exploration and the stated project information. In our evaluations, we have utilized both subsurface data from this exploration and our experience with similar structures and subsurface conditions. If the structural information is incorrect or changed subsequent to our reporting, if the siting or building components have been changed, or if the subsurface conditions encountered during the construction vary from those reported, our recommendations should be reviewed in light of the changed conditions.

Experience indicates that the actual subsoil conditions at a site could vary from those generalized on the basis of soil test borings made at specific locations. Therefore, it is essential that a geotechnical engineer be retained to provide soil-engineering services during the site preparation, excavation, and foundation construction phases of the proposed project. The geotechnical engineer should observe compliance with the design concepts, specifications, and recommendations, and to allow design changes in the event subsurface conditions differ from those anticipated prior to the start of construction.

5.2 General Geotechnical Considerations

5.2.2 Soft Subgrade Soils

As discussed in the Stratigraphy section of this report, soft upper soils were encountered across portions of the site. The soft soils were comprised of a mixture of very moist, silty clays. The soft soil zones within two of the soil test borings extended to depths of approximately 3 feet below ground surface.

In the area of the proposed water storage tank, it will be necessary to conduct undercutting during the earthwork activities due to the potential for long term settlement of the proposed structure. The proposed building area should be undercut a minimum of 36-inches. The undercutting activities should be witnessed by competent geotechnical personnel to verify subgrade conditions. The undercut area should be backfilled with properly compacted limestone dense graded aggregate (DGA). The DGA should be placed in maximum 8-inch lifts and compacted to at least 98 percent of the materials maximum dry density.

5.2.3 Silty Soils / Construction Traffic / Subgrade Degradation

As stated in Section 3.2 Stratigraphy, the in-situ soils consist of low plasticity silty clay loams and clayey silts. It should be noted that silty clays loams are very susceptible to degrade to unsuitable soils in the presence of moisture and construction traffic. In addition, silty soils are typically difficult to properly compact when wet of optimum moisture content as determined by a Standard Proctor test. The importance of these characteristic of silty soils cannot be overstated. The contractor must fully understand the causes and effects of moisture versus compaction for silty soil and the detrimental effect of construction traffic on soil subgrades. A discussion of silty soils and some of the potential negative effects of moisture and construction traffic are provided below.

The silty clay and clayey silts soils need to be close to its optimum moisture content (as determined by the Standard Proctor) before it can be properly compacted to the required density. If the silty clay soils are too dry or wet (above or below the optimum moisture content) then the soils will typically not compact properly even with above normal compaction efforts. If the soils are too dry then water can be easily added on site during the compaction activities. However, if the soil moistures are too high, as typically the case in the spring and winter months, then the silts must be manipulated to accelerate drying by discing and aerating or by other means that would require above routine efforts.

The contractor should understand that aerating the silty soil requires a concerted effort to overturn, disc and manipulate the soils multiple times during the drying process. Typically, overturning the soils and discing once or twice will not be sufficient effort to dry the soils. It is the process of continually overturning and exposing the soils to the sun and wind that actually causes the drying process. However, this process is less effective during the wet seasons of the year and would typically require longer drying times. If the project time constraints do not allow for aeration, then additional drying methods, such as lime stabilization or other methods may be needed.

It is also important to note that at the end of each day or prior to any rainfall events that the soil must be smoothed and rolled to minimize any surface water infiltration. The site grading should always provide for positive site drainage away from the project site even during construction activities. Surface water / storm water should not be allowed to pond on the surface or in tire ruts.

Another significant characteristic of the silty clay soils is the high potential of subgrade degradation in the presence of elevated moistures and construction traffic. As is common construction knowledge, extremely large tire loadings are typically present on construction sites from dump trucks, concrete trucks, masonry block and brick/masonry block forklifts (Pettybone). The tire loadings from these vehicles are usually the most significant concentrated loadings that the soil subgrades will most likely encounter. In many cases these

tire loadings will exceed the overall shear strength of the in-situ soils and rutting and pumping will occur as a result. This is especially true during repeated heavy tire loadings occur when the soil subgrade wet or above its optimum moisture content. To reiterate, the contractor should be aware that repeated heavy construction traffic loadings will cause significant damage to the soil subgrade especially when the soils are wet or saturated.

5.3 Foundation Recommendations

5.3.1 Shallow Foundations (Ringwall)

As previously discussed in the geotechnical considerations section of this report, soft soils were encountered in the upper soil zones within the soil test borings. As a result, it is recommended that the tank footprint be undercut a minimum of 36-inches (deeper isolated undercut area may be possible) and the area backfilled with properly compacted limestone DGA. The DGA should be placed in maximum 8-inch lifts and compacted to a minimum of 98% of the materials maximum dry density. According to the Kentucky Building Code shallow foundations should be seated to a minimum depth of 24-inches. Therefore, the any remaining depth of overexcavation should extend beyond the perimeter of the ringwall foundation on a minimum slope of 1:1.

It is anticipated that the shallow foundations will be seated on the properly compacted DGA fill. A net allowable soil bearing pressures of 2,500 pounds per square feet (psf) should be anticipated for structural support.

All undercut and backfill activities should be observed by competent geotechnical personnel to determine adequate bearing subgrade. In addition, the foundation bearing seats should be inspected by competent personnel prior to any steel or concrete placement. Water should not be allowed to accumulate in the foundation excavation prior to concrete placement.

5.3.4 Seismic Site Class (2009 International Building Code)

Based on requirements of the 2009 International Building Code, site classification are required for the design of seismic elements of structures. Upon review of subsurface soil data obtained and the 2009 International Building Code and the subsurface conditions encountered a Site Class D is recommended for use in design.

5.4 Site Preparation (General Site Recommendations)

5.4.1 Clearing / Grubbing / Stripping

Each area of construction on the subject site should be cleared, stripped and grubbed of topsoil / organics, deleterious materials, concrete, asphalt and soft/unsuitable soils.

Any extensive soft soil deposits encountered should be evaluated by extensive proof rolling and/or shallow excavations to determine the amount of undercutting required. Under no circumstances should the stripped material (ie. old fill, trees, topsoil) be used as fill for any excavations, low-lying areas, or for any subsurface structural element.

5.4.2 Subgrade Preparation

After stripping and clearing, the areas intended to support floor slabs, new fill, and pavements should be carefully inspected by a qualified geotechnical personnel. The testing personnel may require a visual subgrade inspections and possible proof-rolling of the subgrades.

Proof-rolling activities should occur after a suitable period of dry weather to avoid degrading the subgrade. Proof-rolling should be performed by making repeated passes over the subgrade with a 20 to 30-ton loaded truck or other pneumatic-tired vehicle of similar size and weight. The vehicle should make a sufficient number of passes in each of two perpendicular directions covering the proposed development area.

Any areas judged to deflect excessively during, proof rolling should be undercut and rerolled. This process should be repeated until all soft soils are removed or the geotechnical engineer recommends an alternate stabilization method such as lime stabilization. Proof rolling activities should occur immediately before fill placement. If fill material is not immediately placed and subgrade is allowed to stand unprotected, then additional proof-rolling activities will be required in the same area to verify subgrade stability.

It is important to note that at the end of each day or prior to any rainfall events that the site subgrade be smoothed and rolled to minimize any surface water infiltration. The site grading should always provide for positive site drainage away from the project site even during construction activities. Surface water / storm water should not be allowed to pond on the surface or in tire ruts.

5.4.3 Engineered Fill Placement

Prior to any fill activities taking place, we recommend that representative samples of the proposed fill material be collected (minimum 5-gallon container of material) and tested to determine the laboratory compaction characteristics, plasticity and natural moisture contents. The tests should be conducted to determine the suitability of proposed fill material. Based on the subsurface data obtained, the in-situ soils should be acceptable for use as engineered fill material once stripped of topsoil / organics and rootballs.

Proposed fill materials should be free of organics, deleterious debris, or rocks larger than 3 inches in diameter. Suitable fill soil should have a plasticity index (PI) of less than 30 and a maximum dry density according to the standard Proctor compaction test of at least 100

pounds per cubic foot (pcf). All fill soils and fill pads should be properly compacted and tested.

The fill should be compacted to at least 98 percent of the soil maximum dry density (ASTM D-698 "Standard Proctor") under structures and building slabs. Fill materials under proposed paved areas, walkways and athletic fields should be compacted to at least 95 percent of the soils maximum dry density (ASTM D-698). Fill materials in lawn area should be compacted to at least 92 percent of the soils maximum dry density. Moisture contents of the fill materials should be maintained to within ± 2 percent of the soils optimum moisture.

The soil should be placed in lifts of 8 inches or less for materials compacted by heavy equipment and not more than 4 inches loose depth for hand compaction equipment. Each lift should be compacted and tested by nuclear density gauge methods prior to placing additional lifts every 2,500 square feet. All fill pads should extend laterally at least 10 feet beyond the building before sloping down. In-place density testing should be conducted for each lift placed to check the compaction achieved.

Positive surface drainage should be maintained to prevent water from ponding on the surface during all earthwork operations. After each days work or prior to any anticipated rainfall, the subgrade should be rolled with a rubber-tired or steel-drummed roller to improve surface runoff. The geotechnical engineer should be notified if the subgrade soils become excessively wet, dry or frozen.

As is common construction knowledge, extremely large tire loadings are typically present on construction sites from dump trucks, concrete trucks, masonry block and brick/masonry block forklifts (Pettybone). The tire loadings from these vehicles are usually the most significant concentrated loadings that the soil subgrades will most likely encountered. In many cases these tire loadings will exceed the overall shear strength of the in-situ soils or recently placed engineered fill and rutting and pumping will occur as a result. This is especially true during repeated heavy tire loadings occur when the soil subgrade wet or above its optimum moisture content. It is important that the site subgrade be properly maintained by the contractor for the extent of the entire project. The site should not be allowed to become rutted or water allowed to pond.

5.4.4 Surface Water Control

The site was observed to have moderate surface drainage conditions. However, active methods must be used to keep surface water and rainwater from ponding or draining into the proposed building pad area. Surface water should not be allowed to pond on the building subgrade surfaces. This is especially true during construction activities. Proper erosion and sedimentation control plans must be developed as per the City and State requirement.

5.5 Other Design Considerations

5.5.1 Project Specifications

Specifications for this project should meet local building codes and OSHA guidelines. The observations, recommendations, and considerations presented in this report should be fully read and understood by the owner, project designer(s) and contractor(s) prior to final submittal of project plans and specifications.

5.5.2 Construction Monitoring

The implementation of a soil and concrete quality testing program aids in assuring that the end product is that which was designed. Thorough testing also allows opportunity for correction before major problems develop. For these reasons, Bacon Farmer Workman Engineering & Testing, Inc. (BFW), recommends the retainage of a qualified testing laboratory (by the Owner) to conduct quality tests on structural fill, aggregate base course, and concrete placement.

6.0 Qualifications of Recommendations

Our evaluation of foundation and pavement design and construction conditions has been based on our understanding of the site and on conditions encountered in the borings at the time of investigation. The general subsurface conditions used were based on our interpolation of the subsurface data between the borings. Regardless of the thoroughness of a subsurface investigation, there is the possibility that conditions between borings will differ from those at the boring locations, that conditions are not as anticipated by the designers, or that the construction process has altered the soil conditions. Therefore, experienced geotechnical engineers should observe earthwork and foundation construction to confirm that the conditions anticipated in design are noted. Otherwise, Bacon Farmer Workman Engineering & Testing, Inc.(BFW), assumes no responsibility for construction compliance with the design concepts, specifications, or recommendations.

The design recommendations in this report have been developed on the basis of the previously described project characteristics and subsurface conditions. If project criteria or locations change, a qualified geotechnical engineer should be permitted to determine whether the recommendations must be modified. The findings of such a review will be presented in a supplemental report.

The nature and extent of variations between the borings may not become evident until the course of construction. If such variations are encountered, it will be necessary to reevaluate the recommendations of this report after on-site observations of the conditions.

Our professional services have been performed, our findings derived, and our

recommendations prepared in accordance with generally accepted geotechnical engineering principles and practices. This warranty is in lieu of all other warranties either expressed or implied. Bacon Farmer Workman Engineering & Testing, Inc. (BFW), is not responsible for the conclusions, opinions, or recommendations of others based on this data.

Appendix A

Boring Log / Laboratory Procedure Guide

BORING LOG / LABORATORY PROCEDURE GUIDE

SUBSURFACE EXPLORATION

Bacon Farmer Workman Engineering & Testing, Inc., conducts soil test borings, field sampling and laboratory analysis in general accordance with methods of the American Society for Testing Materials (ASTM) and generally accepted engineering practices. Soil test borings were advanced with truck or track mounted rotary-type drilling rig equipment. Hollow stem or solid flight augers were used to advance soil test borings (ASTM D 1452). A series of soil samples are typically obtained for visual inspection and laboratory analysis during drilling activities. The samples collected may include disturbed, undisturbed or auger cutting samples.

BORING LOCATIONS / ELEVATIONS

Boring Locations are either selected by our project manager or have been selected by the client. The borings are typically located in the field by estimating right angles and measuring distances from site landmarks. Because of the locating methods used, the boring locations indicated on the Boring Location Plan (In Appendix) are approximate unless specifically noted. When topographic plans of the site are provided, the project engineer estimates the surface elevation of the boring locations using available information. Surveying to determine the locations and elevations of the borings is typically beyond the scope of the typical geotechnical study. Therefore, the boring locations and elevations should be considered approximate unless specifically noted.

BORING LOGS / RECORDS

The Subsurface Boring Logs included in this report are our interpretation of the conditions encountered at each boring location. The Subsurface Boring Logs are prepared on the basis of the field crew's observations during drilling, engineering review of the soil samples obtained, and laboratory testing on selected samples. Soil descriptions are made using the Unified Soil Classification System and ASMT D 2488 as guides. The depths designating strata changes on the Boring Records are estimations. In many geologic settings, the transition between strata is gradual.

GROUNDWATER LEVEL READINGS

Groundwater levels are monitored in each borehole upon the completion of drilling. In low permeability soils such as silts and clays, the groundwater level in the boreholes may take several or more hours to stabilize. Therefore, when possible, water level readings are also made at least 24-hours after drilling activities cease. Groundwater levels may be dependent upon recent rainfall activity and other site specific factors. Since these conditions may change with time, the water level information presented on the Subsurface Boring Logs represents the conditions only at the time each measurement is taken.

SAMPLING TECHNIQUES

Soil samples are typically obtained at selected depths during the drilling activities. Representative portions of the soil samples obtained are placed in sealed containers, labeled, and transported to the laboratory. The soil samples obtained are used for visual classification, and for strength, index and consistency testing. Samples obtained from the drilling activities include: Disturbed, undisturbed and bulk samples. Disturbed samples are collected during the Standard Penetration Tests using a split spoon sampler and hammer as described in the following section. Undisturbed samples are obtained by advancing a thin-walled Shelby tube with hydraulic pressure as described in the following section. Bulk samples are obtained from the auger cuttings generated during the advancement of the augers.

The **STANDARD PENETRATION TEST (ASTM D 1586)** is a method to obtain disturbed soil samples for examination and testing and to obtain relative density and consistency information. A standard 1.4-inch I.D. / 2-inch O. D. split-barrel (split spoon) sampler is driven three 6-inch increments with a 140 lb. hammer falling 30 inches. The hammer can either be of a trip, free-fall design or actuated by a rope and cathead. The hammer blows required to drive the sampler the final foot is the *standard penetration resistance (N-value)*. Standard penetration resistance, when properly evaluated, is an index to the soil's strength, consistency and density. Upon completion of each standard penetration test, the sampler is brought to the surface and the tube is split open to expose the soils penetrated. Our project manager / engineer examines the soil and places a representative portion of the soil into a sealed container for transportation to our laboratory.

BORING LOG / LABORATORY PROCEDURE GUIDE
(Continued)

UNDISTURBED SOIL SAMPLING (ASTM D 1587) is a method used to obtain a relatively undisturbed soil sample for more precise laboratory analysis including unconfined compressive strengths, compressibility or permeability. Undisturbed soil sampling is conducted by advancing a 3–inch O. D., 16 gauge, steel tube (Shelby Tube) with a sharpened edge slowly and uniformly into the underlying soil stratum under constant hydraulic pressure to the desired sampling elevation. The tube is then removed from the ground and both ends are sealed to prevent loss of moisture. The depth at which the undisturbed samples were collected is indicated on the Subsurface Boring Logs.

SOIL LABORATORY TESTS

The **MOISTURE CONTENT (ASTM D 2216)** of soils is an indicator of various physical properties, including strength and compressibility. Each test sample is weighed and then placed in an oven (110°C ± 5°C). The sample remains in the oven until the free moisture has evaporated. The dried sample is removed from the oven, allowed to cool and then reweighed. The moisture content is computed by dividing the weight of evaporated water by the weight of the dry sample. The results are expressed as a percent.

ATTERBERG LIMITS (ASTM D 4318) tests are used to help define the relationship between behavior changes in fine-grained soils at different moisture contents values. Depending upon the moisture content, a fine-grained soil may occur in a liquid, plastic, semi-solid, or solid state. These set of tests are used to establish the approximate moisture contents at which the soil changes its state. **LIQUID LIMIT** – a soil specimen is wetted until it is in a viscous fluid state. A portion of the soil is then placed in a standardized dimension brass cup, and a groove is made through the middle of the soil specimen with a grooving tool of standardized dimensions. The cup is attached to a cam that lifts it 10 mm, and then allows it to freefall and strike a hard rubber base. The cam is rotated at about 2 drops per second until the two halves of the soil specimen come in contact at the bottom of the groove along a distance of 13 mm. The number of blows required to close the groove is recorded, and a portion of the specimen is subjected to moisture content determination. Additional water is added to the remainder of the specimen, and the grooving process and cam action process repeated. After the third trial, the number of blows versus moisture content is plotted on semi-logarithmic graph paper. The moisture content corresponding to 25 blows is designated as the Liquid Limit.

The **Plastic Limit** is the lowest moisture content at which the soil is sufficiently plastic to be manually rolled into threads 3 mm in diameter. It is determined by taking a pat of soil remaining from the liquid limit test, and repeatedly rolling, kneading, and air drying the specimen until the soil breaks into threads about 3 mm in diameter and 3 to 10 mm long. The moisture content of these soil threads is then determined, and is designated the Plastic Limit.

A **PARTICLE SIZE ANALYSIS** determines the distribution of particles sizes in soils. Distribution of particle sizes larger than the No. 200 sieve is determined by the sieving process, while the distribution of particles smaller than the No. 200 sieve are determined by a sedimentation process, using a hydrometer. In the sieving process the soil is prepared by air drying and crushing, to separate clusters that clump together. A series of sieves, that consist of a square mesh woven-wire cloth having different size openings as per ASTM specifications are each weighed individually. They are stacked with the greatest size opening at the top with each successive lower sieve having smaller openings. A pan is placed on the bottom of the stack to catch soil finer that the # 200 sieve (0.75 mm). The soil is placed into the top sieve of the stack and is covered. The nest of sieves is placed and locked into a sieve shaker which is then agitated for approximately 10 minutes. Each sieve is reweighed with the retained soil. A semi-logarithmic graph is created showing the percent passing each specific sieve size.

The **UNCONFINED COMPRESSIVE STRENGTH TEST, (ASTM D 2166)** is a relatively quick method to obtain the approximate compressive strength of soils that possess sufficient cohesion to allow testing in the unconfined state. An undisturbed sample is obtained from the borehole with a Shelby Tube sampler. The tube is sealed in the field to retain natural moisture content. Once in the laboratory the undisturbed sample is extruded from the tube and cut to a specified length. The sample measurements are recorded. The sample is placed in its natural state in a compressive strength load frame. The sample is compressed under increasing load. Measurements of the load applied and the sample strain are recorded. Upon specimen failure the test is concluded and a graph of stress versus strain is plotted. The maximum stress applied is defined as the unconfined compressive strength.

Subsurface Boring Log Legend

Standard Penetration Test (N-Value Tables)

Fine Grained Soils (Silts & Clays)

N	Consistency	Qu, (KSF) Estimate Only
0 - 1	Very Soft	0 – 0.25
2 – 4	Soft	0.25 – 0.5
5 – 8	Firm	0.5 – 1.0
9 – 15	Stiff	1.0 – 2.0
16 – 30	Very Stiff	2.0 – 4.0
Over 30	Hard	> 4.0

Coarse Grained Soils (Sands & Gravels)

N	Relative Density
0 – 4	Very Loose
5 – 10	Loose
11 – 20	Firm
21 – 30	Very Firm
31 – 50	Dense
Over 50	Very Dense

Particle Sizes

Boulders	Greater than 300 mm (12 in)
Cobbles	75 mm to 300 mm (3 to 12 in)
Gravel	4.74 mm to 75 mm (3/16 to 3 in)
Coarse Sand	2 mm to 4.75 mm
Medium Sand	0.425 mm to 2 mm
Fine Sand	0.075 mm to 0.425 mm
Silts & Clays	Less than 0.075 mm

Relative Proportions

Descriptive Term	Percent
Trace	1 – 10
Little	11 – 20
Some	21 – 35
And	36 - 50

Boring Log Symbols / Abbreviations

N: Blows per foot of a 140 lb. hammer falling 30-inches on a 2 inch O. D. split spoon

Qp: Unconfined compressive strength, hand penetrometer, tsf

Qu: Unconfined compressive strength, Shelby tube sample, ksf

Mc: Percent of water in sample (%)

Dd: Sample Dry Density, pcf

LL: Liquid Limit

PL: Plastic Limit

PI: Plasticity Index

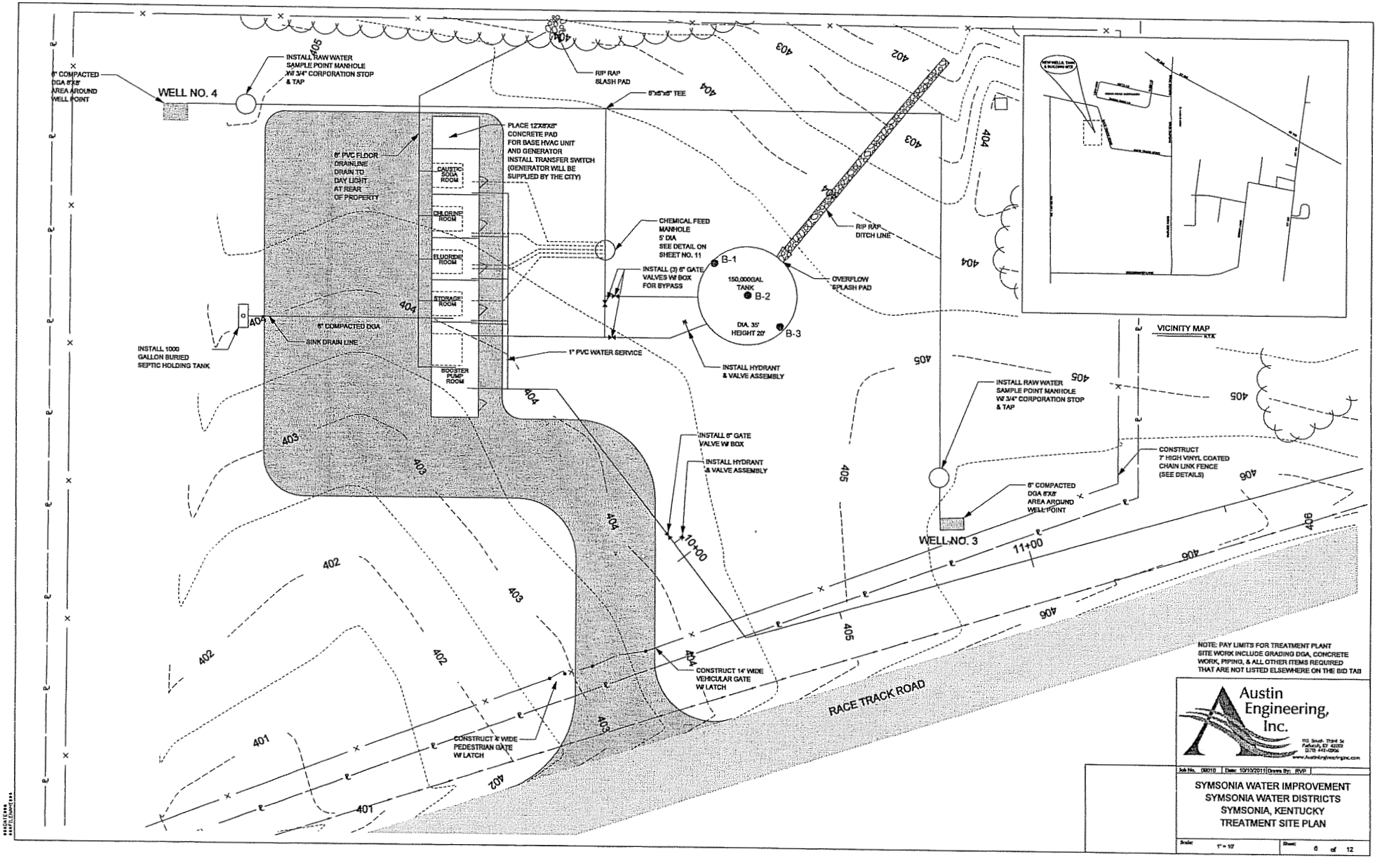
-# 200: Percent of sample passing a # 200 sieve (0.075mm)

-#4: Percent of sample passing a # 4 sieve

BFW BACON | FARMER | WORKMAN ENGINEERING & TESTING, INC

Appendix B

Soil Test Boring Location Map


6" COMPACTED DGA 8'X8' AREA AROUND WELL POINT
WELL NO. 4
INSTALL RAW WATER SAMPLE POINT MANHOLE W/ 3/4" CORPORATION STOP & TAP
RIP RAP SLASH PAD
6"x6"x6" TEE
PLACE 12'X8'X6" CONCRETE PAD FOR BASE HVAC UNIT AND GENERATOR INSTALL TRANSFER SWITCH (GENERATOR WILL BE SUPPLIED BY THE CITY)
6" PVC FLOOR DRAINLINE DRAIN TO DAY LIGHT AT REAR OF PROPERTY
CAUSTIC SODA ROOM
CHLORINE ROOM
FLUORIDE ROOM
STORAGE ROOM
BOOSTER PUMP ROOM
CHEMICAL FEED MANHOLE 5' DIA SEE DETAIL ON SHEET NO. 11
INSTALL (3) 6" GATE VALVES W/ BOX FOR BYPASS
B-1
150,000GAL TANK
B-2
DIA. 35'
HEIGHT 20'
B-3
RIP RAP DITCH LINE
OVERFLOW SPLASH PAD
INSTALL 1000 GALLON BURIED SEPTIC HOLDING TANK
6" COMPACTED DGA
SINK DRAIN LINE
1" PVC WATER SERVICE
INSTALL HYDRANT & VALVE ASSEMBLY
VICINITY MAP
INSTALL RAW WATER SAMPLE POINT MANHOLE W/ 3/4" CORPORATION STOP & TAP
INSTALL 6" GATE VALVE W/ BOX
INSTALL HYDRANT & VALVE ASSEMBLY
CONSTRUCT 7' HIGH VINYL COATED CHAIN LINK FENCE (SEE DETAILS)
6" COMPACTED DGA 8'X8' AREA AROUND WELL POINT
WELL NO. 3
10+00
11+00
CONSTRUCT 14' WIDE VEHICULAR GATE W/ LATCH
CONSTRUCT 4' WIDE PEDESTRIAN GATE W/ LATCH
RACE TRACK ROAD
NOTE: PAY LIMITS FOR TREATMENT PLANT SITE WORK INCLUDE GRADING DGA, CONCRETE WORK, PIPING, & ALL OTHER ITEMS REQUIRED THAT ARE NOT LISTED ELSEWHERE ON THE BID TAB
Austin Engineering, Inc.
SYMSONIA WATER IMPROVEMENT
SYMSONIA WATER DISTRICTS
SYMSONIA, KENTUCKY
TREATMENT SITE PLAN
Job No. 09010 | Date: 10/10/2011 | Drawn By: RVP
Scale: 1" = 10'
Sheet 6 of 12

Appendix C

Subsurface Boring Log

Bacon | Farmer | Workman
Engineering & Testing, Inc.
500 South 17th Street, Paducah, KY 42003
Telephone: 270443-1995
Fax: 270443-1904

BORING NUMBER B-01

CLIENT Austin Engineering
PROJECT NUMBER 11352
DATE STARTED 12/9/11 COMPLETED 12/9/11
DRILLING CONTRACTOR BFW
DRILLING METHOD Hollow Stem Auger 6.25" OD
LOGGED BY Bret Watkins CHECKED BY Chris Farmer
NOTES

PROJECT NAME Ground Storage-Potable Water - Symsonia, KY
PROJECT LOCATION Symsonia, KY
GROUND ELEVATION HOLE SIZE 4.25 inches
GROUND WATER LEVELS:
AT TIME OF DRILLING 43.00 ft
AT END OF DRILLING ---
AFTER DRILLING 29.00 ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
0		Approximately 0.5' TOPSOIL					
		LEAN CLAY, SILTY, (CL) light grayish brown medium plasticity, firm, moist	SS 1	100	1-1-2 (3)		
			SS 2	100	3-3-4 (7)		
			ST 3				
10			SS 4	100	1-3-4 (7)		
		LEAN CLAY WITH SAND, SILTY, (CL) reddish brown low plasticity, firm, moist, with fine-grained red-brown sand and mica intermixed	SS 5	100	1-3-4 (7)		
20			SS 6	100	1-2-3 (5)		
			SS 7	100	1-2-3 (5)		
30		SILTY SAND, CLAYEY, (SM) light grayish brown very fine-grained, loose, laminated	SS 8	100	3-5-5 (10)		
		WELL GRADED GRAVEL WITH SAND, SANDY GRAVEL, (GW) light grayish brown fine - coarse grained, very firm to very dense, dry	SS 9	67	1-14-32 (46)		
		some iron oxide	SS 10	78	7-18-19 (37)		
40			SS 11	67	5-12-16 (28)		
50		heaving sand - approximately 0.5 feet in auger flight, used water	SS 12	67	8-18-22 (40)		
			SS 13	67	10-23-30 (53)		
60		heave - approximately 0.5 feet in auger flight	SS 14	67	12-16-21 (37)		

Bottom of borehole at 60.0 feet.

SPT N VALUE
20 40 60 80
PL MC LL
20 40 60 80
FINES CONTENT (%)
20 40 60 80

Bacon | Farmer | Workman
Engineering & Testing, Inc.
500 South 17th Street, Paducah, KY 42003
Telephone: 270443-1995
Fax: 270443-1904

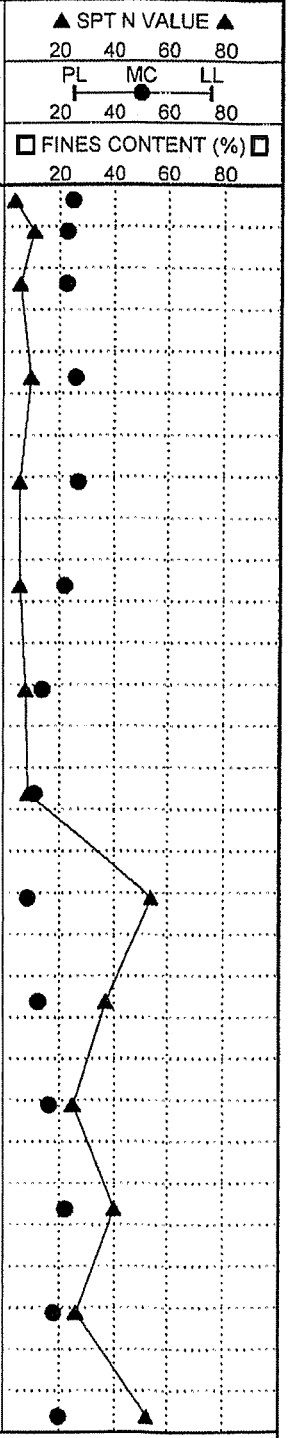
BORING NUMBER B-02

CLIENT Austin Engineering
PROJECT NUMBER 11352
DATE STARTED 12/9/11 COMPLETED 12/9/11
DRILLING CONTRACTOR BFW
DRILLING METHOD Hollow Stem Auger 6.25" OD
LOGGED BY Bret Watkins CHECKED BY Chris Farmer
NOTES

PROJECT NAME Ground Storage-Potable Water - Symsonia, KY
PROJECT LOCATION Symsonia, KY
GROUND ELEVATION HOLE SIZE 4.25 inches
GROUND WATER LEVELS:
AT TIME OF DRILLING 43.00 ft
AT END OF DRILLING ---
AFTER DRILLING --- Dry

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
0		Approximately 0.5' TOPSOIL					
		LEAN CLAY, SILTY, (CL) light grayish brown medium plasticity, firm, moist	SS 1	67	1-2-2 (4)		
			SS 2	100	2-5-6 (11)		
			SS 3	100	2-3-3 (6)		102
10			SS 4	100	2-4-6 (10)		
		LEAN CLAY WITH SAND, SILTY, (CL) reddish brown low plasticity, firm, moist, with fine-grained red-brown sand and mica intermixed	SS 5	100	2-3-3 (6)		
20			SS 6	67	2-2-4 (6)		
			SS 7	67	2-3-5 (8)		
30		SILTY SAND, CLAYEY, (SM) light grayish brown very fine-grained, loose, laminated	SS 8	67	3-5-4 (9)		
		WELL GRADED GRAVEL WITH SAND, SANDY GRAVEL, (GW) light grayish brown fine - coarse grained, very firm to very dense, dry	SS 9	67	1-24-30 (54)		
40		some iron oxide	SS 10	67	5-15-22 (37)		
			SS 11	33	3-9-16 (25)		
50		heaving sand - approximately 0.5 feet in auger stem	SS 12	33	8-18-22 (40)		
		heave - approximately 1 foot in auger stem	SS 13	100	3-11-15 (26)		
60		heave - approximately 0.5 feet in auger stem	SS 14	100	26-32-20 (52)		

Bottom of borehole at 60.0 feet.



Bacon | Farmer | Workman
Engineering & Testing, Inc.
500 South 17th Street, Paducah, KY 42003
Telephone: 270443-1995
Fax: 270443-1904

BORING NUMBER B-03

CLIENT Austin Engineering
PROJECT NUMBER 11352
DATE STARTED 12/1/11 COMPLETED 12/1/11
DRILLING CONTRACTOR BFW
DRILLING METHOD Hollow Stem Auger 6.25" OD
LOGGED BY Daniel Jameson CHECKED BY Chris Farmer
NOTES

PROJECT NAME Ground Storage-Potable Water - Symsonia, KY
PROJECT LOCATION Symsonia, KY
GROUND ELEVATION HOLE SIZE 4.25 inches
GROUND WATER LEVELS:
AT TIME OF DRILLING 39.00 ft
AT END OF DRILLING ---
AFTER DRILLING 21.00 ft

DEPTH (ft)	GRAPHIC LOG	MATERIAL DESCRIPTION	SAMPLE TYPE NUMBER	RECOVERY % (RQD)	BLOW COUNTS (N VALUE)	POCKET PEN. (tsf)	DRY UNIT WT. (pcf)
0		Approximately 0.5' TOPSOIL					
		LEAN CLAY, SILTY, (CL) light grayish brown medium plasticity, firm, moist	SS 1		1-2-1 (3)		
			SS 2		1-3-4 (7)		
			ST 3				105
10			SS 4		1-4-6 (10)		
			SS 5		2-2-4 (6)		
		LEAN CLAY WITH SAND, SILTY, (CL) reddish brown low plasticity, firm, moist, with fine-grained red-brown sand and mica intermixed	SS 6		1-2-3 (5)		
20		SILTY SAND, CLAYEY, (SM) light grayish brown very fine-grained, loose, laminated	SS 7		2-2-4 (6)		
			SS 8		2-4-5 (9)		
30		WELL GRADED GRAVEL WITH SAND, SANDY GRAVEL, (GW) light grayish brown fine - coarse grained, very firm to very dense, dry to wet	SS 9		4-11-11 (22)		
			SS 10		3-22-31 (53)		
40			SS 11		3-18-22 (40)		
			SS 12		10-13-13 (26)		
50		POORLY GRADED SAND WITH GRAVEL, (SP) dark grayish brown medium grained, firm, wet	SS 13		4-8-8 (16)		
60			SS 14		4-9-8 (17)		

Bottom of borehole at 60.0 feet.

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

Appendix D

Soil Laboratory Data

Bacon | Farmer | Workman
Engineering & Testing, Inc.
500 South 17th Street, Paducah, KY 42003
Telephone: 270443-1995
Fax: 270443-1904

SUMMARY OF LABORATORY RESULTS

CLIENT Austin Engineering **PROJECT NAME** Ground Storage-Potable Water - Symsonia, KY

PROJECT NUMBER 11352 **PROJECT LOCATION** Symsonia, KY

Borehole	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Maximum Size (mm)	%<#200 Sieve	Class-ification	Water Content (%)	Dry Density (pcf)	Satur-ation (%)	Void Ratio
B-01	0.0							24.8			
B-01	1.5							26.0			
B-01	8.5							21.5			
B-01	13.5							20.0			
B-01	18.5							27.2			
B-01	23.5							15.3			
B-01	28.5							20.4			
B-01	33.5							6.3			
B-01	38.5							13.9			
B-01	43.5							16.4			
B-01	48.5							15.2			
B-01	53.5							12.0			
B-01	58.5							17.5			
B-02	0.0							25.0			
B-02	1.5							22.9			
B-02	4.0							22.6	102.4		
B-02	8.5							25.9			
B-02	13.5							27.0			
B-02	18.5							22.0			
B-02	23.5							14.0			
B-02	28.5							11.2			
B-02	33.5							8.9			
B-02	38.5							12.7			
B-02	43.5							16.5			
B-02	48.5							22.3			
B-02	53.5							18.2			
B-02	58.5							19.9			
B-03	0.0							28.3			
B-03	1.5							30.5			
B-03	4.0	26	18	8				20.3	104.7		
B-03	8.5							19.3			
B-03	13.5							16.3			
B-03	18.5							18.9			
B-03	23.5							13.1			
B-03	28.5							11.3			
B-03	33.5							12.2			
B-03	38.5							13.1			
B-03	43.5							16.2			
B-03	48.5							20.3			
B-03	53.5							25.8			
B-03	58.5							23.7			

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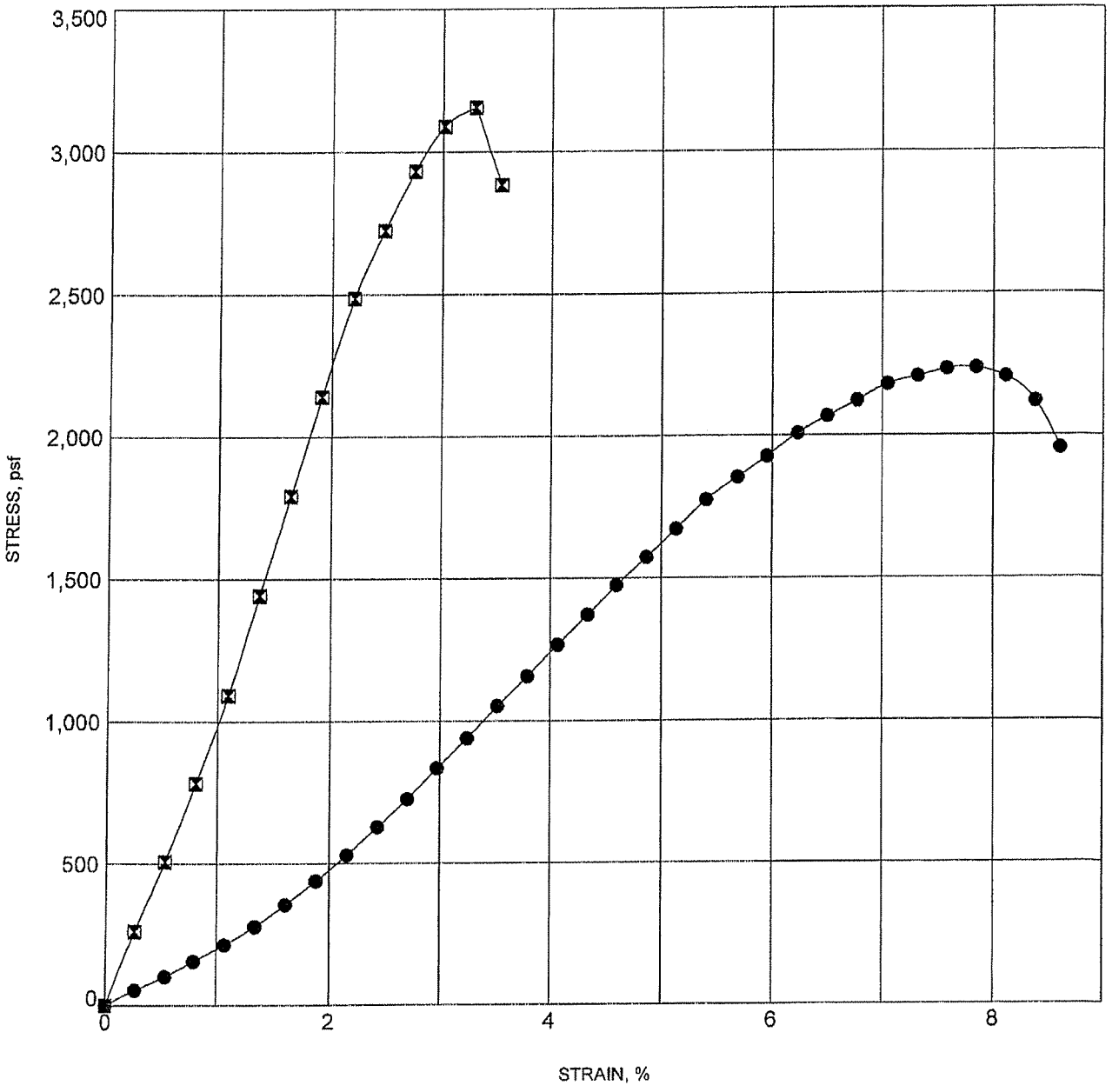
UNCONFINED COMPRESSION TEST

CLIENT Austin Engineering

PROJECT NAME Ground Storage-Potable Water - Symsonia, KY

PROJECT NUMBER 11352

PROJECT LOCATION Symsonia, KY



	BOREHOLE	DEPTH	Classification	γ_d	MC%
●	B-02	4.0		102	21
⊠	B-03	4.0		105	20

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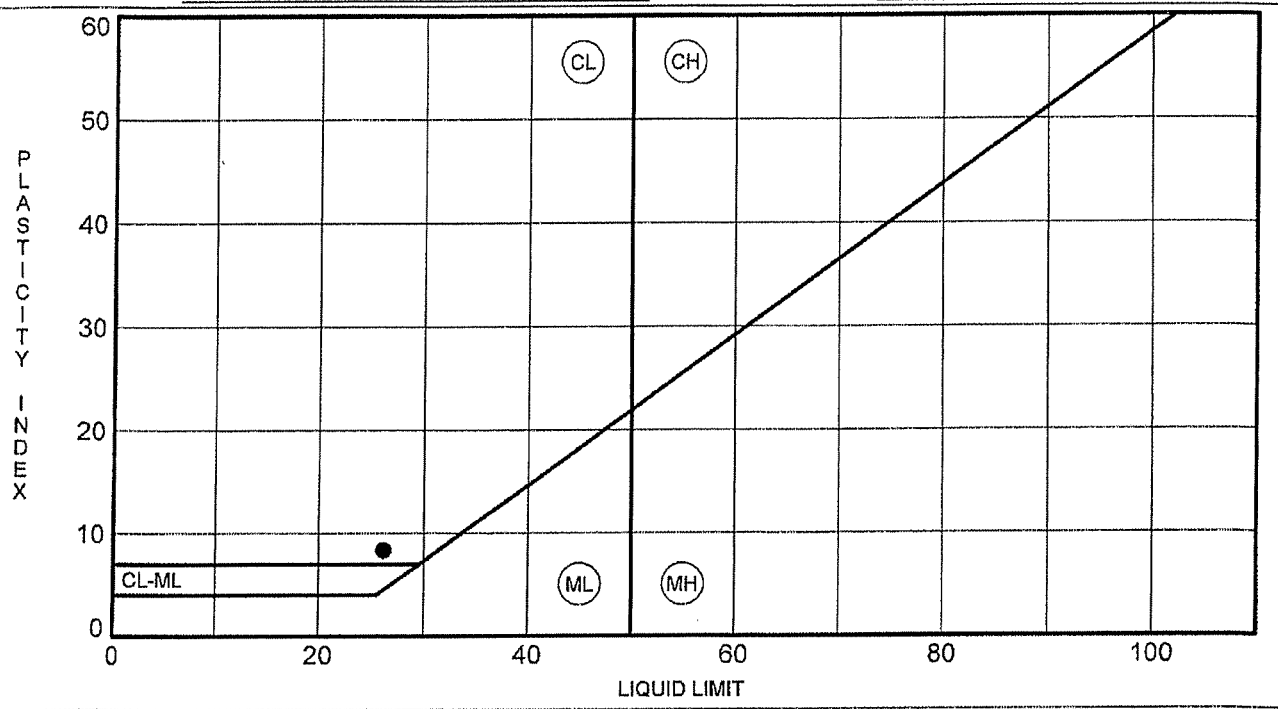
ATTERBERG LIMITS' RESULTS

CLIENT Austin Engineering

PROJECT NAME Ground Storage-Potable Water - Symsonia, KY

PROJECT NUMBER 11352

PROJECT LOCATION Symsonia, KY



	BOREHOLE	DEPTH	LL	PL	PI	Fines	Classification
●	B-03	4.0	26	18	8		