



LAKE HAVASU CITY

CONTRACT DOCUMENTS

AND

TECHNICAL SPECIFICATIONS

CITY FUELING FACILITIES IMPROVEMENTS REBID

Project # B24- PW-101010-500430 REBID

LAKE HAVASU CITY

**LAKE HAVASU CITY
CITY FUELING FACILITIES IMPROVEMENTS REBID
PROJECT #B24-PW-101010-500430 REBID**

**CONTRACT DOCUMENTS
VOLUME 1**

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EXPIRES 12-31-2025

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SECTION 00020
NOTICE INVITING BIDS
Lake Havasu City

PROJECT NO.: **B24-PW-101010-500430 RE-BID**

PROJECT NAME: **CITY FUELING FACILITIES IMPROVEMENTS RE-BID**

PRE-BID MEETING: **A Non-Mandatory Pre-Bid Meeting** will be held at the Public Works Maintenance Facility, 900 London Bridge Road, Lake Havasu City, AZ 86404 at 9:00 a.m. Arizona Time, on **Wednesday, December 20, 2023**. Both sites will be visited during the meeting.

BID DUE DATE: **January 3, 2024**

BID DUE TIME: **3:00 p.m., ARIZONA TIME**

PROJECT DESCRIPTION:

The work involves constructing one (1) fueling facility, consisting of two (2) above ground fuel storage tanks, dispenser islands, and other appurtenances, including civil and electrical improvements; and one (1) above ground storage fuel tank to supply a backup generator.

As an alternative additional bid item, construct an additional one (1) fueling facility, consisting of two (2) above ground fuel storage tanks, dispenser islands, and other appurtenances, including civil and electrical improvements.

QUESTIONS: All questions that arise relating to this solicitation shall be directed in writing to purchasing@lhcaz.gov and engineeringinfo@lhcaz.gov. To be considered, written inquiries shall be received at the above-referenced email address by **December 27, 2023 at 3:00 p.m.**, Arizona Time.

Inquiries received will then be answered in an Addendum.

Sealed bids for the project specified will be received by the **City Clerk's Office, 2330 N. McCulloch Boulevard, Lake Havasu City, Arizona, 86403** until the time and date stated. **Bids received by the correct time and date will be opened and read aloud immediately thereafter in Room 109 of Lake Havasu City Hall.** Public openings may be attended virtually by accessing the following video conferencing system:

To join the meeting on a computer or mobile phone:

<https://tinyurl.com/3f94b2ww>

Meeting ID: 270 366 031 956

Passcode: jcVbxK

Join with a video conferencing device

160264325@teams.bjn.vc

Video Conference ID: 112 219 692 0

Bids must be clearly addressed to the City Clerk's Office, 2330 McCulloch Blvd. N, Lake Havasu City, Arizona, 86403, and received no later than the exact time and date indicated above. Late bids will not be considered under any circumstances.

Bids must be submitted in a sealed envelope with the Project Number and the bidder's name and address clearly indicated on the envelope. All bids must be completed in ink or typewritten on a form to be obtained from the specifications and a complete Invitation for Bid returned along with the offer no later than the time and date cited above.

Bidders interested in taking advantage of the streamlined e-Bid and e-Bond process shall submit their bids electronically via the City's DemandStar Network at <https://www.demandstar.com/app/buyers/bids/432149/details>. Paper bids and paper bid bonds will continue to be accepted. Bidders submitting e-Bids will be required to scan and enclose their paper bid bond/cashier's check with their electronic bid submission. The apparent low bidder shall submit their original bid bond/cashier's check within three (3) business days following the Bid opening.

Bid documents and specifications are available on Lake Havasu City's website at www.lhcaz.gov or on DemandStar at www.demandstar.com. For documents obtained outside of DemandStar please contact purchasing@lhcaz.gov to be added to the planholders' list.

BONDS:

Bid Bond:	<u>10%</u>
Labor and Material Bond:	<u>100%</u>
Faithful Performance Bond:	<u>100%</u>

Project Completion Date: 120 Calendar Days for base bid plus force account after Notice to Proceed. If add alternate awarded **an additional 90 Calendar Days** will be added.

Lake Havasu City reserves the right to accept or reject any or all bids or any part thereof and waive informalities deemed in the best interest of the City.

Pursuant to the Americans with Disabilities Act (ADA), Lake Havasu City endeavors to ensure the accessibility of all of its programs, facilities and services to all persons with disabilities. If you need an accommodation for this meeting, please contact the City Clerk's office at (928) 453-4142 at least 24 hours prior to the meeting so that an accommodation may be arranged.

Publication Dates: Today's News Herald December 6, 2023 & December 13, 2023
Arizona Business Gazette December 7, 2023 & December 14, 2023

**** END OF SECTION ****

SECTION 00040
INTENT TO BID NOTIFICATION

ITB NO.: B24-101010-500430 REBID

ITB TITLE: CITY FUELING FACILITIES IMPROVEMENTS REBID

CLOSING DATE & TIME: JANUARY 3, 2024, 3:00 P.M., ARIZONA TIME

LETTER OF INTENT TO BID SUBMITTAL

This is notification that it is our present intent to submit a bid in response to the above referenced ITB. Please add our company to your planholders list.

The individual to whom all information regarding this ITB should be transmitted is:

Company Name: _____

Contact Name: _____

Street Address: _____

City, State, & Zip: _____

Phone Number: Fax Number: _____

E-Mail Address: _____

Submit this Letter of Intent by the deadline for requests for clarification and protests, which must be physically received by **December 20, 2023 at 3:00 p.m., Arizona Time.**

Clarification/Protest/Question/Letter of Intent to Bid ITB
No.: 101010
Lake Havasu City
Administrative Services Department, Procurement Email
to: purchasing@lhcaz.gov

** END OF SECTION **

SECTION 00100
INFORMATION FOR BIDDERS

1. RECEIPT AND OPENING OF BIDS

The City of Lake Havasu City, Arizona, (hereinafter called the "Owner") invites Bids on the form attached hereto. All blanks must be appropriately filled in. The Bidder shall also complete and submit a form listing proposed subcontractors as enclosed herein. Any subcontractors proposed to be used on the project but not listed on this form shall not be considered when evaluating the Contractor's qualifications and ability to perform the work. Bids for the **City Fueling Facilities Improvements Rebid, Project No. B24-PW-101010-500430 Rebid** will be received by the **City Clerk's office, 2330 N. McCulloch Boulevard, Lake Havasu City, Arizona 86403 no later than January 3, 2024, at 3:00 PM, Arizona Time**, where said Bids will be publicly opened and read aloud immediately thereafter in the Room 109 of Lake Havasu City Hall.

The Owner may consider informal any Bid not prepared and submitted in accordance with the provisions hereof and may waive any informalities or reject any and all Bids. Any Bid may be withdrawn prior to the above scheduled time for the opening of Bids or authorized postponement thereof. Any Bid received after the time and date specified shall not be considered. No Bidder may withdraw a Bid within ninety (90) days after the actual date of the opening thereof.

2. PREPARATION OF BID

Each Bid must be submitted on the prescribed Form. Each Document must be submitted with an original signature of the Bidder, as well as all witnesses indicated therein. All blank spaces for Bid prices must be filled in, in ink or typewritten, in both words and figures.

Each Bid must be submitted in a sealed envelope bearing on the outside the name of the Bidder, the Bidder's address, and the name and number of the project for which the Bid is submitted. If forwarded by mail, the sealed envelope containing the Bid must be enclosed in another envelope addressed as specified in the Bid form.

3. PRE-BID MEETING

The pre-bid conference will be held for this project at the time and place stipulated in Section 00020 - Notice Inviting Bids, as modified by Addenda.

4. FACSIMILE BIDS OR MODIFICATIONS

No facsimile ("FAX") Bids or bid modifications will be accepted. Any modifications to the Bid shall be made by an authorized representative of the bidding company in person.

5. QUALIFICATIONS OF BIDDER

The Owner may make such investigations as he deems necessary to determine the

qualifications of and the ability of the Bidder to perform the Work, and the Bidder shall furnish the Owner such information and data for this purpose as the Owner may request. The Owner may request that the Bidder provide a list of key people for the project with their related work experience.

The Owner reserves the right to reject any Bid if the evidence submitted by or investigation of such Bidder fails to satisfy the Owner that such Bidder is properly qualified to carry out the obligations of the Contract and to complete the work contemplated therein in a timely manner. Conditional Bids will not be accepted.

All Bidders and listed subcontractors must be valid Arizona Licensed Contractors at the time of Bidding, approved by the Arizona State Registrar of Contractors to do the type and amount of work specified in these documents. In accordance with the Arizona State Registrar of Contractors, the Bidder must possess a minimum of a Arizona Contractor's License to perform the type and amount of work specified in these documents. **Failure of any bidder to possess all contractors' licenses as listed in the bid packet, at the time of bidding, shall result in the bid being considered non-responsive and not in substantial compliance, and any such bid shall not be considered.** Refer to Section 00420, page 3, item 13.

6. ARITHMETIC DISCREPANCIES IN THE BID

- A. For the purpose of the evaluation of Bids, the following will be utilized in resolving arithmetic discrepancies found on the face of the Bid Schedule as submitted by Bidders:
1. Obviously misplaced decimal points will be corrected;
 2. In case of discrepancy between unit price and extended price, the unit price will govern;
 3. Apparent errors in extension of unit prices will be corrected;
 4. Apparent errors in addition of lump sums and extended prices will be corrected; and
 5. In case of discrepancy between words and figures in unit prices, the amount shown in words shall govern.
- B. For the purpose of Bid evaluation, the Owner will evaluate the bids on the basis of the unit prices, extensions, and totals arrived at by resolution of arithmetic discrepancies as provided above.

7. INCOMPLETE BIDS

Failure to submit a Bid on all items in the Schedule will result in an incomplete Bid and the Bid may be rejected. **UNIT OR LUMP SUM PRICES MUST BE SHOWN FOR EACH**

BID ITEM WITHIN THE SCHEDULE.

NOTE: FAILURE TO INDICATE UNIT OR LUMP SUM PRICES IN THE APPROPRIATE COLUMN, WITH THE EXTENSION OF THE PRICES IN THE FAR RIGHT COLUMN, WILL CAUSE THE BID TO BE "NON-RESPONSIVE".

All forms indicated in the Bid Proposal, Section 00300, must be completely filled out, executed, and submitted with the Bid. Failure to do so will render the bid "non-responsive" and the bid will not be accepted.

8. BID SECURITY

Each Bid must be accompanied by certified check, cashier's check, or a Bid Bond prepared on the form attached hereto or on a similar form acceptable to the Owner, duly executed by the Bidder as principal and having as surety thereon a surety company approved by the Owner, in the amount of ten percent (10%) of the Bid. Bid Bonds shall be valid for at least ninety (90) days after the date of the receipt of Bids. Such cash, check or Bid Bond will be returned to all except the three (3) lowest Bidders within fifteen (15) business days after the opening of Bids. The remaining checks, or Bid Bonds will be returned promptly after the Owner and the accepted Bidder have executed the Contract, or if no award has been made within ninety (90) days after the date of the opening of Bids, upon demand of the Bidder at any time thereafter, so long as he has not been notified of the acceptance of his Bid.

9. LIQUIDATED DAMAGES FOR FAILURE TO ENTER INTO CONTRACT

The successful Bidder, upon his failure or refusal to execute and deliver the Contract, Bonds, and certificates required within ten (10) calendar days from the date of the Notice of Award, shall forfeit to the Owner, as liquidated damages for such failure or refusal, the difference between his bid and the amount of the contract actually entered into with another party should he not enter into a contract at the bid price and provide the required payment and performance bonds and certificates of insurance. Liquidated damages for failure to enter into the contract shall not exceed the amount of the Bid Bond.

10. SECURITY FOR FAITHFUL PERFORMANCE AND PAYMENT

Simultaneously with his delivery of the executed Contract, the Bidder shall furnish **on the forms provided herein**, in 100% of the amount of this Contract, 1) a surety bond as security for faithful performance of this Contract, and 2) a surety bond as security for the payment of all persons performing labor on the project under this Contract and persons furnishing materials in connection with this Contract, and 3) a listing of all subcontractors who will be performing or providing more than one-half percent (0.50%) of the contract work, as specified in the General Conditions included herein. The surety on such bond or bonds shall be a duly authorized surety company satisfactory to the Owner, listed on the Treasury Department's most current list (Circular 570 as amended), and authorized to transact business in the State of Arizona.

11. POWER OF ATTORNEY

Attorneys-in-fact who sign Bid Bonds or Contract bonds must file with each bond a certified and effectively dated copy of their power-of-attorney.

12. LAWS AND REGULATIONS

The Bidder's attention is directed to the fact that all applicable Federal Laws, State Laws, municipal ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the project shall apply to the Contract throughout, and they will be deemed to be included in the Contract the same as though herein written out in full.

13. METHOD OF AWARD

- A. The City will award the Contract on the basis of the Bid or Bids most advantageous to the City. In determining whether a Bid is most advantageous, in addition to price, the City may consider the following:
1. The ability, capacity, and skill of the Bidder to perform the Contract or provide the service indicated;
 2. Whether the Bidder can perform the Contract or provide the service promptly, and within the time specified without delay or interference;
 3. The character, integrity, reputation, judgment, experience, and efficiency of the Bidder;
 4. The quality of performance on previous contracts;
 5. The previous compliance with laws and ordinances by the Bidder;
 6. The financial responsibility of the Bidder to perform under the Contract or provide the service;
 7. The limitations of any license the Bidder may be required to possess;
 8. The quality, availability, and adaptability of the product or service;
 9. The ability of the Bidder to provide future maintenance and/or service;
 10. The number and scope of any conditions attached to the Bid; and;
 11. The life cycle, maintenance, and performance of the equipment or product being offered.

14. OBLIGATION OF THE BIDDER

At the time of the opening of Bids, each Bidder will be presumed to have inspected the site and to have read and to be thoroughly familiar with the Plans and Contract documents (including all Addenda, if applicable). The failure or omission of the Bidder to examine any form, instrument or document, or site changes due to natural causes, shall in no way relieve any Bidder from any obligation in respect to his Bid. Site changes due to natural causes prior to Bid opening shall not be cause for Bid alteration or withdrawal.

15. TIME OF COMPLETION AND LIQUIDATED DAMAGES

The Bidder must agree to commence work on or before a date to be specified in a written "Notice to Proceed" from the Owner, and to complete the work for the base bid within **120 Calendar Days** and if additive alternate awarded an additional **90 Calendar Days** will be added of the date of the Notice to Proceed.

The Bidder further agrees to pay as liquidated damages, the sum indicated in the following Schedule of Liquidated Damages for each consecutive calendar day thereafter, plus any additional costs incurred by the Engineer as provided in Section 17 of the General Conditions, that the Contract remains incomplete. For the purposes of determining the Liquidated Damages for the project, the Original Contract Amount shall be that which is included in the Contract between the Owner and the Contractor for the project.

SCHEDULE OF LIQUIDATED DAMAGES		
Original Contract Amount		Daily Charges
From More Than	To and Including	Calendar Day or Fixed Rate
0	25,000	210
25,000	50,000	250
50,000	100,000	280
100,000	500,000	430
500,000	1,000,000	570
1,000,000	2,000,000	710
2,000,000	5,000,000	1,070
5,000,000	10,000,000	1,420
10,000,000	---0---	1,780

16. CONDITIONS OF WORK

Each Bidder must inform himself fully of the conditions relating to the construction of the project and the employment of labor thereon. Failure to do so will not relieve a successful Bidder of his obligation to furnish all material and labor necessary to carry out the provisions of his Contract. Insofar as possible, the Contractor, in carrying out his work, must employ such methods or means as will not cause any interruption of or interference with the work of any other Contractor.

17. ADDENDA AND INTERPRETATIONS

All questions that arise relating to this solicitation shall be directed in writing to:

Purchasing@lhcaz.gov

Administrative Services Department, Procurement Division

Lake Havasu City

2330 McCulloch Blvd. North

Lake Havasu City, AZ 86403

To be considered, written inquiries shall be received by the above-referenced contact by **December 27, 2023 @ 3:00 PM, Arizona Time**. Inquiries received will then be answered in an Addendum. Any and all such interpretations and any supplemental instructions will be in the form of written Addenda to the Specifications which, if issued, will be available to all prospective Bidders, not later than seven (7) calendar days prior to the date fixed for the opening of Bids. Failure of any Bidder to incorporate any such Addendum or interpretation shall not relieve such Bidder from any obligation under his/her Bid as submitted. All Addenda so issued shall become part of the Contract documents.

No informal contact initiated by offerors on this solicitation will be allowed with members of City staff from the date of distribution of this solicitation until after the closing date and time for the submissions of quotations. All questions or issues related to this solicitation shall be submitted in writing.

18. CONFLICT OF INTEREST

Pursuant to A.R.S. Section 38-511, this Contract is subject to cancellation by Buyer if any person significantly involved initiating, negotiating, securing, drafting or creating the Contract on behalf of Lake Havasu City is, at any time while the Contract is in effect, an employee of any other party to the Contract in any capacity or a consultant to any other party of the Contract with respect to the subject matter of the Contract.

19. NO COLLUSION

The bidder will be required to complete, notarize and submit as part of this bid package the "No Collusion Affidavit" form, as attached herein. Failure of the bidder to submit a properly executed affidavit may be grounds for rejection of the bid.

20. EMPLOYMENT ELIGIBILITY VERIFICATION

The bidder will be required to complete, notarize and submit as part of this bid package the "Employer Verification of Employment Eligibility" form, as attached herein. Failure of the bidder to submit a properly executed verification of eligibility form may be grounds for rejection of the bid.

21. EXAMINATION OF THE PLANS AND SPECIFICATIONS

Each Bid shall be made in accordance with the Plans and Specifications which may be examined at the following locations:

- A. Lake Havasu City, 2330 N. McCulloch Boulevard, Lake Havasu City, AZ 86403, 928.855.2116
- B. Dodge Data & Analytics, 3315 Central Avenue, Hot Springs, AR, 71913, 871.375.2946, FAX 501.625.3544, www.construction.com, dodge.bidding@construction.com
- C. Colorado River Building Industry Association, 2182 McCulloch Blvd, Suite 3, Lake Havasu City AZ 86403, 928.453.7755, FAX 928.453.3175, www.crbia.org, frontdesk@criba.org
- D. Northern AZ Home Builders, 1500 E. Cedar Avenue, Suite 86, Flagstaff AZ 86004, 928.779.3071, FAX 928.779.4211, www.nazba.org, info@nazba.org
- E. Performance Graphics Blueprinting, 4140 Lynn Drive, Suite 107, Fort Mohave, AZ, 86426, 928.763.6860, FAX 928.763.6835, prints@pgblueprinting.net
- F. Construction Market Data, 30 Technology Parkway South, Suite 500, Norcross, GA 30092-2912, 800.876.4045, FAX 800.303.8629, www.cmdgroup.com, projects@cmdgroup.com
- G. ISqFt, 3301 N 24th Street, Phoenix, AZ, 85016, 800.364.2059, FAX 800.792.7508, www.isqft.com, arizonaplanroom@isqft.com
- H. Integrated Digital Technologies, LLC, 4633 E Broadway Blvd., Tucson, AZ 85711, PO Box 13086, Tucson AZ, 85732, 520.319.0988, FAX, 520.319.1430, www.contractorsplanroom.com, content@idtplans.com
- I. Yuma/Southwest Contractors Association, 350 W. 16th Street, Suite 207, Yuma, AZ 85364, Phone: 928-539-9035, Fax: 928-539-9036, www.yswca.com, plans@yswca.com

- J. Arizona Builders Exchange, 1700 N. McClintock Drive, Tempe, AZ, 85281, (480) 227-2620, www.azbex.com, rkettenhofen@azbex.com
- K. Construction Reports.com, 4110 N Scottsdale Road, Suite 335, Scottsdale, AZ, 85251, 480.994.0020, FAX 480.994.0030, www.constructionreports.com, jess@constructionreports.com
- L. Construction Reporter, 1609 2nd Street NW, Albuquerque, NM, 87102, 505.243.9793, FAX 505.242.4758, www.constructionreporter.com, jane@constructionreporter.com
- M. PlanRoom Central at A&E Reprographics, 1030 Sandretto Drive, Suite F, Prescott, AZ, 86305, 928.442.9116, www.a-erepro.com, planroom1@a-erepro.com
- N. Shirley's Plan Service, 425 S. Plumer Ave, Tucson, AZ, 85719, 520.791.7436, FAX 520.882.9208, www.shirleysplanservice.com, shirley@shirleysplanservice.com
- O. Construction Notebook Nevada, 3131 Meade Ave, Suite B, Las Vegas, NV, 89102-7885, 702.876.8660, FAX 702.876.5683, www.constructionnotebook.com
- P. The Blue Book Building & Construction Network, Jefferson Valley, NY 10535, 800.431.2584, www.thebluebook.com, info@thebluebook.com, tdizon@mail.thebluebook.com
- Q. Integrated Marketing Systems (IMS), 945 Hornblend Street, Suite G, San Diego, CA 92109, 888.467.3151, FAX 858.490.8811, www.imsinfo.com , ims@imsinfo.com

** END OF SECTION **

SECTION 00300
BID PROPOSAL

Lake Havasu City, Arizona

The undersigned, as bidder, declares that we have received and examined the documents entitled "**City Fueling Facilities Improvements Rebid, Project No. B24-PW-101010-500430 Rebid**" and will contract with the Owner, on the form of Contract provided herewith, to do everything required for the fulfillment of the contract for the construction of the **City Fueling Facilities Improvements Rebid, Project No. B24-PW-101010-500430 REbid** at the prices and on the terms and conditions herein contained.

We agree that the Contract Documents include Divisions 1, 2, and 3 of the Contract Documents as well as the drawings and any other referenced documents.

We agree that the following shall form a part of this proposal and are included herein as our submittal:

<u>Section</u>	<u>Title</u>	<u>Enclosed</u>
00300	Bid Proposal	✓ _____
00310	Bid Schedule	_____
00400	Arizona Statutory Bid Bond	_____
00420	Bidder's Statement of Qualifications	_____
00430	Affidavit of Contractor Certifying That There Was No Collusion In Bidding For Contract	_____
00450	Hazard Communication Program	_____
00460	Employment Eligibility Verification	_____

We acknowledge that addenda numbers _____ through _____ have been received and have been examined as part of the Contract Documents.

We certify that our proposal is genuine, and not sham or collusive, nor made in the interest or behalf of any undisclosed person, organization, or corporation, and that we have not directly or indirectly induced or solicited any other bidder to put in a sham bid, or directly or indirectly induced or solicited any other potential bidder to refrain from bidding, and that we have not in any manner sought by collusion to secure an advantage over any other bidder.

The bidder agrees that this Bid shall be good and may not be withdrawn for a period of ninety (90) calendar days after the scheduled closing time for receiving Bids.

Upon receipt of written notice of the acceptance of this bid, Bidder shall execute the formal Contract attached within 10 days and deliver a Performance Bond, Payment Bond, and Certificates of Insurance as required by Paragraph 25 of the General Conditions and the Special Provisions.

We hereby declare that we have visited the site and have carefully examined the Contract Documents relating to the work covered by the above bid or bids.

Enclosed herewith is a certified or cashier's check or bid bond, payable to Lake Havasu City, Arizona, in the amount of ten percent (10%) of the total bid. This check or bond is submitted as a guarantee that we will enter into a Contract and furnish the required bonds in the event a contract is awarded us. The bid security attached, without endorsement, is to become the property of Lake Havasu City, Arizona, in the event the Contract and Bonds are not executed within the time set forth, as liquidated damages for delay and additional work caused thereby.

We understand that Lake Havasu City, Arizona reserves the right to reject any and/or all bids, or to waive any informalities in any bid, deemed by them to be for the best interests of Lake Havasu City, Arizona.

Dated in _____ this _____ day of _____, _____.

Respectfully Submitted By:

By: _____

Title: _____

Name of Firm: _____

Address: _____

Phone: _____ FAX: _____

Seal - If bid by a Corporation:

Arizona Contractor's License No.: _____ Type: _____

** END OF SECTION **

BID SCHEDULE
LAKE HAVASU CITY
CITY FUELING FACILITIES IMPROVEMENTS REBID
B24-PW-101010-500430 REBID

Lake Havasu City Council
Lake Havasu City
2330 N. McCulloch Boulevard
Lake Havasu City, AZ 86403

The City Council:

Pursuant to request for bids to be opened the **3rd day of January, 2024, at 3:00 P.M.**, Arizona Time, at Room 109 of Lake Havasu City Hall, for the above project, the Contractor proposes to complete work, including furnishing all labor and materials, per the Specifications and Plans at the Following prices.

This Schedule of Items and Prices shall be completed in ink or typed by the Bidding Contractor. In case of discrepancy between the words and figures amount description, the word description shall control extensions.

Prices must be entered for each item and the appropriate subtotal and total shall be filled out. Bid prices shall include sales tax and all other applicable taxes and fees.

Bidder agrees to perform all the necessary work to complete the **City Fueling Facilities Improvements Rebid, Project No. B24-PW-101010-500430 Rebid.**

SECTION 00310

BID SCHEDULE

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT OF MEASURE	UNIT PRICE ¹ (Words & Figures Amount)	ITEM TOTAL COSTS ²
BASE BID – PUBLIC SAFETY FUELING FACILITY AND POLICE DEPARTMENT FUEL TANK					
1	Mobilization, Bonds, Insurance	1	LS	\$	\$
2	Public Safety Fueling Facility – Site Work	1	LS	\$	\$
3	Public Safety Fueling Facility – Concrete Pads	215	CY	\$	\$
4	Public Safety Fueling Facility – Inlet Drive Street Access Entrances	2	EA	\$	\$
5	Public Safety Fueling Facility – Spezzano Way Street Access Entrance	1	LS	\$	\$
6	Public Safety Fueling Facility – Asphalt	3,038	SY	\$	\$
7	Public Safety Fueling Facility – Perimeter Screen Wall	840	LF	\$	\$
8	Public Safety Fueling Facility – Spezzano Way Southern Screen Wall	360	LF	\$	\$
9	Public Safety Fueling Facility – Gasoline and Diesel Tanks	1	LS	\$	\$
10	Public Safety Fueling Facility – Dispensers, Pumps, and Piping	1	LS	\$	\$
11	Public Safety Fueling Facility – Electrical	1	LS	\$	\$

SECTION 00310

BID SCHEDULE

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT OF MEASURE	UNIT PRICE ¹ (Words & Figures Amount)	ITEM TOTAL COSTS ²
12	Police Department Fuel Tank – All Work	1	LS	\$	\$
13	Force Account	1	LS	<u>\$80,000 Eighty Thousand</u>	<u>\$ 80,000</u>
BASE BID TOTAL + FORCE ACCOUNT³				\$	

Above line items and totals shall include all work shown on the plans and specified herein, including taxes, insurance and bonding.

¹ The "Unit Price" column shall indicate unit or lump sum prices for each bid item and shall be indicated in written and numerical form.

² The "Item Total Costs" column shall indicate the extension of the unit prices, which is obtained by multiplying the "Estimated Quantity" column by the "Unit Price" column.

³ The "Bid Total" amount shall be the sum of all costs listed in the "Item Total Costs". Additive Alternates are not to be included.

SECTION 00310

BID SCHEDULE

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT OF MEASURE	UNIT PRICE ¹ (Words & Figures Amount)	ITEM TOTAL COSTS ²
ADDITIONAL ALTERNATE BID – PUBLIC WORKS FUELING FACILITY					
ADD ALT 1.1	Mobilization, Bonds, Insurance	1	LS	\$	\$
ADD ALT 1.2	Public Works Fueling Facility – Demolition	1	LS	\$	\$
ADD ALT 1.3	Public Works Fueling Facility – Site Work	1	LS	\$	\$
ADD ALT 1.4	Public Works Fueling Facility – Concrete Pads	248	CY	\$	\$
ADD ALT 1.5	Public Works Fueling Facility – Asphalt	2,866	SY	\$	\$
ADD ALT 1.6	Public Works Fueling Facility – Gasoline and Diesel Tanks	1	LS	\$	\$
ADD ALT 1.7	Public Works Fueling Facility – Dispensers, Pumps, and Piping	1	LS	\$	\$
ADD ALT 1.8	Public Works Fueling Facility – Electrical	1	LS	\$	\$
ADD ALT 1.9	Force Account	1	LS	<u>\$40,000 Forty Thousand</u>	<u>\$ 40,000</u>
ADDITIONAL ALTERNATE BID TOTAL + FORCE ACCOUNT³				\$	

Above line items and totals shall include all work shown on the plans and specified herein, including taxes, insurance and bonding.

¹ The “Unit Price” column shall indicate unit or lump sum prices for each bid item and shall be indicated in written and numerical form.

SECTION 00310

² The "Item Total Costs" column shall indicate the extension of the unit prices, which is obtained by multiplying the "Estimated Quantity" column by the "Unit Price" column.

³ The "Bid Total" amount shall be the sum of all costs listed in the "Item Total Costs". The "Additional Alternate" bids will be selected by the City.

SECTION 00310

The unit prices for **City Fueling Facilities Improvements Rebid, Project No. B24-PW-101010-500430 Rebid**, shall include all labor, materials, water disposal, bailing, shoring, removal, disposal, overhead, profit, insurance, and all other related costs and work to cover the finished work of the several kinds called for. Changes in the Contract shall be processed in accordance with Paragraph 16 of the General Conditions.

Bidder understands that the Owner reserves the right to reject any or all Bids, or portions thereof, and to waive any informalities in the bidding.

The Bidder agrees that this Bid shall be good and may not be withdrawn for a period of ninety (90) calendar days after the scheduled closing time for receiving Bids.

Upon receipt of written notice of the acceptance of this Bid, Bidder shall execute the formal Contract attached within 10 days and deliver a Performance Bond, Payment Bond, and Certificates of Insurance as required by Paragraph 25 of the General Conditions and the Special Provisions.

The Bid security attached in the sum of \$_____ is to become the property of the Owner in the event the Contract and Bond(s) are not executed and provided within the time above set forth, as liquidated damages for the delay and additional expense to the Owner caused thereby.

Bidder hereby acknowledges receipt of the following Addenda: ____, ____, ____.

RESPECTFULLY SUBMITTED BY:

BY: _____

TITLE: _____

FIRM: _____

ADDRESS: _____

PHONE: _____ FAX _____

Seal - if Bid by a corporation

AZ Contractor's License No: _____ Type _____

** END OF SECTION **

SECTION 00400
ARIZONA STATUTORY BID BOND

PURSUANT TO TITLES 28, 34 AND 41, ARIZONA REVISED STATUTES
(Penalty of this bond must not be less than 10% of the bid amount)

KNOW ALL MEN BY THESE PRESENTS:

That, _____(hereinafter "Principal"), as Principal, and _____, (hereinafter "Surety"), a corporation organized and existing under the laws of the State of _____, with its principal offices in the City of _____, holding a certificate of authority to transact surety business in Arizona issued by the Director of the Department of Insurance pursuant to Title 20, Chapter 2, Article 1, as Surety, are held and firmly bound unto Lake Havasu City, Arizona, (hereinafter "Obligee"), as Obligee, in the amount of Ten Percent (10%) of the amount of the bid of Principal, submitted by Principal to the Obligee for the work described below, for the payment of which sum, the Principal and Surety bind themselves, and their heirs, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for

City Fueling Facilities Improvements Rebid, Project No. B24-PW-101010-500430 Rebid

NOW, THEREFORE, if the Obligee shall accept the proposal of the Principal and the Principal shall enter into a contract with the Obligee in accordance with the terms of the proposal and give the bonds and certificates of insurance as specified in the standard specifications with good and sufficient surety for the faithful performance of the contract and for the prompt payment of labor and materials furnished in the prosecution of the contract, or in the event of the failure of the Principal to enter into the contract and give the bonds and certificates of insurance, if the Principal pays to the Obligee the difference not to exceed the penalty of the bond between the amount specified in the proposal and such larger amount for which the Obligee may in good faith contract with another party to perform the work covered by the proposal then this obligation is void. Otherwise it remains in full force and effect provided, however, that this bond is executed pursuant to the provisions of Section 34-201, Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions of that section to the extent as if it were copied at length herein.

Witness our hands this ____ day of _____, _____.

PRINCIPAL

SEAL

SURETY

SEAL

By: _____ By: _____
Attorney-in-Fact

Its: _____
Agency of Record

Agency Address

**** END OF SECTION ****

SECTION 00420
BIDDER'S STATEMENT OF QUALIFICATIONS

The Undersigned certifies the truth and correctness of all statements and of all answers to questions made hereinafter.

SUBMITTED TO: Lake Havasu City, Arizona
2330 N. McCulloch Boulevard
Lake Havasu City, AZ 86403

SUBMITTED BY: _____ NAME: _____
[] Corporation
[] Partnership
ADDRESS: _____ [] Individual
[] Joint Venture
PRINCIPAL OFFICE: _____ [] Other

(NOTE: Attach separate sheets as required)

1. How many years has your organization been in business as a Contractor?
2. How many years has your organization been in business under its present business name?
3. If a Corporation, answer the following:
Date of Incorporation: _____
State of Incorporation: _____
President: _____
Vice President(s): _____
Secretary: _____
Treasurer: _____
4. If a Partnership, answer the following:
Date of organization: _____
Type of Partnership: _____
(General/Limited/Assoc.)
Name and Address of all partners.

5. If other than a Corporation or Partnership, describe Organization and name Principals:

6. What percent of the work do you normally perform with your own forces?
List trades:

7. Have you ever failed to complete any work awarded to you? If so, indicate when, where and why:

8. Has any Officer or Partner of your Organization ever been an Officer or Partner of another Organization that failed to complete a construction contract? _____ If so, state circumstances:

9. List major construction projects your Organization has under contract on this date:

Project Name	Name, Email Address & Telephone Number of Owner	Project Location	Contract Amount	Contract Date	Percent Complete	Scheduled Completion

10. List similar construction projects your Organization has completed in the past five years:

Project Name	Name, Email Address & Telephone Number of Owner	Project Location	Contract Amount	Date Awarded	Date Completed	Percent with Own Forces

11. List the construction experience of the principal individuals in your Organization:

Individual's Name	Construction Experience - Years	Within Your Organization		
		Present Position & Years Experience	Dollar Volume Responsibility	Previous Position & Years Experience

12. List states and categories in which your Organization is legally qualified to do business:

13. List all Arizona Contractor licenses currently held by your Organization; the status of each license; and provide a photocopy of each license with your bid proposal.

	License Class / #	Status
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____

Please attach a list of additional Arizona Contractor licenses, if any.

14. Bank References:

15. Trade References:

16. Name of Bonding and Insurance Companies and Name and Address of Agents: Maximum

Bonding Capacity _____

17. The Undersigned agrees to furnish, upon request by the Owner, within seven days after the Bid Opening, a current Statement of Financial Conditions, including Contractor's latest regular dated financial statement or balance sheet which must contain the following items:

Current Assets: (Cash, joint venture accounts, accounts receivable, notes receivable, accrued interest on notes, deposits, and materials and prepaid expenses), net fixed assets and other assets.

Current Liabilities: (Accounts payable, notes payable, accrued interest on notes, provision for income taxes, advances received from owners, accrued salaries, accrued payroll taxes), other liabilities, and capital (capital stock, authorized and outstanding shares par values, earned surplus).

Date of statement or balance sheet: _____

Name of firm preparing statement: _____

By: _____
(Agent and Capacity)

18. List of Subcontractors. In accordance with paragraph 1.0 of Instructions to Bidders, the following is a breakdown of all subcontractors anticipated to be used for completing this project and their approximate percentage of work to be performed.

The Bidder certifies that all Subcontractors listed are eligible to perform Work on public works projects pursuant to ARS 34-241.

<u>Subcontractor</u>	<u>Description of Work</u>	<u>% of Total Project</u>
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
	Total % of all Subcontractor's work on	_____

_____ project _____

Total % for Prime Contractor _____

19. Dated at _____ this _ day of _____, _____

Name of Organization: _____

By: _____

Title: _____

**** END OF SECTION ****

SECTION 00430
**AFFIDAVIT OF CONTRACTOR
CERTIFYING THAT THERE WAS
NO COLLUSION IN BIDDING
FOR CONTRACT**

STATE OF)
) ss
CITY OF)

(NAME OF INDIVIDUAL)

BEING DULY SWORN, DEPOSES AND SAYS:

THAT HE IS _____

(TITLE)

OF _____

(NAME OF BUSINESS)

THAT PURSUANT TO SECTION 34-253 OF THE ARIZONA REVISED STATUTES, HE CERTIFIES AS FOLLOWS:

THAT NEITHER HE NOR ANYONE ASSOCIATED WITH SAID

(NAME OF BUSINESS)

HAS DIRECTLY, OR INDIRECTLY, ENTERED INTO ANY CONTRACT, PARTICIPATED IN ANY COLLUSION OR OTHERWISE TAKEN ANY ACTION IN RESTRAINT OF FREE COMPETITIVE BIDDING IN CONNECTION WITH THIS PROJECT.

NAME

TITLE

NAME OF BUSINESS

SUBSCRIBED AND SWORN TO BEFORE ME THIS ___ DAY OF _____, _____

MY COMMISSION EXPIRES: _____

NOTARY PUBLIC: _____

** END OF SECTION **

SECTION 00450
HAZARD COMMUNICATION PROGRAM
Lake Havasu City

HAZARD COMMUNICATION PROGRAM FOR _____

(Name of Company)

The purpose of this program is to ensure that potential hazards and hazard control measures for chemicals used by this company are understood by company employees.

The written program is available for employee review at any time. It is located _____ . A copy of the program will be provided to any employee or employee representative, upon request.

CONTAINER LABELING:

_____ will verify that all containers received for use by this company will: (name/title of individual)

- * be clearly labeled as to the contents, matching identification on SDS;
- * note the appropriate hazard warnings;
- * List the name and address of the manufacturer.

No containers will be released for use until the above data is verified.

MATERIAL SAFETY DATA SHEETS:

Copies of SDS's for all hazardous chemicals to which employees may be exposed will be kept

_____ will be responsible for ensuring that:
(name/title of individual)

- * SDS's for the new chemicals are available;
- * SDS's will be available for review to all employees during each work shift;
- * Copies will be available on request.

EMPLOYEE TRAINING AND INFORMATION:

Each employee will be provided the following information and training before working in areas where hazardous chemicals exist. In addition, if a new hazardous material is introduced into the workplace, affected employees will be given new information and training concerning that material.

A. Minimum Information Provided:

- (1) All operations and locations in the work area where hazardous chemicals are present.

GENERAL INDUSTRY

A. Minimum Information Provided:

- (1) The location and availability of the written hazard communication program, including list(s) of hazardous chemicals used and related material safety data sheets;
- (2) The method the company will use to inform employees of potential hazards of non-routine tasks (jobs that are not routine for an individual because of infrequency, location or type.)

B. Minimum Training Provided:

- (1) Methods and observations used to detect the presence or release of a hazardous chemical in the work area (such as company monitoring programs, continuous monitoring device, visual appearance, odor or to other characteristics of hazardous chemicals;
- (2) The physical and health hazards of chemicals in the assigned work area;
- (3) The measures to take to protect against such hazards, including specific company procedures concerning work practices, emergencies and care and use of protective equipment.
- (4) Details of the company hazard communication program, including explanation of the labeling system, the material safety data sheets, and how to obtain and use the appropriate hazard information.

(OPTIONAL) Upon completion of the training, each employee will sign a form acknowledging receipt of the written hazard communication program and related training.

HAZARDOUS NON-ROUTINE TASKS: (If applicable.)

If company employees are required to do hazardous non-routine tasks, such as welding in confined spaces, or cleaning of tanks, the employer must address how the employees doing the work will be informed about the specific hazards to which they will be exposed, what personal protective equipment will be provided and who will be responsible to oversee the operation or operations. If the company does not have any hazardous non-routine tasks, line through this section and state "NO HAZARDOUS NON-ROUTINE TASKS".

CHEMICALS IN UNLABELED PIPES: (If applicable.)

If the company has chemicals in unlabeled pipes, the company must inform the employees of the hazards associated with those chemicals. If the company does not have any chemicals in unlabeled pipes, line through this section and state "NO CHEMICALS IN UNLABELED PIPES".

INFORMING CONTRACTORS:

Providing contractors and their employees with the following information is the responsibility of _____.
(Name/title of individual)

- (1) Hazardous chemicals to which they may be exposed while on the job site;
- (2) Measures the employees may take to lessen the possibility of exposure;
- (3) Steps the company has taken to lessen the risks;
- (4) Where the SDS's are for chemicals to which they may be exposed;
- (5) Procedures to follow if they are exposed.

CONTRACTORS INFORMING EMPLOYERS:

Contractors entering this workplace with hazardous materials will supply this employer with SDS's covering those particular products the contractor may expose this company's employees to while working at this site.

LIST OF HAZARDOUS CHEMICALS IN THIS WORKPLACE

CONTRACTOR:

By: _____

Name: _____

Title: _____

Address: _____

END OF SECTION

SECTION 00460

LAKE HAVASU CITY
EMPLOYMENT ELIGIBILITY VERIFICATION & FORM

INSTRUCTIONS FOR COMPLETION OF EMPLOYMENT ELIGIBILITY VERIFICATION FORM

WHO MUST COMPLETE THIS FORM:

In accordance with Lake Havasu City Code Chapter 3.30, Employment of Unauthorized Aliens, all contractors and subcontractors furnishing labor, time, or effort for construction or maintenance of any structure, building, transportation facility, or improvements of real property must complete this form.

Contractors or subcontractors, as described above, must certify that they have complied, in good faith, with the applicable requirements of the Federal Immigration Control and Reform Act with respect to the hiring of covered employees. This certification must be executed by an authorized representative.

WHEN THIS FORM MUST BE COMPLETED:

This form must be completed by all contractors and subcontractors and submitted to the City department awarding the contract, license agreement, or lease no later than notification of successful direct selection, bid, request for proposals, request for qualification, or any similar competitive or noncompetitive procurement or bidding process.

SECTION 00460

**LAKE HAVASU CITY
EMPLOYMENT ELIGIBILITY VERIFICATION & FORM**

LIST OF ACCEPTABLE DOCUMENTS:

LIST A		LIST B		LIST C
Documents that Establish Both	OR	Documents that Establish	AND	Documents that Establish
U.S. Passport (unexpired or expired)		Driver's license or ID Card issued by a state or outlying possession of the United States provided it contains a photograph or information such as name date of birth		U.S. social security card issued by the Social Security Administration
Certificate of U.S. Citizenship		ID card issued by a federal, state or local government agencies or entities, provided it contains a photograph or information		Certification of Birth Abroad issued by the Department of State
Certificate of Naturalization		School ID card with photograph		Original or certified copy of a birth certificate issued by a state, county, municipal authority or outlying
Unexpired foreign passport with I-551 stamp or attached federal Form I-94		Voter's registration card		Native American tribal document
Permanent Resident Card or Alien		U.S. Military card or draft record		U.S. Citizen ID Card
Unexpired Temporary		Military dependent's ID card		ID Card for the use of Resident Citizen in the
Unexpired Employment		U.S. Coast Guard Merchant Mariner Card		Unexpired employment authorization document issued by DHS
Unexpired Reentry		Native American tribal		
Unexpired Refugee Travel Document		Driver's license issued by a		
Unexpired Employment Authorization Document issued by DHS that contains a		For persons under age 18 who are unable to present a document listed above: School record or report card; Clinic.		

LAKE HAVASU CITY
EMPLOYER VERIFICATION OF EMPLOYMENT ELIGIBILITY & FORM

The undersigned attests under penalty of perjury, that they have reviewed the documents presented to them by their employees, and that the documents provided to the undersigned by their employees, as more particularly identified in the attached exhibit entitled "list of acceptable documents" appear to be genuine and appear to relate to the employee name, and to the best of the undersigned's knowledge, the employee is eligible to work in the United States based upon the undersigned's review of the documents presented.

Signature of Authorized Representative of Covered Employer/Contractor/Subcontractor	Print Name	Title
Business or Organization Name	Business Phone Number	Date (month/date/year)
Address (Street Name and Number)		
City, State, Zip Code		

SECTION 00500
CONTRACT

THIS CONTRACT is entered into by and between LAKE HAVASU CITY, ARIZONA, a municipal corporation ("OWNER"), and _____ a(n) ARIZONA corporation, **Federal I.D. # _____**, ("CONTRACTOR").

WHEREAS, OWNER has developed plans for and desires to commence the **City Fueling Facilities Improvements Rebid, Project No. B24-PW-101010-500430 Rebid** ("PROJECT"); and

WHEREAS, CONTRACTOR represents that it possesses the experience, competence, equipment and financing to properly complete the PROJECT, and has formally proposed to do so, and to furnish all necessary labor, materials, and equipment and services therefore in accordance with said plans, and subject to the terms and conditions hereof.

NOW, THEREFORE, in consideration of these promises and the mutual covenants herein, it is hereby agreed as follows:

1. CONTRACTOR shall commence and complete the construction of the PROJECT;
2. CONTRACTOR shall furnish all of the material, supplies, tools, equipment, labor and other services necessary for the construction and completion of the PROJECT.
3. CONTRACTOR shall commence the PROJECT in accordance with the CONTRACT DOCUMENTS within TEN (10) calendar days after the date of the Notice to Proceed. Final completion of the PROJECT shall occur within **120 calendar days** of the date of the Notice to Proceed for base bid plus force account and if additive alternate awarded an **additional 90 Calendar Days** will be added too. The period for completion may be extended through the authorized and approved change order process.
4. **Liquidated Damages:** OWNER and CONTRACTOR recognize that time is of the essence of this CONTRACT and that OWNER will suffer financial loss if the PROJECT is not completed within the time specified in paragraph 3 above, plus any extensions thereof allowed in accordance with the General Conditions. They also recognize the delays, expense and difficulties involved in proving in a legal or arbitration proceeding the actual losses or damages (including special, indirect, consequential, incidental and any other losses or damages) suffered by OWNER if a complete acceptable PROJECT is not delivered on time.

Accordingly, and instead of requiring proof of such losses or damages, OWNER and CONTRACTOR agree that as liquidated damages for delay (but not as a penalty) CONTRACTOR shall pay the OWNER \$ _____ for each calendar day that expires after the time specified in paragraph 3 for delivery of acceptable Bid Items, plus any costs incurred by the Engineer as provided in Section 17 of the General Conditions.

5. CONTRACTOR agrees to complete the PROJECT in accordance with all of the terms and conditions of the CONTRACT DOCUMENTS for the sum of \$ _____ as shown in the Bid

Schedule.

6. CONTRACTOR shall submit a completed Section 00450 entitled Hazard Communication Program with the executed copy of this CONTRACT.

7. The term "CONTRACT DOCUMENTS" means and includes the following:

- 00020 Notice Inviting Bids
- 00100 Information for Bidders
- 00300 Bid Proposal
- 00310 Bid Price Schedule
- 00400 Bid Bond
- 00420 Bidder's Statement of Qualifications
- 00430 Bidder's Affidavit of No Collusion
- 00450 Hazard Communication Program
- 00460 Employment Eligibility Verification
- 00500 CONTRACT
- 00500A Indemnification and Insurance Requirements
- 00500B Contractor Claim Handling Procedure
- 00510 Arizona Statutory Performance Bond
- 00520 Arizona Statutory Payment Bond
- 00670 Notice of Award
- 00680 Notice to Proceed
- 00685 Certificate of Substantial Completion
- 00690 Certificate of Final Completion
- 00700 General Conditions
- 00800 Special Provisions
 - Technical Specifications and Details
 - Construction Contract Drawings
 - Change Orders
 - Lien Releases (Conditional and Final)
 - Addenda

8. OWNER shall pay CONTRACTOR in the manner and at such times as set forth in the General Conditions and in such amounts as required by the CONTRACT DOCUMENTS.

9. In the event CONTRACTOR fails to perform any portion of the PROJECT or satisfy any term or condition of the CONTRACT DOCUMENTS, OWNER may at its sole discretion file notice and/or claim of such failure with CONTRACTOR'S surety.

10. Israel. If applicable, Contractor certifies that it is not currently engaged in, and agrees for the duration of this Contract that it will not engage in, a boycott of goods and services from Israel, as defined in A.R.S. § 35-393.

11. Export Administration Act. The CONTRACTOR warrants compliance with the Export Administration Act.

12. Recyclable Products. The CONTRACTOR shall use recyclable products and products which contain recycled content to the maximum extent economically feasible in the performance of the work set forth in the CONTRACT.

13. Asbestos License. The CONTRACTOR shall possess an asbestos abatement license if required under A.R.S. Title 32 or 49.

14. Assignment. No right or interest in this CONTRACT shall be assigned by CONTRACTOR without prior, written permission of the OWNER signed by the City Manager; and no delegation of any duty of CONTRACTOR shall be made without prior written permission of the OWNER signed by the City Manager. Any attempted assignment or delegation by CONTRACTOR in violation of this provision shall be a breach of this CONTRACT by CONTRACTOR.

[SIGNATURES ON FOLLOWING PAGE]

SAMPLE

IN WITNESS WHEREOF, the parties hereto have executed, or caused to be executed by their duly authorized officials, this CONTRACT in two (2) copies, each of which shall be deemed an original. The last date of signature shall be the effective date of this CONTRACT.

OWNER:

Lake Havasu City, Arizona

By: _____

Date: _____

Name: _____

Title: _____

APPROVED AS TO FORM:

Lake Havasu City Attorney's Office

By: _____

Date: _____

CONTRACTOR:

By: _____

Date: _____

Name/Title: _____

Address: _____

ATTEST:

BY: _____

Name/Title: _____

**** END OF SECTION ****

SECTION 500A
LAKE HAVASU CITY CONSTRUCTION CONTRACT
INDEMNIFICATION AND INSURANCE REQUIREMENTS
(long form)

I. INDEMNIFICATION

Contractor shall indemnify and hold harmless City, its officers, employees and volunteers from and against any and all liabilities, damages, losses, and costs, including reasonable attorney's fees, but only to the extent caused by the negligence, recklessness, or intentional wrongful conduct of Contractor or other persons employed or used by the Contractor in the performance of this Contract. It is agreed that Contractor will be responsible for primary loss investigation, defense, and judgment costs where this indemnification is applicable.

II. INSURANCE REQUIREMENTS

A. CONTRACTOR and its subcontractors shall procure and maintain until all of their obligations have been discharged, including any warranty periods under this CONTRACT, are satisfied, insurance against claims for injury to persons or damage to property which may arise from or in connection with the performance of the work hereunder by the CONTRACTOR, its agents, representatives, employees or subcontractors.

B. The insurance requirements herein are minimum requirements for this CONTRACT and in no way limit the indemnity covenants contained in this CONTRACT. City in no way warrants that the minimum limits contained herein are sufficient to protect the CONTRACTOR from liabilities that might arise out of the performance of the work under this CONTRACT by the CONTRACTOR, its agents, representatives, employees or subcontractors, and CONTRACTOR is free to purchase additional insurance.

C. MINIMUM SCOPE AND LIMITS OF INSURANCE: CONTRACTOR shall provide coverage with limits of liability not less than those stated below.

1. Commercial General Liability – Occurrence Form

Policy shall include bodily injury, property damage, personal injury and broad form contractual liability coverage.

a. General Aggregate	\$5,000,000
b. Products – Completed Operations Aggregate	\$5,000,000
c. Personal and Advertising Injury	\$5,000,000
d. Blanket Contractual Liability – Written and Oral	\$1,000,000
e. Fire Legal Liability	\$50,000
f. Each Occurrence	\$5,000,000

- i. The policy shall be endorsed to include the following additional insured language: "*Lake Havasu City, its departments, agencies, boards, commissions, and its officers, officials, agents, volunteers and employees shall be named as additional insureds with respect to liability arising out of the activities performed by or on behalf of the CONTRACTOR.*"
- ii. Policy shall contain a waiver of subrogation against Lake Havasu City, its departments, agencies, boards, commissions, and its officers, officials, agents, volunteers and employees for losses arising from work performed by or on behalf of the CONTRACTOR.
- iii. Completed operations coverage shall remain effective for at least two years following expiration of CONTRACT.

2. Business Automobile Liability

- a. Bodily Injury and Property Damage for any owned, hired, and/or non-owned vehicles used in the performance of this CONTRACT.

Combined Single Limit (CSL) \$1,000,000

- i. The policy shall be endorsed to include the following additional insured language: "Lake Havasu City, its departments, agencies, boards, commissions, and its officers, officials, agents, volunteers and employees shall be named as additional insureds with respect to liability arising out of the activities performed by or on behalf of the CONTRACTOR, involving automobiles owned, leased, hired or borrowed by the CONTRACTOR."
- ii. Policy shall contain a waiver of subrogation against Lake Havasu City, its departments, agencies, boards, commissions, and its officers, officials, agents, volunteers and employees for losses arising from work performed by or on behalf of the CONTRACTOR.

3. Workers' Compensation and Employers' Liability

- a. Workers' Compensation Statutory
- b. Employers' Liability Each Accident \$ 500,000
 - Disease – Each Employee \$ 500,000
 - Disease – Policy Limit \$1,000,000

- i. Policy shall contain a waiver of subrogation against Lake Havasu City, its departments, agencies, boards, commissions, and its officers, officials, agents, volunteers and employees for losses arising from work performed by or on behalf of the CONTRACTOR.
- ii. This requirement shall not apply if exempt under A.R.S. Section 23-901.

4. Professional Liability (Errors and Omissions Liability) (if applicable)

- a. Each Claim \$1,000,000
- b. Annual Aggregate \$2,000,000

- i. In the event that the professional liability insurance required by this CONTRACT is written on a claims-made basis, CONTRACTOR warrants that any retroactive date under the policy shall precede the effective date of this CONTRACT; and that either continuous coverage will be maintained or an extended discovery period will be exercised for a period of two (2) years beginning at the time work under this CONTRACT is completed.
- ii. The policy shall cover professional misconduct or lack of ordinary skill for those positions defined in the Scope of Work of this CONTRACT.

5. Builders' Risk (Property) Insurance (Vertical Construction Only)

a. CONTRACTOR shall purchase and maintain, on a replacement cost basis Builders' Risk insurance in the amount of the initial CONTRACT amount as well as subsequent modifications thereto, including modifications through Change Order, for the entire work at the site. Such Builders' Risk insurance shall be maintained until final payment has been made or until no person or entity other than CITY has an insurable interest in the property required to be covered, whichever is earlier. This insurance shall include interests of CITY, CONTRACTOR and any tier of CONTRACTOR's subcontractors in the work during the life of the CONTRACT and course of construction, and shall continue until the work is completed and accepted by CITY. For new construction projects, CONTRACTOR agrees to assume full responsibility for loss or damage to the work being performed and to the buildings or structures under construction. For renovation construction projects, CONTRACTOR agrees to assume responsibility for loss or damage to the work being performed at least up to the full CONTRACT amount, unless otherwise required by the Contract documents or amendments thereto.

b. Builders' Risk insurance shall be on an all-risk policy form and shall also cover false work and temporary buildings or structures and shall insure against risk of direct physical loss or damage from external causes including debris removal, demolition occasioned by enforcement of any applicable legal requirements and shall cover reasonable compensation for architects' and engineers' services and expenses, and other "soft costs," required as a result of such insured loss.

c. Builders' Risk insurance must provide coverage from the time any covered property falls within CONTRACTOR's control and/or responsibility and continue without interruption during construction or renovation or installation, including any time during which covered property is being transported to the construction or installation site, and while on the construction or installation site awaiting installation. The policy will provide coverage while the covered premises or any part thereof is occupied. Builders' Risk insurance shall be primary and not contributory.

d. If the CONTRACT requires testing of equipment or materials or other similar operations, at the option of CITY, CONTRACTOR will be responsible for providing property insurance for these exposures under a Boiler Machinery insurance policy.

6. Contractor's Personal Property

CONTRACTOR and each of its subcontractors and suppliers shall be solely responsible for any loss or damage to its or their personal property and that of their employees and workers, including, without limitation, property or materials created or provided pursuant to this CONTRACT, any subcontract or otherwise, its or their tools, equipment, clothing, fencing, forms, mobile construction equipment, scaffolding, automobiles, trucks, trailers or semi-trailers including any machinery or apparatus attached thereto, temporary structures and uninstalled materials, whether owned, used, leased, hired or rented by CONTRACTOR or any subcontractor, consultant or supplier or employee or worker (collectively, "Personal Property"). CONTRACTOR and its subcontractors, consultants and suppliers, at its or their option and own expense, may purchase and maintain insurance for such Personal Property and any deductible or self-insured retention in relation thereto shall be its or their sole responsibility. Any such insurance shall be CONTRACTOR's and the subcontractors', suppliers' volunteers and employees' and workers' sole source of recovery in the event of loss or damage to its or their Personal Property. Any such insurance purchased and maintained by CONTRACTOR and any subcontractor, consultant or supplier shall include a waiver of subrogation as to Owner. CONTRACTOR waives all rights of

recovery, whether under subrogation or otherwise, against all such parties for loss or damage covered by CONTRACTOR's property insurance. CONTRACTOR shall require the same waivers from all subcontractors and suppliers and from the insurers issuing property insurance policies relating to the Work or the Project purchased and maintained by all subcontractors and suppliers. The waivers of subrogation referred to in this subparagraph shall be effective as to any individual or entity even if such individual or entity (a) would otherwise have a duty of indemnification, contractual or otherwise, (b) did not pay the insurance premium, directly or indirectly, and (c) whether or not such individual or entity has an insurable interest in the property which is the subject of the loss or damage.

7. Theft, Damage, or Destruction of Work

In the event of theft, damage or destruction of the Work, CONTRACTOR will re-supply or rebuild its Work without additional compensation and will look to its own resources or insurance coverages to pay for such re-supply or rebuilding. CONTRACTOR will promptly perform, re-supply or rebuild, regardless of the pendency of any claim by CONTRACTOR against any other party, including Owner, that such party is liable for damages, theft or destruction of CONTRACTOR's Work. This subparagraph shall apply except to the extent that the cost of re-supply or rebuilding is paid by Owner's builder's risk insurance; in such event, Owner waives (to the fullest extent permitted by the builder's risk policy) all rights of subrogation against CONTRACTOR and each of its subcontractors to the extent of such payment by Owner's builder's risk insurer.

- D. ADDITIONAL INSURANCE REQUIREMENTS: The policies shall include, or be endorsed to include, the following provisions:
1. Lake Havasu City, its departments, agencies, boards, commissions and its officers, officials, agents, volunteers and employees wherever additional insured status is required. Such additional insured shall be covered to the full limits of liability purchased by the CONTRACTOR, even if those limits of liability are in excess of those required by this CONTRACT.
 2. The Contractor's insurance coverage shall be primary insurance with respect to all other available sources.
 3. Coverage provided by the Contractor shall not be limited to the liability assumed under the indemnification provisions of this CONTRACT.

- E. NOTICE OF CANCELLATION: Each insurance policy required by the insurance provisions of this CONTRACT shall not be suspended, voided, cancelled, reduced in coverage or in limits without ten (10) business days written notice to City. Such notice shall be mailed directly to Lake Havasu City, Public Works Department, Procurement Division, 2330 McCulloch Blvd. North, Lake Havasu City, AZ 86403 and shall be sent by certified mail, return receipt requested.
- F. ACCEPTABILITY OF INSURERS: Insurance is to be placed with duly licensed or approved non-admitted insurers in the state of Arizona with an "A.M. Best" rating of not less than A- VII. CITY in no way warrants that the above-required minimum insurer rating is sufficient to protect the CONTRACTOR from potential insurer insolvency.
- G. VERIFICATION OF COVERAGE:
1. CONTRACTOR shall furnish CITY with certificates of insurance as required by this CONTRACT. The certificates for each insurance policy are to be signed by a person authorized by that insurer to bind coverage on its behalf and the Project/contract number and project description shall be noted on the certificate of insurance.
 2. All certificates and endorsements are to be received and approved by CITY at least ten (10) days before work commences. Each insurance policy required by this CONTRACT must be in effect at or prior to commencement of work under this CONTRACT and remain in effect for the duration of the Project. Failure to maintain the insurance policies as required by this CONTRACT, or to provide evidence of renewal, is a material breach of contract.
 3. All renewal certificates required by this CONTRACT shall be sent directly to Lake Havasu City, Public Works Department, Procurement Division, 2330 McCulloch Blvd. North, Lake Havasu City, AZ 86403. The Project/contract number and project description shall be noted on the certificate of insurance. CITY reserves the right to require complete, certified copies of all insurance policies required by this CONTRACT at any time.
- H. SUBCONTRACTORS: CONTRACTOR's certificate(s) shall include all subcontractors as insureds under its policies **or** CONTRACTOR shall furnish to CITY separate certificates and endorsements for each subcontractor. All coverages for subcontractors shall be subject to the minimum requirements identified above.
- I. APPROVAL: Any modification or variation from the insurance requirements in this CONTRACT must have prior approval from the CITY's Human

Resources/Risk Management Division, whose decision shall be final. Such action will not require a formal CONTRACT amendment, but may be made by administrative action.

- J. **EXCEPTIONS:** In the event the CONTRACTOR or sub-contractor(s) is/are a public entity, then the Insurance Requirements shall not apply. Such public entity shall provide a Certificate of Self-Insurance.

SECTION 00500B
CONTRACTOR Claim Handling Procedure

1. Claimant is to submit in writing to the OWNER or their REPRESENTATIVE the details of the claim to include the where, when, and how of the claim, and an estimate of damage, if applicable.
2. OWNER or their REPRESENTATIVE will forward the claim directly to the CONTRACTOR for handling. The CONTRACTOR is to respond to the claimant, in writing, within 30 calendar days of receipt with copies to:

Lake Havasu City Human Resources/Risk Management Division
Lake Havasu City Public Works Department
OWNER'S REPRESENTATIVE, if applicable

If the CONTRACTOR denies the claim, the reasons for such denial must be included in the response to the claimant.

SECTION 00510
ARIZONA STATUTORY PERFORMANCE BOND

PURSUANT TO TITLES 28, 34, AND 41, ARIZONA REVISED STATUTES
(Penalty of this bond must be 100% of the Contract amount)

KNOW ALL MEN BY THESE PRESENTS THAT: _____
(hereinafter "Principal"), as Principal, and _____
(hereinafter "Surety"), a corporation organized and existing under the laws of the State of with its principal office in the City of _____, holding a certificate of authority to transact surety business in Arizona issued by the Director of Insurance pursuant to Title 20, Chapter 2, Article 1, as Surety, are held and firmly bound unto Lake Havasu City, Arizona (hereinafter "Obligee") in the amount of _____(Dollars) (\$), for the payment whereof, Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the day of _____, _____, to furnish all of the material, supplies, tools, equipment, labor and other services necessary for the construction and completion of

City Fueling Facilities Improvements Rebid, Project No. B24-PW-101010-500430 Rebid

which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THE OBLIGATION IS SUCH, that if the Principal faithfully performs and fulfills all of the undertakings, covenants, terms, conditions and agreements of the contract during the original term of the contract and any extension of the contract, with or without notice of the Surety, and during the life of any guarantee required under the contract, and also performs and fulfills all of the undertakings, covenants, terms, conditions and agreements of all duly authorized modifications of the contract that may hereafter be made, notice of which modifications to the Surety being hereby waived, the above obligation is void. Otherwise it remains in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Title 34, Chapter 2, Article 2, Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions of Title 34, Chapter 2, Article 2, Arizona Revised Statutes, to the same extent as if it were copied at length in this agreement.

The prevailing party in a suit on this bond shall recover as part of the judgment reasonable attorney fees that may be fixed by a judge of the court.

Witness our hands this ____ day of _____, _____.

PRINCIPAL SEAL

AGENCY OF RECORD BY: _____

AGENCY ADDRESS SURETY SEAL
BY: _____

** END OF SECTION **

SECTION 00520
ARIZONA STATUTORY PAYMENT BOND
PURSUANT TO TITLES 28, 34, AND 41, ARIZONA REVISED STATUTES
(Penalty of this bond must be 100% of the Contract amount)

KNOW ALL MEN BY THESE PRESENTS THAT: _____
(hereinafter "Principal"), as Principal, and _____ (hereinafter Surety), a corporation organized and existing under the laws of the State of _____ with its principal office in the City of _____, holding a certificate of authority to transact surety business in Arizona issued by the Director of the Department of Insurance pursuant to Title 20, Chapter 2, Article 1, as Surety, are held and firmly bound unto Lake Havasu City, Arizona (hereinafter "Obligee") in the amount of _____ (Dollars) (\$ _____), for the payment whereof, Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the _____ of _____, _____, to furnish all of the material, supplies, tools, equipment, labor and other services necessary for the construction and completion of

City Fueling Facilities Improvements Rebid, Project No. B24-PW-101010-500430 Rebid

which contract is hereby referred to and made a part hereof as fully and to the same extent as if copied at length herein.

NOW, THEREFOR, THE CONDITION OF THE OBLIGATION IS SUCH, that if the Principal promptly pays all monies due to all persons supplying labor or materials to the Principal or the Principal's subcontractors in the prosecution of the work provided for in the contract, this obligation is void. Otherwise it remains in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Title 34, Chapter 2, Article 2, Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions, conditions and limitations of Title 34, Chapter 2, Article 2, Arizona Revised Statutes, to the same extent as if it were copied at length in this agreement.

The prevailing party in a suit on this bond shall recover as part of the judgment reasonable attorney fees that may be fixed by a judge of the court.

Witness our hands this ____ day of _____, _____.

PRINCIPAL SEAL

BY: _____
AGENCY OF RECORD

AGENCY ADDRESS SURETY SEAL

BY: _____

** END OF SECTION **

SECTION 00670
NOTICE OF AWARD

TO:

DATE:

PROJECT DESCRIPTION: City Fueling Facilities Improvements Rebid, Project No. B24-PW-101010-500430 Rebid

The OWNER has considered the BID submitted by you for the above described WORK in response to its Advertisement for BIDS dated _____, and Information for Bidders.

You are hereby notified that your BID has been accepted for items in the amount of \$_____, to include all work for the project entitled, "City Fueling Facilities Improvements", Lake Havasu City Project 101010.

You are required by the Information for Bidders to execute the Contract and furnish the required CONTRACTOR'S Performance Bond, Payment Bond, and Certificates of Liability, Vehicular, and Workmen's Compensation Insurance within ten (10) calendar days from the postmark date when this notice was sent by U.S. Mail.

If you fail to execute said Contract 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 a 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 _____, 2023.

Lake Havasu City, Arizona

BY: _____

NAME: Kimberly Fiumara

TITLE: Purchasing & Grants Supervisor

Acceptance of Notice

(NOTE: The contractor shall return a signed copy of this notice to the owner.)

Receipt of this NOTICE OF AWARD is hereby acknowledged by:

Contractor

This the ____ day of _____, 2023.

BY: _____

TITLE: _____

** END OF SECTION **

SECTION 00680
NOTICE TO PROCEED

DATE:

TO:

RE: City Fueling Facilities Improvements Rebid, Project No. B24-

PW-101010-500430 Rebid

You are hereby notified to commence WORK in accordance with the Contract dated _____, within ten (10) calendar days of the date of this Notice To Proceed, and you are to complete the WORK within **120 CALENDAR DAYS** for base bid plus force account, and an **additional 90 Calendar Days** if additive alternate awarded, with a completion date of _____. The period for completion may be extended through the authorized and approved change order process.

OWNER: Lake Havasu City, Arizona

By: _____

Name: Kimberly Fiumara

Title: Purchasing & Grants Supervisor

ACCEPTANCE OF NOTICE

(NOTE: The Contractor shall return a signed copy of this Notice to the Owner)

Receipt of the above NOTICE TO PROCEED is hereby acknowledged

this the _____ day of _____, _____.

By: _____

Name: _____

Title:

**** END OF SECTION ****

**SECTION 00685
CERTIFICATE OF SUBSTANTIAL COMPLETION**

I hereby state that the degree of completion of:

**City Fueling Facilities Improvements Rebid, Project No. B24-
PW-101010-500430 Rebid** Provides the full-time use of the project, or defined portion of the project, for the purposes for which it was intended and is the commencement of the Guarantee Period.

"Substantial Completion" shall not be considered as final acceptance.

Lake Havasu City, Arizona

Date: _____

By: _____

Name: _____

Title: _____

ACCEPTANCE OF NOTICE

(NOTE: The Contractor shall return a signed copy of this Notice to the Owner)

Receipt of the above **CERTIFICATE OF SUBSTANTIAL COMPLETION** is hereby acknowledged this the _____ day of _____, _____.

By: _____

Name: _____

Title: _____

CERTIFICATE OF COMPLETION

I hereby state that all goods and services required by:

City Fueling Facilities Improvements Rebid, Project No. B24-PW-101010-500430 Rebid

have been delivered in conformance with the Contract, and all activities required by the Contractor under the Contract were completed as of _____.
(Date)

Lake Havasu City, Arizona

By: _____

Name: _____

Title: _____

SECTION 00700
GENERAL CONDITIONS

This section of the Contract Documents is pre-printed. Any modifications to the following Articles, as may be required for this Project, are made in the Special Provisions.

1.0 DEFINITIONS

Wherever in the Contract Document the following terms are used, the intent and meaning shall be interpreted as follows:

1.1 Addenda

Written or graphic instruments issued prior to the opening of Bids which modify or interpret the Contract Documents, Drawings and Specifications, by additions, deletions, clarifications or corrections.

1.2 As Approved

The words "as approved," unless otherwise qualified, shall be understood to be followed by the words "by the Owner."

1.3 As Shown, and as Indicated

The words "as shown" and "as indicated" shall be understood to be followed by the words "on the Drawings" or "in the Specifications."

1.4 Award

The acceptance, by the Owner, of the successful Bidder's proposal.

1.5 Bid

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

1.6 Bidder

Any individual, firm partnership or corporation, or combination thereof submitting a proposal for the Work contemplated, acting directly or through a duly authorized representative.

1.7 Bonds

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

1.8 Calendar Day

Every day shown on the calendar, measured from midnight to the next midnight.

1.9 Change Order

A written order to the Contractor, signed by the Owner, covering changes in the Plans, Specifications, or proposal quantities and establishing the basis of payment and contract time adjustment, if any, for the Work affected by such changes.

If the Change Order increases the existing Contract Amount, the Builder's Risk Insurance limit must be increased to the adjusted Contract Amount.

1.10 Contract

The "Contract" is the written Contract covering the performance of the Work and the furnishing of labor, materials, incidental services, tools, and equipment in the construction of the Work. It includes Supplemental Contracts amending or extending the Work contemplated in the manner hereinafter described and which may be required to complete the Work in a substantial and acceptable manner to the Owner. The Contract may include Contract Change Orders.

1.11 Contract Documents

The "Contract Documents" consist of the Bidding Requirements, Contract Forms, Conditions of the Contract including General and/or Supplemental General Conditions, Special Provisions, the Technical Specifications, and the Drawings, including all Addenda and modifications thereafter incorporated into the Documents before execution and including all other requirements incorporated by specific reference thereto.

1.12 Contract Price

The total monies payable by Owner to the Contractor under the terms and conditions of the Contract Documents.

1.13 Contract Time

The number of calendar days stated in the Contract Documents for the completion of the Work.

1.14 Contractor

The individual, partnership, firm, or corporation primarily liable for the acceptable performance of the Work contracted for and the payment of all legal debts pertaining to the Work who acts directly or through lawful agents or employees to complete the Contract Work.

1.15 Days

Unless otherwise specifically stated, the term "days" will be understood to mean calendar days.

1.16 Drawings

The term "Drawings," also described as "Plans," refers to the official drawings, profiles, cross sections, elevations, details, and other working drawings, and supplementary drawings, or reproductions thereof, which show the locations, character, dimensions, and details of the Work to be performed. Drawings may either be bound in the same book as the balance of the Contract Documents or bound in separate sets, and are a part of the Contract Documents, regardless of the method of binding.

1.17 Engineer

The individual, partnership, firm, or corporation duly authorized by the Owner (sponsor) to be responsible for the Engineering of the contract Work and acting directly or through an authorized representative.

1.18 Field Order

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

1.19 Final Acceptance

Upon due notice from the Contractor of presumptive completion of the entire project, the Owner will make an inspection. If all construction provided for and contemplated by the contract is found completed to the Owner's satisfaction and all requirements of the contract have been met, that inspection shall constitute the final inspection and the Owner will make the final acceptance and issue the Certificate of Completion.

If, however, the inspection discloses any work, in whole or in part, as being unsatisfactory or that all requirements of the contract have not been met, the Owner will give the Contractor the necessary instructions for correction or completion, and the Contractor shall immediately comply with and execute the instructions. Upon correction of the work, completion of contract requirements, and notification to Owner, another inspection will be made which shall constitute the final inspection provided the work has been satisfactorily completed and all requirements of the contract met. In such event, the Owner will make the final acceptance and issue the Certificate of Completion.

1.20 Inspector

An authorized representative of the Owner assigned to make all necessary inspections and/or tests of the Work performed or being performed, or of the materials furnished or being furnished by the Contractor.

1.21 Methodology and Quality of Workmanship

The manner and sequence of construction which considered to be the acceptable standard in which to perform the Work.

1.22 Notice

The term "notice" or the requirement to notify, as used in the Contract Documents or applicable State or Federal statutes, shall signify a written communication delivered in person or by certified or registered mail to the individual, or to a member of the firm, or to an officer of the corporation for whom it is intended. Certified or registered mail shall be addressed to the last business address known to him who gives the notice.

1.23 Notice of Award

The written notice of the acceptance of the Bid from the Owner to the successful Bidder.

1.24 Notice to Proceed

Written communication issued by the Owner to the Contractor authorizing him to proceed with the Work and establishing the date of commencement of the Work.

1.25 Or Equal

The phrase "or equal" shall be understood to indicate that the "equal" product is the same or better than the product names in function, performance, reliability, quality, and general configuration. Determination of equality in reference to the project design requirements will be made by the Owner.

1.26 Owner

The term "Owner" shall be understood to be Lake Havasu City, Arizona.

1.27 Payment Bond

The approved form of security furnished by the Contractor and its surety as a guaranty that it will pay in full all bills and accounts for materials and labor used in the construction of Work.

1.28 Performance Bond

The approved form of security furnished by the Contractor and its surety as a guarantee that the Contractor will complete the Work in accordance with the terms of the Contract and guarantee the Work for a period of one (1) year after the date of Certificate of Substantial Completion.

1.29 Plans

Plans shall have the same meaning as "Drawings," see Section 1.16.

1.30 Project

The undertaking to be performed as provided in the Contract Documents, see Section 1.11.

1.31 Proposal

The offer of the Bidder for the Work when made out and submitted on the prescribed proposal form, properly signed and guaranteed.

1.32 Proposal Guarantee

The cash, or cashier's check or certified check, or bidder's bond accompanying the Proposal submitted by the Bidder, as a guarantee that the Bidder will enter into a contract with the Owner for the construction or doing of the Work, if it is awarded to it, and will provide the contract bonds and insurance required.

1.33 Shop Drawings

All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the Contractor, a Subcontractor, manufacturer, supplier or distributor, which illustrate how specific portions of the Work shall be fabricated or installed.

1.34 Specifications

The directions, provisions and requirements pertaining to the method and manner of performing the Work or to the quantities and qualities of the materials to be furnished under the Contract, together with all other directions, provisions and requirements, plus such amendments, deletions from or additions which may be provided for by Supplemental Contract or Change Orders.

1.35 Subcontractor

A Subcontractor is a person or entity who has a direct or indirect contract with a Contractor to perform any of the Work at the site. For convenience, the term Subcontractor is referred to throughout the Contract Documents as if singular in number and masculine in gender but includes the plural and feminine gender and includes a Sub-Subcontractor or an authorized representative thereof. The term Subcontractor does not include any separate Contractor or its Subcontractors.

1.36 Substantial Completion

"Substantial Completion" shall be that degree of completion of the project or a defined portion of the project, sufficient to provide the Owner, at its discretion, the full-time use of the project or defined portion of the project for the purposes for which it was intended. "Substantial Completion" shall not be considered as final acceptance.

1.37 Supplemental General Conditions

Modifications to General Conditions required by a Federal Agency for participation in the Project and approved by the agency for participation in the Project and approved by the agency in writing prior to inclusion in the Contract Documents and such requirements that may be imposed by applicable state laws. The term also includes modifications or additions to the General Conditions required by the Owner or Engineer.

1.38 Supplier

Any person or organization who supplies materials or equipment for the Work, including that fabricated to a special design, but who does not perform labor at the site.

1.39 Surety

The corporation, partnership, or individual, other than the Contractor, executing Payment, or Performance Bonds which are furnished to the Owner by the Contractor.

1.40 Work

The word "Work" within these Contract Documents shall include all material, labor, tools, utilities, and all appliances, machinery, transportation, and appurtenances necessary to perform and complete the Contract, and such additional items not specifically indicated or described which can be reasonably inferred as belonging to the item described or indicated and as required by good practice to provide a complete and satisfactory system or structure.

1.41 Working Day

A working day shall be any day, other than a legal holiday, Saturday or Sunday, on which the normal working forces of the Contractor may proceed with regular work.

2.0 **NOTICE TO PROCEED**

2.1 After the Owner has issued the Notice Of Award, the Contractor shall provide the Performance Bond, the Payment Bond, the Certificate Of Insurance, the Work Schedule, the monthly cash flow, and a signed Contract within ten (10) calendar days. The Owner's attorney will review each document and, if they are found to be acceptable, the Owner will sign and execute the Contract. Within a period of sixty (60) calendar days after executing the Contract,

the Owner will issue the Notice To Proceed. Within ten (10) calendar days of the postmark date of the Notice To Proceed, the Work shall commence. The Contractor shall not commence any Work until such time that the Notice To Proceed has been issued.

3.0 ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS

3.1 The Engineer may furnish additional instructions to the Contractor by means of Drawings or otherwise, during the progress of the Work as necessary to make clear or to define in greater detail the intent of the Specifications and Contract Drawings.

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

4.0 SCHEDULES, REPORTS AND RECORDS

4.1 The Contractor shall submit to the Owner payrolls, reports, estimates, records and other data where applicable as are required by the Contract Documents for the Work to be performed.

4.2 The Contractor, after the Contract award and prior to the Pre-Construction Conference, shall prepare for submittal to the Engineer for review, a detailed progress schedule. The progress schedule shall be brought up to date and submitted to the Engineer prior to each progress payment request, and at such other time intervals as the Engineer may request.

A. Progress Schedule

The schedule shall be a time-scaled critical path progress schedule showing in detail the proposed sequence of activity. The critical path analysis shall consist of a graphic network diagram and shall clearly show start and completion dates and percentage of work completed.

4.3 The Contractor shall also forward to the Engineer, prior to each progress payment request, an itemized report of the delivery status of major and critical items of purchased equipment and material, including Shop Drawings and the status of shop and field fabricated work. These progress reports shall indicate the date of the purchase order, the current percentage of completion, estimated delivery, and cause of delay, if any.

4.4 If the completion of any part of the Work or the delivery of materials is behind the approved schedule, the Contractor shall submit in writing a plan acceptable to the Engineer for bringing the Work up to schedule.

4.5 The Owner shall have the right to withhold progress payments for the Work if the Contractor fails to update and submit the progress schedule and reports as specified, and such withholding shall not constitute grounds for additional claims by the Contractor against the Owner.

4.6 The Contractor shall submit an estimated monthly cash flow, based upon the progress schedule with the bonds, schedules, and Certificate Of Insurance.

5.0 DRAWINGS AND SPECIFICATONS

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

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

5.3 Any discrepancies found between the Drawings and Specifications and site conditions or any inconsistencies or ambiguities in the Drawings or Specifications shall be immediately reported verbally and within 24 hours of such a discovery, in writing to the Engineer, who shall promptly correct such inconsistencies or ambiguities in writing. Work done by the Contractor after his discovery of such discrepancies, inconsistencies or ambiguities shall be done at the Contractor's risk, and the Contractor shall assume full responsibility therefor and shall bear all costs attributable thereto, if not acceptable to the Owner.

6.0 SHOP DRAWINGS

6.1 The Contractor shall provide seven (7) copies of the Shop Drawings as specified or as may be necessary for the prosecution of the Work as required by the Contract Documents. All drawings and schedules shall be submitted sufficiently in advance to allow the Engineer not less than 20 regular working days for checking the submittal. The Engineer's approval of any Shop Drawings shall not release the Contractor from responsibility for deviations from the Contract Documents.

6.2 When submitted for the Engineer's review, Shop Drawings shall bear the Contractor's certification by means of a signed Stamp, that he has reviewed, checked and approved the Shop Drawings and that they are in conformance with the requirements of the Contract Documents. Shop Drawings, which in the opinion of the Engineer are incomplete or unchecked by the Contractor, will be returned to the Contractor for resubmission in the proper form.

If Shop Drawings or submittals are rejected by the Engineer, all costs incurred by the Engineer Or The Owner for reviewing the resubmittals shall be charged to the Contractor, and the Owner has the right to deduct such costs from any monies owed the Contractor by the Owner.

6.3 When Shop Drawings have been reviewed by the Engineer, two sets of submittals will be returned to the Contractor appropriately stamped. If major changes or corrections are necessary, the Shop Drawing may be rejected and one set will be returned to the Contractor with such changes or corrections indicated, and the Contractor shall correct and resubmit the Shop Drawings. No changes shall be made by the Contractor to resubmitted Shop Drawings other than those changes indicated by the Engineer, unless such changes are clearly described in a letter

accompanying the resubmitted Shop Drawings.

6.4 The review of such Shop Drawings and catalog cuts by the Engineer shall not relieve the Contractor from responsibility for corrections of dimensions, fabrication details, and space requirements, or for deviations from the Contract Drawings or Specifications, unless the Contractor has called attention to such deviations in writing by a letter accompanying the Shop Drawings and the Engineer approves the change or deviation in writing at the time of submission; nor shall review by the Engineer relieve the Contractor from the responsibility for errors in the Shop Drawings. When the Contractor does call such deviations to the attention of the Engineer, the Contractor shall state in his letter whether or not such deviations involve any deduction or extra cost adjustment.

6.5 Portions of the Work requiring a Shop Drawing or sample submission shall not begin until the Shop Drawing or submission has been approved by the Engineer. A copy of each approved Shop Drawing and each approved sample shall be kept in good order by the Contractor at the site and shall be available to the Engineer.

7.0 RECORD DRAWINGS

7.1 During construction, the Contractor shall keep an accurate record of the following:

- A. Deviations between the Work as shown on the Plans and the Work as actually installed.
- B. The specific locations of piping, valves, electric conduits, duct work, equipment, and other such work which was not located on the Plans. The Record Drawings shall show distances to these locations from known points on the Plans.
- C. Equipment schedules indicating manufacturer's names and model numbers. When all revisions showing work as installed are made, the corrected set of plans shall be delivered to the Engineer before the final pay request is processed. These plans shall be clearly marked "Record Drawings."

7.2 Nothing contained in this section shall be construed as authorizing any deviation in the Work as shown on the Contract Drawings without a written Change Order or written authority to the Contractor from the Engineer.

8.0 MATERIALS, SERVICES, AND FACILITIES

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

8.2 The Contractor shall furnish the Owner a list of materials and the source of supply of each of the materials on the list. The source of supply of each of the materials shall be approved by

the Owner before the delivery of said materials is started. Only materials conforming to these Specifications and approved by the Owner shall be used in the Work. All materials proposed for use may be inspected or tested at any time during their preparation and use. After trial, if it is found that sources of supply which have been approved do not furnish a uniform product, or if the product from any source proves unacceptable at any time, the Contractor shall furnish approved material from other approved sources. No material which, after approval, has in any way become unfit for use shall be used in the Work.

8.3 The Contractor warrants to the Owner and Engineer that the materials and equipment furnished under the Contract will be new and of a quality equal to that specified or approved and, that all Work will be of good quality, free from faults and defects and in conformance with the Contract Documents. Mechanical and electrical equipment shall be the products of manufacturers of established good reputations and regularly engaged in the fabrication of such equipment. Unless otherwise noted, any equipment offered shall be current models which have been in successful regular operation under comparable conditions for a period of at least two years. This time requirement, however, does not apply to minor details nor to thoroughly demonstrated improvements in design or in material of construction. Work shall be done and completed in a thorough and workmanlike manner and if required by Engineer, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment used.

8.4 All materials which the Engineer or its authorized Inspector has determined do not conform to the requirements of the Plans and Specifications will be rejected. They shall be removed immediately from the vicinity of the Work by the Contractor at his own expense, unless otherwise permitted by the Engineer. No rejected material, the defects of which have been subsequently corrected, shall be used in the Work, unless approval in writing has been given by the Engineer. Upon failure of the Contractor to comply promptly with any order of the Engineer made under the provisions in this section, the Engineer shall have authority to cause the removal and replacement of rejected material and to deduct the cost thereof from any monies due or to become due the Contractor.

8.5 If any part or portions of the Work done or material furnished under this Contract shall prove defective or non-conforming with the Drawings and Specifications, and if the imperfection in the same shall not be of sufficient magnitude or importance as to make the Work dangerous or unsuitable, or if the removal of such Work will create conditions which are dangerous or undesirable, the Engineer shall have the right and authority to retain such Work but shall make such deductions in the final payment therefor as may be just and reasonable. Such adjustment shall be effected whether or not final payment has been made.

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

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

8.8 Materials, supplies or equipment to be incorporated into the Work shall not be purchased

by the Contractor or the Subcontractor subject to a chattel mortgage or under a conditional sale contract or other Contract by which an interest is retained by the seller.

9.0 INSPECTION AND TESTING

9.1 All material and equipment used in the construction of the Project shall be subject to adequate inspection and testing in accordance with generally accepted standards, as required and defined in the Contract Documents.

9.2 The Owner shall provide all inspection and testing services not required by the Contract Documents.

9.3 The Contractor shall provide at its expense the testing and inspection services required by the Contract Documents.

9.4 If the Contract Documents, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any Work to specifically be inspected, tested, or approved by someone other than the Contractor, the Contractor will give the Engineer timely notice of readiness, the minimum of which shall be forty-eight (48) hours. The Contractor will then furnish the Engineer the required certificates of inspection, testing or approval.

9.5 Inspections, tests or approvals by the Engineer or others shall not relieve the Contractor from its obligations to perform the Work in accordance with the requirements of the Contract Documents.

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

9.7 If any Work is covered contrary to the written instructions of the Engineer or prior to inspection, if must, if requested by the Engineer, be uncovered for his observation and replaced at the Contractor's expense.

9.8 If the Engineer considers it necessary or advisable that Work that has already been approved be inspected or tested by the Engineer or others, the Contractor, at the Engineer's request, will uncover, expose or otherwise make available for observation, inspection or testing as the Engineer may require, that portion of the Work in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such Work is defective, the Contractor will bear all the expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction. If, however, such Work is not found to be defective, the Contractor will be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction and an appropriate Change Order shall be issued.

10.0 SUBSTITUTIONS

10.1 Whenever a material, article or piece of equipment is identified on the Drawings or Specifications by reference to brand name or catalogue number, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements and that other products of equal capacities, quality and function shall be considered. The Contractor may recommend the substitution of a material, article, or piece of equipment of equal substance and function for those referred to in the Contract Documents by reference to brand name or catalogue number, and if, in the opinion of the Engineer, such material, article, or piece of equipment is of equal substance and function to that specified, the Engineer may approve its substitution and use by the Contractor. Any cost differential shall be deductible from the Contract Price and the Contract Documents shall be appropriately modified by Change Order. The Contractor warrants that if substitutes are approved, no major changes in the function or general design of the Project will result. Incidental changes or extra component parts required to accommodate the substitute will be made by the Contractor without a change in the Contract Price or Contract Time. Any substitutions not properly approved and authorized by the Engineer may be considered defective and the Engineer may require the Contractor to remove the substituted material, article or piece of equipment and the Contractor shall bear any and all costs associated with the removal of the substituted item, including all engineering, inspection, testing or surveying costs incurred by the Owner or the Engineer.

10.2 Determination of equality in reference to the project design requirements will be made by the Owner. "Equal" products shall not be purchased or installed by the Contractor without the Owner's written approval. Contractor shall have fourteen (14) days after issuance of Notice to Proceed for submission of data substantiating a request for substitution of an "or equal" item.

11.0 PATENTS

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

12.0 SURVEYS, PERMITS, REGULATIONS

12.1 The Owner shall furnish all boundary surveys and establish all base lines for locating the principal component parts of the Work together with a suitable number of bench marks adjacent to the Work as shown in the Contract Documents. The Contractor shall satisfy itself as to the accuracy of all measurements before constructing any permanent structure and shall not take advantage of any errors which may have been made in laying out the Work. From the information provided by the Owner, unless otherwise specified in the Contract Documents, the Contractor shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, stakes for pile locations and other working points, lines, elevations and cut sheets.

12.2 Such stakes and markings as the Engineer may set for either its own or the Contractor's guidance shall be scrupulously preserved by the Contractor. In the event the Contractor, or its employees, destroy or otherwise remove or obliterate such stakes or markings, an amount equal to the cost of replacing the same may be deducted from subsequent estimates due the Contractor at the discretion of the Owner.

12.3 Permits and licenses of a temporary nature necessary for the prosecution of the Work shall be secured and paid for by the Contractor unless otherwise stated in the Supplemental General Conditions. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the Owner, unless otherwise specified. The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the Work as drawn and specified. If the Contractor perceives that the Contract Documents are at variance therewith, he shall promptly notify the Engineer in writing, and any necessary changes shall be adjusted as provided in Section 16. Changes In The Work. If the Contractor performs and works knowing it to be contrary to such laws, ordinances, rules and regulations, and without such notice to the Engineer, he shall assume full responsibility therefore and shall bear all costs attributable thereto.

13.0 PROTECTION OF WORK, PROPERTY AND PERSONS

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

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

13.3 In emergencies affecting the safety of persons or the Work or property at the site or adjacent thereto, the Contractor, without special instruction or authorization from the Engineer or Owner, shall act to prevent threatened damage, injury or loss. He shall give the Engineer prompt Written Notice of any significant changes in the Work or deviations from the Contract

Documents caused thereby, and a Change Order shall thereupon be negotiated and issued covering the changes and deviations involved, as provided in Section 16.0, Changes in the Work.

13.4 The Contractor shall designate a responsible member of its organization at the site whose duty shall be the prevention of accidents and the safety of all those at the site. The person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and the Engineer. The Engineer will not be responsible for safety precautions and programs in connection with the Work or for the Contractor's failure to properly perform its responsibilities with respect to initiating, maintaining and supervising all safety precautions and programs.

14.0 PUBLIC SAFETY

14.1 Whenever the Contractor's operations create a condition hazardous to traffic or to the public, it shall furnish at its own expense, and without cost to the Owner, such flagmen and guards as are necessary to give adequate warning to the public of any dangerous conditions to be encountered and he shall furnish, erect, and maintain such fences, barricades, lights, signs, and other devices as are necessary to prevent accidents and avoid damage or injury to the public.

14.2 Should the Contractor appear to be neglectful or negligent in furnishing warning and protective measures as above provided, the Engineer may direct attention to the existence of a hazard and the necessary warning and protective measures shall be furnished and installed by the Contractor at its own expense without cost to the Owner. Should the Engineer point out the inadequacy of warning and protective measures, such action on the part of the Engineer shall not relieve the Contractor from responsibility for public safety or abrogate his obligation to furnish and pay for these devices.

14.3 Should the Contractor fail to, be neglectful, or be negligent in furnishing or maintaining warning and protective facilities as required herein, the Owner may furnish or maintain such facilities and charge Contractor therefor by deducting the cost thereof from periodic progress payments due the Contractor as such costs are incurred by Owner.

14.4 No material or equipment shall be stored where it will interfere with the free and safe passage of public traffic, and at the end of each day's Work and at other times when construction operations are suspended for any reason, the Contractor shall remove all equipment and other obstructions from that portion of the right-of-way open for use by public traffic.

15.0 SUPERVISION BY CONTRACTOR

15.1 The Contractor shall supervise and direct the Work, using its best skill and attention. The Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. The Contractor shall employ and maintain on the Work a qualified supervisor or superintendent who shall have been designated in writing by the Contractor as the Contractor's representative at the site, and who shall have been approved by the Engineer, which approval shall not be unreasonably withheld. The supervisor shall have full authority to act on behalf of the Contractor and all communications given to and by the supervisor shall be as binding

as if given to and by the Contractor. The supervisor shall be present on the site at all times. The Contractor shall be responsible to the Owner for the acts and omissions of the employees, subcontractors, and the agents and employees, and other persons performing any other Work under the Contract with the Contractor.

16.0 CHANGES IN THE WORK

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

16.2 The Engineer, also, may at any time, by issuing a Field Order, make changes in the details of the Work. The Contractor shall proceed with the performance of any changes in the Work so ordered by the Engineer unless the Contractor believes that such Field Order entitles him to a change in Contract Price or Time, or both, in which event he shall give the Engineer Written Notice thereof within seven (7) days after the receipt of the ordered change. Thereafter the Contractor shall document the basis for the change in Contract Price or Time within fourteen (14) days. The Contractor shall not execute such changes pending the receipt of an executed Change Order or further instruction from the Owner.

16.3 If the Contractor wishes to make a claim for an increase in the Contract sum, it shall give the Engineer written notice thereof within fourteen (14) days after the occurrence of the event giving rise to such claim. This notice shall be given by the Contractor before proceeding to execute the Work, except in an emergency endangering life or property, in which case Contractor shall proceed in accordance with the provisions of the Contract. No such claim shall be valid unless so made. If the Owner and Contractor cannot agree on the amount of adjustment in the Contract sum, it shall be determined by the Engineer. Any change in the Contract sum resulting from such claim shall be authorized in a Change Order.

16.4 The value of any Work covered by a Change Order shall be determined by one or more of the following methods in the order of precedence listed below:

- A. Unit prices previously approved.
- B. An agreed lump sum.
- C. Cost plus percentage.

17.0 TIME FOR COMPLETION AND LIQUIDATED DAMAGES

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

17.2 The Contractor shall proceed with the Work at such rate of progress to insure full completion within the Contract Time. It is expressly understood and agreed, by and between the Contractor and the Owner, that the Contract Time for the completion of the Work described herein

is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the Work.

17.3 The Contractor shall only work an eight (8) hour day consisting of Monday through Friday, between 6:00 a.m. to 6:00 p.m., and do not include local municipal holidays. If the Contractor desires to carry on Work more than eight (8) hours each day, or work at night or outside the regular hours, it shall give timely notice (72 hours) to the Engineer and receive the Owner's written approval to allow satisfactory arrangements to be made for inspecting the Work in progress. Should the prosecution of the Work be discontinued for any reason, the Contractor shall notify the Engineer at least 24 hours in advance of resuming operations. The Contractor shall be responsible for any extra compensation due or costs incurred as a result of Contractor's desire to carry out Work beyond an eight (8) hour day, or at night or outside regular hours, including but not limited to, any additional costs or compensation due the Engineer And Owner or its employees or agents as a result of having to be present at the site. The costs or extra compensation necessitated by the Contractor's Work beyond an eight (8) hour day, or at night or outside regular business hours may be deducted or withheld from progress payment or any other payments due to Contractor.

17.4 If for any reason a suspension of the work should occur; the Contractor, at its own expense, shall do all the Work necessary to provide a safe, smooth and unobstructed passageway through construction for use by public traffic or to provide for the proper and efficient operation of sewer, drainage and other facilities within the site of the Work, during the period of such suspension. In the event that the Contractor fails to perform the Work specified in this Subsection, the Owner will perform such Work and the cost thereof will be deducted from periodic progress payments due the Contractor.

17.5 During inclement weather and other conditions, the Contractor shall pursue only such portions of the Work as shall not be damaged thereby. No portions of the Work which satisfactory quality or efficiency will be affected by an unfavorable condition shall be constructed while these conditions remain, unless by special means or precautions, approved by the Engineer, the Contractor is able to overcome them.

17.6 Delays in delivery of equipment or material purchased by the Contractor or its Subcontractor, including Engineer-selected equipment, shall not be considered as a just cause for delay as this is not beyond the control of the Contractor. The Contractor shall be fully responsible for the timely ordering, scheduling, expediting, delivery, and installation of all equipment and materials.

17.7 In case of failure on the part of the Contractor to complete the Work within the time affixed in the Contract, or such extension thereof as may be allowed by Engineer or Owner, the Contract shall by that fact be terminated by written notice. The Owner shall not thereafter pay or allow the Contractor any further compensation for any Work done by it under said Contract, and the Contractor and its sureties shall be liable to the Owner for all loss or damage which it may suffer by reason of his failure to complete the Contract within such time. Failure to prosecute the Work diligently shall be grounds for termination by the Owner pursuant to this paragraph.

In the event the Contract should be terminated, the Owner shall have the right to take over the Work and to proceed with the same until it is completed, either by performing said Work itself directly or by contracting it out to some other person or persons, and in such event the Owner may take possession of and utilize, in completing the Work, such materials, appliances and plant as may be on the site of the Work and necessary for its completion. Nothing herein contained shall be deemed to limit the right of the Owner in the event of any breach of Contract by the Contractor; but all rights herein given to the Owner are and shall be deemed to be additional to any other rights or remedies which the Owner shall have under any provision of law.

17.8 Should the Contractor fail to complete the Work, or any part thereof, in the time agreed upon in the Contract or within such extra time as may have been allowed for delays by extensions granted as provided in the Contract, the Contractor shall reimburse the Owner for the additional expense and damage for each calendar day that the Contract remains uncompleted after the Contract completion date. It is agreed that the amount of such additional expense and damage incurred by reason of failure to complete the Work is the per diem rate, as stipulated in Section 15, Information For Bidders, plus any costs incurred by the Engineer including, but not limited to: the Engineer's costs for additional inspection, testing or surveying as a result of the Contractor's failure to complete the Work in the time agreed upon. The said amounts are agreed upon as liquidated damages for the loss to the Owner on account of expense due to the employment of Engineers, inspectors, and other employees after the expiration of the time of completion, and on account of the value of the operation of the Works dependent thereon. It is expressly understood and agreed that this amount is not to be considered in the nature of a penalty, but as liquidated damages which have accrued against the Contractor. The Owner shall have the right to deduct such damages from any amount due, or that may become due the Contractor, or the amount of such damages shall be due and collectible from the Contractor or its Surety.

17.9 The Contractor shall not be charged with liquidated damages or any excess costs when the delay in completion of the Work is due to any of the reasons set forth below provided the Contractor has given Written Notice of the delay within three (3) days of the occurrence of the cause of the delay to the Owner or Engineer. In the event notice is not given as provided, liquidated damages may be assessed.

A. To unforeseeable causes beyond the control and without the fault or negligence of the Contractor, including but not restricted to: acts of God, or of the public enemy, acts of the Owner, acts of another Contractor in the performance of a separate contract with the Owner, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather.

18.0 CORRECTION OF WORK

18.1 The Contractor shall promptly correct all work rejected by the engineer as defective or as failing to conform to the contract documents, whether observed before or after substantial completion and whether or not fabricated, installed or completed. Contractor shall bear all costs of correcting such rejected work, including compensation for the engineer's additional services made necessary thereby. Contractor shall also bear the costs of making good all work of the Owner or separate Contractor destroyed or damaged by such correction or removal.

18.2 All removal and replacement work shall be done at the Contractor's expense. If the Contractor does not take action to remove such rejected work within ten (10) days after receipt of Written Notice, the Owner may remove such work and store the materials at the expense of the Contractor, including compensation for the engineer's additional services made necessary thereby.

19.0 SUBSURFACE CONDITIONS

19.1 The Contractor shall promptly, and before such conditions are disturbed, except in the event of an emergency, notify the Owner by Written Notice of:

- A. Subsurface or latent physical conditions at the site differing materially from those indicated in the Contract Documents; or
- B. Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in Work of the character provided for in the Contract Documents.

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

20.0 SUSPENSION OF WORK, TERMINATION AND DELAY

20.1 The Owner may suspend the Work or any portion thereof for a period of not more than ninety (90) days or such further time as agreed upon by the Contractor, by Written Notice to the Contractor and the Engineer which notice shall fix the date on which Work shall be resumed. The Contractor shall resume that Work on the date so fixed. The Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to any suspension.

20.2 In addition to any other reasons for termination provided in the Contract, the Contractor shall be considered in default of the Contract and such default will be considered as cause for the Owner to terminate the Contract for any of the following reasons if the Contractor:

- A. Fails to begin the Work under the Contract within the time specified in the "Notice To Proceed," or
- B. Fails to perform the Work or fails to provide sufficient workers, equipment or materials to assure completion of Work in accordance with the terms of the Contract, or

- C. Performs the Work unsuitably or neglects or refuses to remove materials or to perform such new Work as may be rejected as unacceptable and unsuitable, or
- D. Discontinues the prosecution of the Work, or
- E. Fails to resume Work which has been discontinued within a reasonable time after notice to do so, or
- F. Becomes insolvent or is declared bankrupt, or commits any act of bankruptcy or insolvency, or
- G. Allows any final judgment to stand against him unsatisfied for a period of 10 days, or
- H. Makes an assignment for the benefit of creditors, or acceptable manner, or
- I. Is otherwise in breach of the Contract and has failed to remedy the breach within ten (10) days of written notice of the existence of such breach, or
- J. Fails to provide safe conditions for its workers and/or the general public.

Should the Owner consider the Contractor in default of the Contract for any reason above, he shall immediately give Written Notice to the Contractor and the Contractor's surety as to the reasons for considering the Contractor in default and the Owner's intentions to terminate the Contract.

If the Contractor or Surety, within a period of 10 days after Written Notice, does not proceed in accordance therewith, then the Owner shall have, upon written notification of the facts of such delay or neglect, the power and authority without violating the Contract, to take the prosecution of the Work out of the hands of the Contractor. The Owner may appropriate or use any or all materials and equipment that have been mobilized for use in the Work and are acceptable and may enter into an Contract for the completion of said Contract according to the terms and provisions thereof, or use such other methods as in the opinion of the Owner will be required for the completion of said Contract in an acceptable manner.

All costs and charges incurred by the Owner, together with the cost of completing the Work under Contract, will be deducted from any monies due or which may come due the Contractor. If such expense exceeds the sum which would have been payable under the Contract, then the Contractor and the Surety shall pay to the Owner the amount of such excess.

20.3 Where Contractor's services have been so terminated by Owner, the termination will not affect any rights or remedies of Owner against Contractor then existing or which may thereafter accrue. Any retention or payment of monies due Contractor by Owner will not release Contractor from liability.

20.4 Upon seven days Written Notice to Contractor and Engineer, Owner may, without cause and without prejudice to any other right or remedy of Owner, elect to terminate the Contract. In such case, Contractor shall be paid (without duplication of any items):

20.4.1 for completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such work;

20.4.2 for expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead on such expenses;

20.4.3 for reasonable costs incurred in settlement of terminated contracts with Subcontractors, Suppliers and others; and

20.4.4 for reasonable expenses directly attributable to termination.

Contractor shall not be paid on account of loss of anticipated profits or revenue or other economic loss arising out of or resulting from such termination.

20.5 If the Work should be stopped under an order of any court or other public authority for a period of more than ninety (90) days, through no act or fault of the Contractor or of anyone employed by him, or if the Owner should fail to pay the Contractor within 45 days after the time specified in the Payments To Contractor, Section 22.0, then the Contractor may, upon 15 days Written Notice to the Owner, stop Work until payment of the amount owing has been received.

20.6 The Owner may terminate the Contract or a portion thereof if conditions encountered during the progress of the Work make it impossible or impracticable to proceed with the Work or a local or national emergency exists.

When Contracts, or any portion thereof, are terminated before completion of all Work in the Contract, adjustments in the amount bid for the pay items will be made on the actual quantity of Work performed and accepted, or as mutually agreed for pay items of Work partially completed or not started. No claim for loss of anticipated profits will be considered.

Termination of the Contract or any portion thereof shall not relieve the Contractor of its responsibilities for the completed work nor the surety of its obligation for and concerning any just claims arising out of the Work performed.

21.0 ISSUANCE OF NOTICE OF COMPLETION AND FINAL ACCEPTANCE BY OWNER

21.1 Upon completion of the Project, a Final Inspection shall be requested by the Contractor in writing and the Owner will make an inspection within seven (7) days. If all construction provided for and contemplated by the contract is found completed to his satisfaction, that inspection shall constitute the final inspection and the Owner will make the final acceptance and issue a Certificate Of Completion to the Contractor.

If, however, the inspection discloses any Work, in whole or in part, as being unsatisfactory, the Owner will give the Contractor the necessary instructions for correction of same, and the Contractor shall immediately comply with and execute such instructions. Upon correction of the Work, another inspection will be made which shall constitute the final inspection provided the Work has been satisfactorily completed. In such event, the Owner will make the final acceptance and issue a Certificate Of Completion to the Contractor.

22.0 PAYMENTS TO CONTRACTOR

22.1 In addition to any documents required by the Engineer to be submitted to Engineer at the time a partial pay estimate is submitted, including partial lien released as specified in Section 22.9 of the General Conditions, the Contractor shall, at least ten (10) days before each progress payment falls due (but not more often than once a month), submit to the Engineer a partial payment estimate filled out and signed by the Contractor covering the Work performed during the period covered by the partial payment estimate and supported by such data as the Engineer may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the Work, title to such materials and equipment shall vest in the Owner, and Contractor shall supply, at the time of submission of payment estimate, supporting documents satisfactory to the Owner, to establish and protect Owner's interest in the materials and equipment, and Contractor shall maintain appropriate insurance on same until such time as actual possession by the Owner of the materials and equipment shall occur. The Engineer will, within seven (7) days after receipt of each partial payment estimate, either indicate in writing his approval of payment and present the partial payment estimate to the Owner or return the partial payment estimate to the Contractor indicating in writing his reasons for refusing to approve payment. In the latter case, the Contractor may make the necessary corrections and resubmit the partial payment estimate. The Owner will, within fourteen (14) days of presentation to him of an approved partial payment estimate, pay the Contractor a progress payment on the basis of the approved partial payment estimate. The Owner shall retain ten (10) percent of the amount of each payment until final completion and acceptance of all Work covered by the Contract Documents. When the Contract is fifty percent completed, one-half of the amount retained shall be paid to the Contractor provided the Contractor makes a written request for the payment and the Contractor is making satisfactory progress on the Contract and there is no specific cause or claim requiring a greater amount to be retained. After the Contract is fifty per cent completed, no more than five per cent of the amount of any subsequent progress payments made under the Contract may be retained providing the Contractor is making satisfactory progress on the project, except that if at any time the Owner determines satisfactory progress is not being made, ten per cent retention shall be reinstated for all progress payments made under the Contract subsequent to the determination.

22.2 In lieu of ten percent (10%) retention provided for in paragraph 22.1, of this Article, the Owner shall, at the Contractor's option, accept as a substitute an assignment of any of the following:

- A. Time certificates of deposit of banks licensed by the State of Arizona; or

- B. Securities of or guaranteed by the United States of America; or
- C. Securities of the State of Arizona, or any county, municipality or school district thereof; or
- D. Shares of savings and loan institutions authorized to transact business in the State of Arizona.

Such assigned instruments shall have a face value in an amount equal to ten percent (10%) of the progress payment for which such instruments are tendered and shall be retained by the Owner as a guarantee for complete performance of the Contract.

In the event the Owner accepts substitute security as provided herein for the ten percent (10%) retention, the Contractor shall be entitled to all interest or income earned by such security, and all such security in lieu of retention shall be returned to the Contractor within sixty (60) days after final completion and acceptance of all material, equipment and work covered by the contract if the Contractor has furnished the Owner satisfactory receipts for all labor and material billed and waivers of liens from any and all persons holding claims against the work.

In no event shall the Owner accept a time certificate of deposit of a bank or shares of a savings and loan institution in lieu of the retention specified in paragraph 22.1 of this Article unless accompanied by a signed and acknowledged waiver of the bank or savings and loan institution of any right or power to set off against either the Owner or the Contractor in relationship to the certificates or shares assigned.

22.3 The Contractor shall promptly pay each Subcontractor, upon receipt of payment from the Owner out of the amount paid to the Contractor on account of such Subcontractors' Work, the amount to which said Subcontractor is entitled, reflecting the percentage actually retained, if any, from payments to the Contractor on account of such Subcontractors' Work. The Contractor shall, by an appropriate Contract with each Subcontractor, require each Subcontractor to make payments to his Sub-subcontractors in similar manner.

22.4 Prior to Substantial Completion, the Owner, with the approval of the Engineer and with the concurrence of the Contractor, may use any completed or substantially completed portions of the Work. Such use shall not constitute an acceptance of such portions of the Work.

22.5 The Owner shall have the right to enter the premises for the purpose of doing Work not covered by the Contract Documents. This provision shall not be construed as relieving the Contractor of the sole responsibility for the care and protection of the Work, or the restoration of any damaged Work except such as may be caused by agents or employees of the Owner.

22.6 Upon final completion and acceptance of the Work, the Engineer shall issue a certificate attached to the final payment request that the Work has been accepted under the conditions of the Contract Documents. No retention of payments may be delayed or retained without a specific written finding by the Engineer or Owner of the reasons justifying the delay in payment. The entire balance found to be due the Contractor, including the retained percentages, except the

amount necessary to pay the expenses the Owner reasonably expected to incur in order to pay or discharge the expenses determined by the Engineer or Owner in the finding justifying the retention or delay, shall be paid to the Contractor, within sixty (60) days of completion or proper filing of the Notice of Completion.

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

22.8 If any payment to Contractor is delayed after the date due, interest shall be paid at the rate of one percent per month or fraction of a month on such unpaid balance as may be due. If the Owner fails to make payment sixty (60) days after final completion and acceptance, in addition to other remedies available to the Contractor, interest shall be paid at the rate of one per cent per month or fraction of the month on such unpaid balance as may be due, except for that amount necessary to pay the expenses the Owner reasonably expects to incur in order to pay or discharge the expense determined by the Engineer or Owner in the finding justifying the retention or delay.

22.9 The Owner may require the Contractor to furnish partial releases or liens executed by all persons, firms and corporations who have furnished labor services or materials incorporated into the Work during the period of time for which the progress payment is due, releasing such lien rights as these persons, firms or corporations may have for that period.

23.0 ACCEPTANCE OF FINAL PAYMENT AS RELEASE

23.1 Following the Owner's acceptance of the Work, the Owner will issue a Notice of Completion to the Contractor. Sixty days after the issuing of the Notice of Completion, and upon receipt of the necessary Unconditional lien releases executed by all persons, firms and corporations who have furnished labor services or materials incorporated into the work evidencing that all liabilities have been fully discharged, the Owner will pay to the Contractor the entire sum so found to be due after deducting therefrom all previous payments and all amounts to be kept and all amounts to be retained under the provisions of the Contract. All previous prior partial estimates and payments shall be subject to correction in the final estimate and payment.

23.2 The acceptance by the Contractor of final payment shall be and shall operate as a release to the Owner of all claims and all liability to the Contractor other than claims in stated amounts as may be specifically excepted by the Contractor for all things done or furnished in connection with this Work and for every act and neglect of the Owner and others relating to or arising out of this Work. Any payment, however, final or otherwise, shall not release the Contractor or his sureties from any obligations under the Contract Documents or the Performance Bond and Payment Bonds.

24.0 INSURANCE

24.1 The Contractor shall give special attention to Section 00500-A of the Bid Documents when preparing a bid, which outline the insurance requirements of Owner and the Contractor shall consider these insurance requirements part of the Bid/Contract documents.

The Contractor shall purchase and maintain such insurance as will protect him from claims set forth below which may arise out of or result from the Contractor's execution of the Work, whether such execution be by itself or by any Subcontractor or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

- A. Claims under worker's compensation, disability benefit and other similar employee benefit acts;
- B. Claims for damages because of bodily injury, occupational sickness or disease, or death of his employees;
- C. Claims for damages because of bodily injury, sickness or disease, or death of any person other than his employees;
- D. Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the Contractor, or (2) by any other person; and
- E. Claims for damages because of injury to or destruction of tangible property, including loss of use resulting therefrom.

The Contractor is responsible to respond to claims arising as a result of its work. See Section 500-B for specific procedures.

24.2 Certificates of Insurance acceptable to the Owner shall be filed with the Owner prior to commencement of the Work. These Certificates shall contain a provision that coverages afforded under the policies will not be canceled unless at least ten (10) days prior Written Notice has been given to the Owner, "Attention: Contract Administrator, 2330 McCulloch Boulevard North, Lake Havasu City, AZ, 86403".

24.3 The Contractor shall procure and maintain, at its own expense, during the Contract Time,

liability insurance as specified in Section 500-A, incorporated herein.

25.0 CONTRACT SECURITY

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

26.0 ASSIGNMENTS

26.1 Neither the Contractor nor the Owner shall sell, transfer, assign or otherwise dispose of the Contract or any portion thereof, or of his right, title or interest therein, or his obligations thereunder, without written consent of the other party. Nor shall the Contractor assign any monies due or to become due to him hereunder without the previous written consent of the Owner.

26.2 The Owner and Contractor each bind itself, its partners, successors and assigns and legal representatives to the other party hereto and to the partners, successors, assigns and legal representatives of such other party in respect to all covenants, Contracts and obligations contained in the Contract Documents.

27.0 INDEMNIFICATION

27.1 Contractor shall indemnify and hold harmless City, its officers and employees from and against any and all liabilities, damages, losses, and costs, including reasonable attorney's fees, but only to the extent caused by the negligence, recklessness, or intentional wrongful conduct of Contractor or other persons employed or used by the Contractor in the performance of this Contract. It is agreed that Contractor will be responsible for primary loss investigation, defense, and judgment costs where this indemnification is applicable.

27.2 In any and all claims against the Owner or the Engineer, or any of their agents or employees, by any employee of the Contractor, any Subcontractor, anyone directly or indirectly

employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation of benefits payable by or for the Contractor or any Subcontractor under worker's compensation acts, disability benefit acts or other employee benefits acts.

27.3 The obligation of the Contractor under this paragraph shall not extend to the liability of the Engineer, his agents or employees arising out of the preparation or approval of maps, DRAWINGS, opinions, reports, surveys, Change Orders, designs or Specifications.

28.0 SEPARATE CONTRACTS

28.1 The Owner reserves the right to let other contracts in connection with this Project. The Contractor shall afford other Contractors reasonable opportunity for the introduction and storage of their materials and the execution of their Work, and shall properly connect and coordinate its Work with theirs. If the proper execution or results of any part of the Contractor's Work depends upon the Work of any other Contractor, the Contractor shall inspect and promptly report to the Engineer any defects in such Work that render it unsuitable for such proper execution and results.

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

28.3 If the performance of additional Work by other Contractors or the Owner is not noted in the Contract Documents prior to the execution of the Contract, written notice thereof shall be given to the Contractor prior to starting any such additional Work. If the Contractor believes that the performance of such additional Work by the Owner or others involves it in additional expense or entitles him to an extension of the Contract Time, it may make a claim therefore as provided in Sections 16 and 17.

29.0 SUBCONTRACTING

29.1 The Contractor may utilize the services of specialty Subcontractors on those parts of the Work which come under normal contracting practices or are typically performed by specialty Subcontractors, provided the Contractor, simultaneously with the delivery of the executed Contract, shall furnish to the Owner and the Engineer in writing the names of the persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for each of the principal portions of the Work. The engineer will promptly reply to the Contractor in writing stating whether or not the Owner or the Engineer, after due investigation, has reasonable objection to any such proposed person or entity. Failure of the Owner or Engineer to promptly reply shall constitute notice of no reasonable objection. The Contractor shall not contract with any such proposed person or entity to whom the Owner or Engineer has made reasonable objection and the Contractor shall not be required to contract with anyone to whom he has a reasonable objection. If the Owner or Engineer has a reasonable objection to any

proposed person or entity, the Contractor shall submit a substitute to whom the Owner or the Engineer has no reasonable objection. The Contractor shall make no substitution for any Subcontractor, person or entity previously selected if the Owner or Engineer makes reasonable objection to such substitution.

29.2 The Contractor shall not award Work to Subcontractor(s), in excess of forty-nine (49%) percent of the Contract Price, without prior written approval of the Owner.

29.3 The Contractor shall be fully responsible to the Owner for the acts and omissions of its Subcontractors, and of persons either directly or indirectly employed by them, as it is for the acts and omissions of persons directly employed by it.

29.4 The Contractor shall not employ any Subcontractors that are not properly licensed with Lake Havasu City and the State of Arizona. Changes of Subcontractors listed with the Proposal shall be made only with the approval of the Owner.

29.5 Nothing contained in these Contract Documents shall be construed as creating any contractual relationship between any Subcontractor and the Owner; the Contractor shall be as fully responsible to the Owner for the acts and omissions of Subcontractors, and of persons employed by them, as he is for the acts and omissions of persons directly employed by him.

29.6 The Contractor shall, without additional expense to the Owner, utilize the services of specialty Subcontractors on those parts of the Work which are specified or required by State or local laws to be performed by specialty Subcontractors.

29.7 The Contractor shall be responsible for the coordination of all trades, Subcontractors, material and people engaged upon this Work. The Owner will not undertake to settle any differences between the Contractor and his Subcontractors or between Subcontractors.

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

29.9 Nothing contained in this Contract shall create any contractual relation between any Subcontractor and the Owner.

30.0 ENGINEER'S AUTHORITY

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

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

30.3 The Engineer shall not be responsible for the construction means, controls, techniques, sequences, procedures, or construction safety precautions and programs in connection with the Work and will not be responsible for the Contractor's failure to carry out the Work in accordance with the Contract Documents. The Engineer shall not be responsible or have control or charge over the acts or omissions of the Subcontractors, or any of their agents or employees, or any other person performing any of the Work.

30.4 The Engineer shall promptly make decisions relative to interpretation of the Contract Documents.

30.5 The Engineer will have the authority to reject Work which does not conform to the Contract Documents. Whenever, in its opinion, it is considered necessary or advisable for the implementation of the intent of the Contract Documents, the Engineer will have authority to require special inspection or testing of the Work in accordance with the other terms of this Contract whether or not such Work be then fabricated, installed or completed.

31.0 LAND AND RIGHTS-OF-WAY

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

31.2 The Owner shall provide to the Contractor information which delineates and describes the lands owned and rights-of-way acquired.

31.3 The Contractor shall provide at its own expense and without liability to the Owner any additional land and access thereto that the Contractor may desire for temporary construction facilities, or for storage of materials.

32.0 GUARANTEE

32.1 Except as otherwise specified, all Work shall be guaranteed by the Contractor against defects resulting from the use of inferior materials, equipment, or workmanship for a period of one (1) year from the date the Certificate of Substantial Completion is issued by the Owner, or within such longer period of time as may be prescribed by law or by the terms of any applicable special guarantee required by the Contract Documents.

32.2 If, within any guarantee period, repairs or changes are required in connection with guaranteed Work, which, in the opinion of the Owner, is rendered necessary as the result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, the Contractor shall, promptly upon receipt of notice from the Owner, and without expense, (1) place in satisfactory condition in every

particular all of such guaranteed Work, correcting all defects therein; (2) make good all damage to the building, site or Work, or equipment or contents thereof, which in the opinion of the Owner, is the result of the use of materials, equipment, or workmanship which are inferior, defective, or not in accordance with the terms of the contract; and (3) make good any Work or material, or the equipment and contents of said building, site or Work disturbed in fulfilling any such guarantee. If the Contractor, after notice, fails to proceed promptly to comply with the terms of the guarantee, the Owner may have the defects corrected and the Contractor and his surety shall be liable for all expense incurred. The Performance Bond shall remain in full force and effect through the guarantee period.

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GUARANTEE

32.3 The Contractor agrees to execute, and to cause each Subcontractor to execute, a written guarantee to the Owner, in substantially the following form:

GUARANTEE FOR:

We hereby guarantee, both jointly and severally, that the improvement which we have installed for the Owner of Project, specifically described as:

City Fueling Facilities Improvements Rebid, Project No. B24-PW-101010-500430

Rebid has been done in accordance with the Contract Drawings and Specifications.

We agree, both jointly and severally, to repair and replace any or all Work included in said improvement, together with any other adjacent work which may be displaced or damaged by so doing, that may prove to be defective in its workmanship or material within a period of one year from date of the Certificate of Substantial Completion, ordinary wear and tear and unusual abuse or neglect accepted.

In the event of our failure to comply with the above mentioned conditions within a reasonable period of time (as determined by the Owner) after being notified in writing by the Owner, we both jointly and severally, do hereby authorize the Owner to proceed to have said defects repaired and made good at our expense, and we will honor and pay the costs and charges therefore upon demand.

Signed _____

Countersigned _____

Local Representative to be contacted for service:

Name _____

Address _____

Phone No. _____

FAX _____

The guarantee form(s) shall be completed and returned with the acknowledgement of the Certificate of Completion.

The failure of the Contractor or any Subcontractor to execute, such guarantee shall not affect the right of the Owner to rely on and enforce the guarantee and the obligations respectively assumed by the Contractor and each Subcontractor under Subparagraph 32.1 and 32.2 hereof.

33.0 ARBITRATION

33.1 Provided both parties mutually agree, all claims, disputes and other matters in question arising out of, or relating to, the Contract Documents or the breach thereof, except for claims which have been waived by the making and acceptance of final payment as provided by Section 23, may be decided by arbitration in accordance with the American Arbitration Association or any other similar body. The foregoing Contract to arbitrate shall be specifically enforceable under the prevailing arbitration law (Arizona Revised Statutes Sections 12-1501, *et seq.*) of the State of Arizona. The award rendered by the arbitrators shall be final, and judgment may be entered upon it in any court having jurisdiction thereof.

33.2 Notice of the demand for arbitration shall be filed in writing with the other party to the Contract Documents and with the American Arbitration Association and a copy shall be filed with the Engineer. The party filing for arbitration may select which arbitration service to use. Demand for arbitration shall in no event be made on any claim, dispute or other matter in question which would be barred by the applicable statute of limitations.

33.3 The Contractor shall carry on the Work and maintain the progress schedule during any arbitration proceedings, unless otherwise mutually agreed in writing.

33.4 The provisions of the Contract pertaining to arbitration are not binding upon Engineer and Engineer cannot be compelled to participate against his will in an arbitration arising out of a dispute over the Contract or Contract Documents unless Engineer so consents in writing to be a party to the arbitration.

34.0 TAXES AND CHARGES

34.1 The Contractor shall pay all State and local sales and use taxes on items, and in a manner as required by the laws and statutes of the State of Arizona and its political subdivisions. The Contractor shall withhold and pay any and all withholding taxes, whether State or Federal, and pay all Social Security charges, State Unemployment Compensation charges, industrial insurance, workers' compensation charges, and pay or cause to be withheld, as the case may be, any and all taxes, charges, or fees, or sums whatsoever, which are now or may hereafter be required to be paid or withheld under any laws.

35.0 MISCELLANEOUS CONDITIONS

35.1 In the event that either party to the Contract is required to institute arbitration or litigation

to enforce its rights under the terms of the Contract, then the prevailing party in the arbitration or litigation shall be entitled to recover all costs and attorney's fees incurred.

35.2 In the event that any provision contained in the Contract is found to be contrary to the applicable law, then it shall be severed and the remaining provisions of the Contract shall remain in full force and effect.

35.3 The Contract shall be governed by the laws of the State of Arizona.

36.0 CONFLICTS WITHIN THE PLANS OR SPECIFICATIONS

36.1 In the event that a conflict is discovered between sections of the Specifications or between the Plans and the Specifications, the following list of priority shall be used to resolve the conflict:

- A. Executed Change Orders
- B. Addenda
- C. Contract
- D. Special Provisions
- E. General Conditions
- F. Instructions to Bidders
- G. Technical Specifications
- H. Plans
- I. Referenced Standard Specifications or Other Documents

37.0 NONDISCRIMINATION

37.1 The Contractor, with regard to the work performed pursuant to this contract, shall not discriminate on the grounds of race, color, sex, religion, creed, age, physical or mental disability, or national origin or ancestry in any contracts with the public and in the selection and retention of employees or subcontractors, nor in the procurement of materials and leases of equipment.

38.0 INTEGRATION

38.1 This Contract represents the entire Contract between the parties hereto and supersedes any and all prior negotiations or representations, either written or oral.

38.2 Amendments or modifications to the Contract shall be in writing, signed by both parties, or by Change Orders.

38.3 The Contract Documents shall not be construed to create any contractual relationship of any kind between the Engineer and the Contractor, but the Engineer shall be entitled to performance of obligations intended for his benefit, and to the enforcement thereof.

39.0 HAZARD COMMUNICATION PROGRAM

39.1 All contractors working on City projects shall submit a copy of their hazard communication

plan to the Fire Prevention Office prior to commencement of work on any project. This will ensure that other individuals on the job site are not unknowingly exposed to a hazardous substance or chemical.

The Fire Prevention Office shall be provided a list of the hazardous substances and the material safety data sheets that are applicable to the work areas of those contract employees.

All contract labor within City facilities will be treated the same as regular employees with regard to this hazard communication standard.

**** END OF SECTION ****

SECTION 00800
SPECIAL PROVISIONS

1.0 SCOPE

These Special Provisions supplement and modify the General Conditions, Technical Specifications, and Plans. All requirements and provisions of the General Conditions, Technical Specifications and Plans apply except where modified by these Special Provisions.

2.0 DEFINITION OF TERMS

Wherever in these documents the word "OWNER" appears, it shall be understood to mean Lake Havasu City, Arizona, the governing body of which is the City Council. Wherever in these documents the word "CONTRACTOR" appears, it shall be understood to mean the party or parties contracting with the Owner to perform the Work. Wherever in these documents the word "ENGINEER" appears, it shall be understood to mean Lake Havasu City Public Works Department, Engineering Division, or their appointed representative.

3.0 PRECONSTRUCTION CONFERENCE

Within ten (10) days after the contract has been awarded, but before the start of construction, the ENGINEER will schedule a conference to be held at the site of the project for the purpose of discussing such matters as project supervision, onsite inspections, progress schedules and reports, payrolls, payments to Contractors, equal employment opportunity, contract change orders, insurance, safety, and any other items pertinent to the project. The Contractor shall arrange to have all supervisory personnel connected with the project on hand to meet with the representatives of the Owner and the Engineer.

4.0 DRAWINGS OF RECORD

Two sets of the Contract Documents are to be kept at the job site, maintained in good condition, and marked daily by the Contractor as the work proceeds. The Contract Documents shall be kept available for inspection by the OWNER at all times, and shall be kept up to date.

5.0 SURVEYS

The CONTRACTOR shall layout the WORK, in accordance with the drawings, shall establish all necessary lines, etc., required to complete the work in accordance with the Contract Documents. The CONTRACTOR shall employ an experienced and competent Arizona Registered Land Surveyor (R.L.S.) satisfactory to the OWNER to layout the WORK and to verify lines and elevations as the WORK progresses.

6.0 WEATHER CONDITIONS

In the event of temporary suspension of work, or during inclement weather, or whenever the OWNER shall direct, the Contractor will and will cause his Subcontractors to protect carefully his

and their work and materials against damage or injury from the weather. If, in the opinion of the OWNER, any work or materials shall have been damaged or injured by reason of failure on the part of the Contractor or any of his subcontractors to so protect his work, such materials shall be removed and replaced at the expense of the Contractor.

7.0 SUBMITTALS

Prior to construction and as soon as possible, the Contractor shall supply all submittals required by the Technical Specifications or as requested by the Owner.

8.0 INSPECTION OF THE WORK

The Owner intends to provide a resident inspector for the project. The resident inspector will be available during the Contractors working time throughout the period of the Contract.

9.0 WATER AND POWER

A. WATER

Water is available from the Water Department at no cost to the Contractor. The Contractor shall make application and obtain a hydrant meter from the Water Department for the purpose of metering the use of water on the project. The Contractor shall adhere to all conditions stated in the Meter Application, including payment of a deposit for the meter, return of the meter to the Water Department each month during the project for reading, and notification to the Water Department prior to any change in the location of the hydrant meter. The maximum water to be drawn off a hydrant at any time is 200 gpm (water drawn from 4" hydrant whenever available). Water shall only be drawn off hydrants approved by the Lake Havasu City Water Superintendent or his authorized representative.

B. POWER

All power for lighting, operation of Contractor's plant or equipment or for any other use as may be required for proper completion of the work to be performed under the provisions of these contract documents, shall be provided by the Contractor at his sole cost and expense.

10.0 BURNING OF VEGETATION

No burning of vegetation will be allowed.

11.0 MATERIALS TESTING

A. CONSTRUCTION TESTING

All quality control testing must be provided by CONTRACTOR. The material and workmanship provided during construction will be tested on a regular basis by the CONTRACTOR. It shall be the responsibility of the CONTRACTOR, at no additional cost, to provide material samples for testing at the **OWNER's** request.

The CONTRACTOR shall be responsible for charges resulting from failed tests, costs for retesting shall be based upon hourly and/or individual test rates. In the event any portion of the project is rejected because of substandard work, all materials testing, engineering, and inspection costs associated with corrective measures shall be chargeable to the CONTRACTOR at the current respective rates.

B. PRELIMINARY MATERIALS TESTING

All preliminary materials testing and mix design testing required by the specifications to ensure materials and mix designs are suitable for project use will be the responsibility of the CONTRACTOR at no additional cost to the OWNER.

12.0 CLEANUP AND POLLUTION CONTROL

A. GENERAL

The CONTRACTOR shall be responsible for the removal of all debris, litter and waste from the job site(s) and/or equipment maintenance area and the restoration of any and all areas affected, directly or indirectly by the construction, transportation of equipment or materials and/or by the acts of neglect or omission by his employees.

All debris, litter, etc., shall be disposed of in accordance with prevailing ordinance or law. Open burning of trash, debris, etc., will not be permitted.

Such clean-up operations shall be on a daily basis. All pavement, concrete, brush, rocks, excess materials, etc. accumulated or removed during the course of construction must be disposed of in those areas designated by the Engineer or his authorized representative, including but not limited to the Lake Havasu City Landfill. All costs for disposal, including gate or tipping fees, etc. are the responsibility of the Contractor. This material must be disposed of within ten (10) days of time of removal. If the areas in question are not cleaned up to the satisfaction of the ENGINEER, progress payments will be withheld until clean-up is completed and approved by the ENGINEER, or, in the case of private projects, other legal action will be taken.

B. TEMPORARY FACILITIES

The CONTRACTOR shall provide temporary mailboxes and traffic control signs where necessary until completion of backfilling and clean-up.

C. SOLID WASTES

All solid wastes shall be removed and disposed of in accordance with prevailing ordinance or law. Clean-up shall be completed on a daily basis. All costs for disposal shall be the responsibility of the Contractor, and shall be considered incidental to the costs of the various bid items.

All spilled paving material shall be removed and disposed of prior to final acceptance and payment.

D. MAINTENANCE AREAS

Maintenance areas shall be kept clean during construction and shall be free of litter at all times. All empty containers, debris, waste, etc., shall be removed and disposed of prior to final acceptance. Upon inspection by the ENGINEER, the CONTRACTOR may be required to dress the surface of the ground, dependent upon the extent of spillage of petroleum products on the surface. If so directed, such dressing shall consist of scarifying the surface to a depth of six (6) inches and moving and compacting the soil in such a way as to blend the spill areas into clean soil and restore the surface by partial compaction.

E. POLLUTION

The CONTRACTOR shall be held responsible for acts leading to pollution of water, air or land by any means.

Open burning of trash, debris, etc., will not be permitted anywhere in the City limits.

The discharge of any pollutants upon the surface of the ground, or into any stream, ravine, wash or body of water which may result in pollution of the public water supply, or of groundwater contributory thereto, will not be permitted.

Violation of these conditions will be cause for the termination of work, and possible legal action.

F. REMOVAL AND REPLACEMENT OF SIGNS, MAILBOXES, ETC.

It is the responsibility of the CONTRACTOR to remove all poles, etc. which are located within the construction area and replace at the time of backfilling and clean-up in the locations determined by the Water Superintendent. In the case of landscaping or other private items located in the construction area, the CONTRACTOR shall hand-deliver a written notice to all residences in that area stating his intentions to perform construction activities and shall do so at least five (5) working days prior to work commencing. If, at the time of construction these items are still in the construction area, the CONTRACTOR is to remove and dispose of them properly. All signs and mailboxes shall be permanently installed within forty-eight (48) hours of completion of construction activities.

G. NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) GENERAL PERMIT

At the time of the preconstruction conference, the contractor shall submit, for the Engineer's approval, a program which includes all the measures which the contractor proposes to take for the construction of permanent erosion control work specified in the contract and all the temporary control measures to prevent erosion and pollution of streams, lakes and reservoirs.

Permanent erosion control work and pollution prevention measures shall be performed at the earliest practicable time consistent with good construction practices. Temporary work and measures are not meant to be performed in lieu of permanent work specified in the contract.

Construction of drainage facilities as well as the performance of other contract work which will contribute to the control of erosion and sedimentation shall be carried out in conjunction with earthwork operations or as soon thereafter as possible.

Except for that approved in writing by the Engineer, the contractor shall perform no clearing and grubbing or earthwork until the contractor's program has been approved.

If in the opinion of the Engineer, clearing and grubbing, excavation, or other construction operations are likely to create an erosion problem because of the exposure of erodible earth material, the Engineer may limit the surface area to be disturbed until satisfactory control measures have been accomplished. Unless otherwise permitted by the Engineer, the contractor shall not expose an area of erodible earth material greater than 217,800 square feet at any one location.

The Engineer may order the contractor to provide immediate measures to control erosion and prevent pollution. Such measures may involve the construction of temporary berms, dikes, dams, sediment basins and slope drains; the use of temporary mulches, mats and seeds and the use of other devices, methods, items, etc., as necessary.

At any time the contractor proposes to change his/her schedule of operations, the contractor shall review and update his/her erosion and pollution control program and submit it to the Engineer for approval.

The contractor shall not be entitled to additional compensation or an extension of contract time for any delays to the work because of the contractor's failure to submit an acceptable erosion and pollution control program.

Erosion control and pollution prevention work specified in the contract which is to be accomplished under any of the various contract items will be paid for by the bid item. Any additional work required by the Owner will be paid for by the Force Account set up for this work.

The cost of any erosion control and pollution prevention work which may be proposed by the contractor in his/her program, in addition to that specified in the contract, will be

considered as included in the prices bid for contract items.

13.0 DUST CONTROL

It shall be the Contractor's responsibility to provide adequate water for dust control. It is imperative that the air quality standards are maintained. In addition, dust could be quite hazardous in the everyday operations. It shall be the Contractor's responsibility to ensure that all regulations for air quality and safety are met.

14.0 SUPERVISORY PERSONNEL

It is the intent of these Specifications to provide a completed project which will in every way reflect the work of competent journeyman mechanics in the various trades represented. The Contractor shall ensure that each portion of the work is supervised by a qualified person, well versed in the operation of the various tools required for the trade, the method in which the work is to be done, and a knowledge of the general requirements of the construction work. All work is to be done in accordance with the latest methods devised for such work to ensure the highest quality product.

15.0 SAFETY REQUIREMENTS

The Contractor shall comply with all pertinent provisions of the Department of Labor "Safety and Health Regulations for Construction" (29 CFR Part 1518, 36 CFR 7340), with additions or modifications thereto, in effect during construction of this project.

THE FOLLOWING MEASURES OR PROVISIONS ARE TO BE ADHERED TO AT ALL TIMES DURING THE CONSTRUCTION OF THIS PROJECT:

- A.** All heavy construction machinery to include trenching machines, bulldozers, backhoes, etc., must be equipped with a roll bar meeting the requirements of the above regulation.
- B.** Safety helmets will be worn by all personnel working at the site. In addition, all spectators and inspectors will be required to wear safety helmets in construction zone.
- C.** Steel toe safety shoes or boots will be worn by all personnel working at the site.

16.0 PRESERVATION OF BENCH MARKS AND MONUMENTS

The Contractor shall exercise caution to ensure that permanent bench marks, monuments, established property corners, survey lines, and points are not damaged or disturbed by this work. If any survey monuments, property corners, survey lines or points are damaged or disturbed, the Contractor's representative shall immediately notify the inspector. All centerline survey monumentation located in pavement removal areas shall be replaced by an Arizona Registered Land Surveyor (R.L.S.) after completion of the pavement removal and replacement operations. All costs incurred to re-establish such points shall be borne by the Contractor.

17.0 DISPOSAL OF EXCESS MATERIAL

Excess soil and unsuitable materials shall be removed from the site by the Contractor at his own expense and disposed of in accordance with the Contract Documents unless otherwise permitted herein. In the event the Contractor chooses to utilize local private lots to dispose of excess material, the Contractor must provide the Engineer with written permission from the lot owner prior to utilizing the lot. Placing material suitable for fill on vacant lots will require a Grading Permit in advance of placing the material.

18.0 REFERENCE STANDARD SPECIFICATIONS

Where standard specifications or testing methods have been referred to, such as ASTM or AASHTO, the intent is to refer to the latest applicable issue or revision of such specifications or testing methods. The following abbreviations are used in these specifications.

AWWA	American Waterworks Association
AASHTO	American Association of State Highway and Transportation Officials
ACI	American Concrete Institute
AI	Asphalt Institute
AISI	American Iron and Steel Institute
ANSI	American National Standards Institute (formerly the USA Standards Institute)
ASTM	American Society for Testing and Materials
API	American Petroleum Institute
NSF	National Sanitation Foundation
S.P.W.C.	Standard Specifications for Public Works Construction. (Wherever written herein shall mean "Maricopa Association of Governments, Arizona Specification for Public Works Construction".) The "Sample Forms" and "Part 100 – General Conditions" of these Standard Specifications for Public Works Construction are excluded from the documents for this project.

19.0 CODES, ORDINANCES AND LOCAL SPECIFICATIONS

All work under this project shall be performed in strict accordance with these specifications and the Standard Specifications for Public Works Construction (SPWC). Where any conflict occurs between these plans and specifications and the local codes and ordinances in effect at the time, such codes and ordinances shall take precedence over these plans and specifications only if these plans and specifications are inferior as to materials and workmanship called for by such codes

and ordinances.

20.0 INTERFERING STRUCTURES AND UTILITIES

The Contractor shall notify Blue Stake (1-800-782-5348) at least three (3) working days prior to any excavations.

The Contractor shall exercise all possible caution to prevent damage to existing structures and utilities, whether above ground or underground. The Contractor shall notify all utility offices concerned at least seventy-two (72) hours in advance of construction operations in which a utility's facilities may be involved.

Any structure or utility damage caused by the work shall be repaired or replaced in a condition equal to or better than the condition prior to the damage. Such repair or replacement shall be accomplished at the Contractor's expense without additional compensation from the Owner.

If interfering structures or installations such as vaults, manholes, valves, utility poles, guy wires, or anchors are encountered, the Contractor shall notify the Engineer and contact the appropriate utility or structure owner at least seven (7) days in advance of construction to arrange for protection or relocation of the structure.

The Contractor shall remove, protect and/or replace all existing structures, utilities or other improvements and similar items within the proposed improvements at his own expense without additional compensation from the Owner unless specifically provided for as a pay item of work by the Specifications or as otherwise provided for on the Plans. Replacement shall be in a manner and in a condition at least equivalent to, or better than, the original condition.

If the Contractor encounters existing facilities which will prevent the construction of any facility and which are not properly shown on the Plans, he shall notify the Owner before continuing with the construction in order that the Owner may make such field revisions as necessary to avoid conflict with the existing structure. The cost of waiting or "down" time during such field revision shall be borne by the Contractor without additional cost to the Owner. If the Contractor fails to notify the Owner when an existing structure is encountered, but proceeds with the construction despite this interference, he does so at his own risk. In particular, when the location of the new construction will prohibit the restoration of existing structures to their original condition; the Contractor shall notify the Engineer and contact the utility or structure owner so a field relocation may be made if possible to avoid the conflict.

In the event of interruption to any utility service as a result of accidental breakage or as a result of being exposed or unsupported, the Contractor shall promptly notify the proper authority. He shall cooperate with the said authority in restoration of service as promptly as possible and shall bear all costs of repair. In no case shall interruption of any utility service be allowed to exist outside working hours unless prior approval of the Owner is received.

Neither the Owner nor its officers or agents shall be responsible for damages to the Contractor as a result of the locations of the water and sewer lines or utilities being other than those shown

on the Plans or for the existence of water, sewer lines or utilities not shown on the Plans.

21.0 AIR QUALITY - OPERATING PERMITS

The Contractor may be required to obtain registration certificates and/or operating permits for sources of air pollution.

Information concerning these certificates and permits may be obtained from:

The Office of Air Quality
Arizona Department of Environmental Quality
P.O. Box 600
Phoenix, AZ 85001-0600
(602) 207-2300

22.0 ADJUST UTILITIES TO FINISHED GRADE

The Contractor shall be responsible for locating all manhole rims, valve boxes, meter boxes, utility vaults, etc., and setting them to finished grade. The Contractor shall adjust sewer and water facilities to finished grade in accordance with the specifications within seven (7) days after street surfacing has been completed on each street. All valves and/or manholes will be made visible and accessible for emergency use within 24 hours. It shall be the responsibility of the Contractor to coordinate with the various private utility companies so that they can adjust their facilities to finished grade at an appropriate time. Adjust all facilities in accordance with these specifications and the MAG Standard Details, as modified by Lake Havasu City.

23.0 SAFETY, HEALTH AND SANITATION PROVISIONS

The Contractor shall provide and maintain in a neat, sanitary condition such accommodations for the use of his employees as may be necessary to comply with the requirements and regulations of the Arizona State Department of Health.

The Contractor shall provide all safeguards, safety devices and protective equipment and take any other needed actions, on his own responsibility or as the Owner may determine, reasonably necessary to protect the life and health of employees on the job, the safety of the public and to protect property in connection with the performance of the work covered by the contract.

Precaution shall be exercised by the Contractor at all times for the protection of persons (including employees) and property. The Contractor shall comply with the provisions of all applicable laws, pertaining to such protection including all Federal and State occupational safety and health acts, and standards and regulations promulgated thereunder.

24.0 PUBLIC SAFETY AND TRAFFIC CONTROL

Every attempt shall be made to provide public safety during the construction of the project. Traffic control shall be performed in accordance with Section 2650, Traffic Control, of the Technical Specifications.

During all construction operations, the Contractor shall construct and maintain such facilities as may be required to provide access for all property owners to their property. No person shall be cut off from access to his residence or place of business for a period exceeding two (2) hours, unless the Contractor has made a special arrangement with the affected persons. It shall be the Contractor's responsibility to notify all adjacent property owners of the construction activity and the schedule of such activities.

The CONTRACTOR shall submit for approval a traffic control and barricade plan within ten (10) days of receipt of Notification of Award of Contract. There shall be no deviations from the approved barricade plan unless a revised barricade plan is submitted and approved. The CONTRACTOR shall issue a news release once a week for duration of the project. The release will be published in Sunday's newspaper and shall indicate the area in which the CONTRACTOR will be performing work for that week.

Businesses must be notified forty-eight (48) hours prior to any restrictions on normal parking areas used by their employees or patrons.

The CONTRACTOR shall contact, cooperate with, and give notice to each resident, homeowner, business or school that will be affected by any part of the construction process, particularly concerning temporary interruptions to vehicular access.

Written notice of the approximate schedule and explanation of work shall be given to each resident, homeowner, business or school at least five (5) days prior to commencement of work in the area. Verbal door-to-door communication shall be made at least twenty-four (24) hours prior to construction to remind all affected parties of the construction to take place.

The OWNER shall receive a copy of all notifications to residents. In the event of complaints by residents, the OWNER may require the CONTRACTOR to provide documentation (ie. check list) showing the date & time of the verbal door-to-door communication.

In addition, the CONTRACTOR is responsible to answer and resolve any conflicts that may arise between a homeowner or business owner and himself during the construction process.

The CONTRACTOR shall provide and station competent flaggers whose sole purpose shall be to direct the movement of public traffic through or around the work. Proper advanced

warning signs shall be in place when flaggers are working and removed when work requiring flaggers is completed. Flaggers must be used to assist trucks for safe ingress and egress whenever truck movements may interfere with safe passage through the work zone.

All traffic control devices that are not in use or will not be used for a period greater than 72 hours or that are determined by the Engineer to be unnecessary, confusing, or causing an unsafe condition, shall be removed by the CONTRACTOR from the public right-of-way immediately upon notification by the Engineer.

Every attempt shall be made to provide public safety during the construction of the project. Traffic control shall be performed in accordance with Section 2650, Traffic Control, of the Technical Specifications. No person shall be cut off from access to his residence or place of business for a period exceeding six (6) hours, unless the Contractor has made a special arrangement with the affected persons. In addition, no work will be scheduled which will interrupt regular trash pickup to either residential or commercial properties. It will be the CONTRACTOR'S responsibility to coordinate his activities with the local trash haulers.

No streets, avenues, boulevards or cul-de-sacs will be closed to traffic unless prior arrangements have been made and approval has been obtained from the ENGINEER.

25.0 TEMPORARY FACILITIES ON SITE

A. General

Except as otherwise provided, the Owner shall bear no costs of temporary facilities and their removal.

B. Temporary Utility Services

The Contractor shall provide temporary electric power as necessary for the execution of the Work, including that required by all Subcontractors. He shall make the necessary arrangements with Owner, shall bear all costs for these temporary services and shall furnish and install all necessary transformers, metering facilities and distribution centers from branch circuits as he may require.

The Contractor shall provide lighting and outlets in temporary structures throughout the project as may be required for safety, proper performance and inspection of the Work. If operations are performed during hours of darkness, or if natural lighting is deemed insufficient by Owner, the Contractor shall provide adequate floodlights, clusters and spot illumination. The use of permanently installed lighting fixtures, lamps and tubes for work will not be permitted except by special permission of Owner. The Contractor shall make arrangements with

Subcontractors for electrical services and lighting as may be necessary in the performance of their work.

Temporary water service lines, if required, shall be installed and removed by the Contractor, who shall pay all charges for making the connections, running the temporary lines, removing the temporary lines at the completion of the Work and disconnecting the services. All relocations required to clear the work of others shall be performed by the Contractor when requested by the Owner.

C. Temporary Structures

Prior to starting Work, the Contractor shall, as directed by Owner, provide and maintain suitable temporary office facilities for the duration of the Project as required for the Contractor's project administration; and all necessary sheds and facilities for the proper storage of tools, materials and equipment employed in the performance of the Work.

D. Toilet Facilities

The Contractor shall provide and maintain temporary toilet facilities for the duration of operations, which shall be maintained in a clean and sanitary condition acceptable to Owner and in full compliance with applicable regulations of any public authority.

E. Telephones

The Contractor shall provide, maintain and pay for telephone services for the duration of the Work as required for the Contractor's operation.

F. Fence and Barricades

The Contractor shall provide such protective fences and barricades as he may deem necessary for public safety and to protect his storage areas and the Work in place. The location and appearance of all fences shall be subject to the approval of the Owner.

G. Contractor Parking

The Contractor shall not park his equipment, nor allow his personnel to park, in any area except those specifically designated by the Owner.

H. Temporary Living Quarters

Temporary living quarters shall not be allowed on the job site or on publicly owned

properties. In addition, all Lake Havasu City Zoning Codes for the area in question shall be strictly adhered to.

I. Removal of Temporary Construction

The Contractor shall remove temporary office facilities, toilets, storage sheds and other temporary construction from the site as soon as, in Owner's opinion, the progress of Work permits. He shall recondition and restore those portions of the site occupied by the same to a condition equal to or better than it was prior to construction.

26.0 ACCESS TO WASHES

- A.** Unless otherwise mentioned herein, the Contractor must obtain written permission from the Owner prior to gaining access or utilizing washes or City parcels for any purpose. Request for access to washes and City parcels will be reviewed on a case by case basis. The Contractor shall have access to washes and City parcels via public streets and/or private easements only. For the purposes of this paragraph, "private easement" means an Contract by and between the Contractor and a property owner, in writing, authorizing the Contractor to travel across the property owner's real property in order to have ingress or egress to washes, parcels or any portion thereof. Such Contracts, if any, shall be filed with the Office of the City Engineer before the Contractor may exercise the rights thereunder granted. Access to any wash, parcels, or portion thereof by any means not in compliance with the terms of this paragraph shall be deemed a trespass and a breach of the terms of the Contract.
- B.** Violations of the provisions of subparagraph (a.) hereof, shall entitle the City to deduct the sum of One Thousand Dollars (\$1,000.00) from the monies due to Contractor as and for liquidated damages for each such violation. For the purposes of this paragraph, each entry by a vehicle upon land for which Contractor has not received permission to enter shall be deemed a separate violation of subparagraph (a.) hereof.

27.0 COORDINATION AND COOPERATION WITH UTILITY COMPANIES AND OTHER TRADES

A. Coordination/Interruption

The Contractor is responsible to coordinate work with all utility companies and other trades, on or affecting the job, for an efficient and effective execution of the complete project. The Contractor shall carefully examine all work that may conflict, and plan removal and/or installation details in advance of the construction to avoid any such conflict. Failure on the contractor's part to coordinate with any

and all utilities, public or private, shall preclude the City's consideration for additional time or cost.

B. Permission Required

Utility mains and utility service to buildings shall not be cut off or otherwise interrupted without the Contractor obtaining permission from the Owner in each and every instance.

C. Scheduling of Interruptions

Where utilities serve facilities or buildings in use, interruptions in service shall be scheduled during the hours when the facility is not in operation. Any overtime costs occasioned thereby shall be regarded as incidental to, and included within, the Contract Sum.

D. General Requirements

Prior to interrupting any utility service, the Contractor shall ascertain that he has the proper materials, together with adequate workmen and equipment, to complete the Work with a minimum of delay.

E. Project Electrical Service

The Contractor is responsible to coordinate with Unisource, Electric Division, to determine the extent of work to be performed by Unisource and by the Contractor to provide electric service for the finished product. The Contractor is also responsible to contact Unisource to determine the hardware required by Unisource to provide service to the final product. Unisource does not provide service to delta connections.

DIVISION II
GENERAL REQUIREMENTS

**SUMMARY OF
WORK**

PART 1 – GENERAL

1.1 Summary

- A. This Section summarizes the Work covered in detail in the complete CONTRACT DOCUMENTS.
- B. **OWNER:** Lake Havasu City is contracting for work described in the CONTRACT DOCUMENTS.
 - a. Contract Identification: **City Fueling Facilities Improvements Rebid, Project No. B24-PW-101010-500430 Rebid**
- C. **ENGINEER:** The CONTRACT DOCUMENTS were prepared by Jacobs Engineering, 1501 W. Fountainhead Pkwy, Suite 401 | Tempe, AZ 85282 | USA

1.2 Project Description

A. Description of Contract

This project consists of construction of a new fueling facility, consisting of two (2) above ground fuel storage tanks, dispenser islands, and other appurtenances and a fuel tank for a backup generator, including civil and electrical improvements, in accordance with the drawings and specifications.

As an alternative additional bid item, construct an additional fueling facility, consisting of two (2) above ground fuel storage tanks, dispenser islands, and other appurtenances, including civil and electrical improvements, in accordance with the drawings and specifications.

B. Work Covered by Contract Documents

Includes all construction activities associated with the construction of up to two fueling facilities and a fuel storage tank for a backup generator. The work also provides for the complete restoration of all the areas disturbed by construction operations.

C. Drawings and Specifications

All work shall be performed in accordance with the drawings, special provisions, supplemental technical specifications, and Standard Technical Specifications for Public Works Construction as furnished

by Lake Havasu City, and MAG, latest edition. Some Specifications have been revised and are different from specifications used in previous years. These changes reflect current design and construction conditions. It is the CONTRACTOR's responsibility to thoroughly review and adhere to the drawings and specifications.

1.3 Contractor's Use of Premises

A. Limited Use

1. CONTRACTOR shall restrict the construction operations to the project site and temporary construction easements as shown on the contract documents. Unauthorized use of washes, City Parcels, and Private Property is not permitted.
2. Conduct operations so as to ensure the least inconvenience to OWNER and the general public.

1.4 Work Sequence

- A. General: The general sequence of construction will be determined by the CONTRACTOR and submitted to the CITY for approval. See Section 00100, Item 15 for Time of Completion and Liquidated Damages.
- B. Continuous Service of Existing Facilities: Exercise caution and schedule operations to ensure that function of present facilities and adjacent facilities will not be disrupted.
- C. Prior to any construction activity in any area, the CONTRACTOR shall take digital photographs in sufficient detail to record the existing conditions of each area. The CONTRACTOR shall provide two copies of the photographs on a compact disk, according to Section 01325, to the Engineer for review and approval prior to commencing work in that area. Video of the areas will not be accepted as a substitute for photographs but may be submitted in addition.

1.5 Copies of Documents

- A. Furnished Copies: After execution of Agreement, CONTRACTOR will be furnished at no cost, electronic files (PDF and CADD e-files) in addition to those used in execution of the Agreement.

1.6 List of Drawings

A. Contract Drawings

1. Each sheet of the Contract Drawings will bear the following title: **City Fueling Facilities Improvements**

PART 2 – PRODUCTS – Not Applicable.

PART 3 – EXECUTION – Not Applicable.

PART 4 – MEASUREMENT & PAYMENT – Not Applicable.

**** END OF SECTION 01110 ****

SECTION 01200

MOBILIZATION/DEMobilIZATION

PART 1 - GENERAL

1.1 Description

A. Description of Work

The work to be performed in accordance with this section includes the movement of personnel, equipment, supplies, and incidentals to the project site; for the establishment of offices, buildings and other facilities necessary for work on the project; for premiums on bonds and insurance for the project and for all other work and operations which must be performed or costs incurred before beginning work on the various contract items.

Demobilization at the end of the job includes removal of tools, materials, equipment and facilities used by the **CONTRACTOR** during construction of the project. Also included is final cleanup to leave the site with a neat, clean appearance.

PART 2 - MATERIALS

2.1 General

Materials shall consist of equipment, buildings, and tools necessary to move to the project site to perform work. Material for bid items shall not be included in Mobilization.

PART 3 - EXECUTION

3.1 General

Setting up of offices, and the use of private property for storage or work area shall be executed in a legal manner in accordance with local and state codes and ordinances.

Use of private property will require a signed agreement with the property owner, and shall be submitted to Engineer for approval prior to use. Sign off from property owner regarding restored property conditions will be required

prior to project closeout.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement

No measurement will be made.

4.2 Payment

Payment for mobilization will be made as follows:

- A.** When 5% of the total original contract amount is earned from other Bid Items, 50% of the amount bid for Mobilization, or 5% of the total original contract amount, whichever is the least, will be paid.
- B.** When 10% of the total original contract amount is earned from other Bid Items, 100% of the amount bid for Mobilization, or 10% of the total original contract amount, whichever is the least, will be paid.
- C.** Upon completion of all work on the project, payment of any amount bid for Mobilization in excess of 10% of the total original contract amount will be paid. Demobilization shall be considered incidental to the Mobilization Bid Item.

Table A

Payment for Mobilization on First Partial Payment	Not to exceed 2.5% of the Lump sum Base Bid
Subsequent payments for Mobilization	Not to exceed 2.5% of the Lump sum Base Bid
Payment for Mobilization on Final Partial Payment	Any remaining Mobilization in excess of 5% of the Lump Sum Base Bid

See Section 00310 Bid Schedule for Bid Items.

SECTION 01210

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 Description

The outline of measurement and payment in this section is intended to provide a general guideline to the Contractor in preparing bids and submitting pay requests. The listing of work included in each bid item is not intended to include all work, but is to provide general guidance to the Contractor for allocating costs. All work will be paid for on a unit price basis with payment made for the quantity of each item completed.

All materials required for construction shall be furnished by the Contractor unless specifically stated. Items not specifically measured and paid for shall be considered as subsidiary items required to complete the installation in accordance with the intent of the contract documents. The Contractor shall include in the unit price bid items, all costs associated with subsidiary items not being measured for payment.

1.2 Authority

Measurement methods delineated in the individual specification sections complement the criteria of this section. In the event of conflict, the requirements of the individual specification section govern.

Take all measurements and compute quantities. The Engineer will verify measurements and quantities.

1.3 Unit Quantities

Quantities indicated in the Bid Form are for bidding and contract purpose only. Quantities and measurements supplied or placed in the Work and verified by the Engineer shall determine payment.

If the actual Work requires more or fewer quantities than indicated, provide the required quantities at the unit prices contracted.

PART 2 – UNITS AND METHODS OF MEASUREMENT

2.1 General

All items that are included in the bid for measurement and payment are included herein. All other items of work shall be considered subsidiary to construction and will not be measured for payment.

2.2 Units and Methods of Measurement

2.2.1 Mobilization, Bonds, and Insurance

The Contract Lump Sum Price for this item shall constitute full compensation for furnishing all materials, labor, equipment and tools for all required bonds, insurance, mobilization of staff and equipment, and any other costs associated with complying with the contract administrative requirements and commencing work at the project site. This item also includes all work and materials necessary to complete the work as described in the plans and specifications. **Payment for this item shall be lump sum and shall not be requested until at least thirty days from the notice to proceed has elapsed.**

Payment for this item shall be made in accordance with Table A.

TABLE A

Payment for Mobilization on First Partial Payment	Not to exceed 2.5% of the Lump Sum Base Bid
Subsequent payments for Mobilization	Not to exceed 2.5% of the Lump Sum Base Bid
Payment For Mobilization on Final Partial Payment	Any remaining Mobilization in excess of 5% of the Lump Sum Base Bid

2.2.2 All Other Lump Sum Prices

Payment for lump sum price items covers all the labor, materials, and services necessary to furnish and install the item.

Payment for lump sum prices shall include the work listed in Table 01210-1 for that item. The Contractor acknowledges that certain miscellaneous work items not described in Table 01210-1 are also part of that Bid item if necessary to complete the work. The intent of the total of the Bid items is to provide for all work, labor, equipment, transportation, and materials, complete, whether specifically mentioned or not, so to provide the Owner with two new tested and functioning water wells. The Contractor agrees to accept as full payment the sum of these Bid item unit prices as full compensation for all work required by these Contract Documents.

2.2.3 Force Account Work

The lump sum quantity shown in the "Force Account" shall be included in the Bid Schedule. Only the OWNER shall determine the use of monies in the "Force Account".

The OWNER will authorize the use of monies in the Force Account by Change Order. Unused Force Account monies will be removed from the Cost of the Work by Change Order.

Table 01210-1

Bid Item	Payment Includes
Mobilization, Bonds, Insurance	As specified in Section 01210.
All Work, Construction and Testing of One Vadose Zone Well	All work complete to provide, install, construct and test one vadose zone well. including site preparation, pavement removal and replacement, final grading, and all site restoration.
All Other Work	All other work, labor, transportation, materials, etc. that is necessary for a fully complete operating well system that delivers groundwater to the LHC WTP not included in the above items, if any.

****END OF SECTION 01210****

SECTION 01300

FORCE ACCOUNT

PART 1 - GENERAL

1.1 Description of Work

The work to be performed in accordance with this section includes additional work that is outside the general scope of the proposed project. The work to be performed shall be specifically requested in writing by the **OWNER** or the **ENGINEER**. As the project is completed, it is anticipated that the **OWNER** may request additional work to be performed that currently is not a part of this Contract and it is the intent that the requested work shall be performed in accordance with this section.

PART 2 - MATERIALS

2.1 General

Any materials utilized under this Section shall conform specifically with the appropriate Materials Section of these Specifications unless the **OWNER** specifically requests in writing a deviation from the Specifications. If the materials are not covered by an appropriate Specification of this document, then the **OWNER** will provide a written specification for the materials requested.

PART 3 - EXECUTION

3.1 Workmanship

Furnish all materials, equipment and labor required to complete the work. All workmanship shall meet or exceed the appropriate Specifications included in this document or any supplemental Specifications that may be provided. Perform work in accordance with the contract Plans or in accordance with any supplemental plans that may be provided by the **OWNER**.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement

The method of measurement shall be in accordance with the appropriate

specification or as included in specific written instructions from the **OWNER** or the **ENGINEER**.

4.2 Payment

Payment for work performed under this section shall be made for those items specifically requested in writing by the **OWNER**. The value of any work performed in this Section shall be determined by one or more of the following methods in the order of precedence listed below.

- A.** Unit prices previously approved.
- B.** An agreed upon price.

The amount specified for Force Account in the Bid Documents is an estimate that is provided so each potential bidder has an equal opportunity in the bidding. The amount does not in any way represent what work may be requested or the quantity or value of the work. The **CONTRACTOR** shall only be compensated for the actual work requested and performed.

See Section 00310 Bid Schedule for Bid Items.

SECTION 01320

PROJECT MEETINGS, SCHEDULES, AND REPORTS

PART 1 - GENERAL

1.1 Summary

- A.** This Section includes the following administrative and procedural requirements.
- B.** Project Meetings
 - 1.** Preconstruction conference.
 - 2.** Coordination schedules.
 - 3.** Progress meetings.
 - 4.** Coordination meetings.
- C.** Schedules and Reports
 - 1.** Initial coordination schedules.
 - 2.** Construction progress schedule.
 - 3.** Procurement schedule.
 - 4.** Construction progress reports.
 - 5.** Schedule of values.
 - 6.** Special reports.
- D.** Related Work Specified Elsewhere
 - Submittal Section 01330

1.2 Project Meetings

A. Preconstruction Conference

1. Engineer will conduct a meeting as described in Section 800, Special Provisions, Paragraph 3.0, to review items stated in the following agenda and to establish a working understanding between the parties as to their relationships during performance of the Work.
2. **Preconstruction conference shall be attended by the following.**
 - a. Contractor and his superintendent.
 - b. Engineer.
 - c. Representative(s) of Owner.
 - d. Representatives of principal Subcontractors and Suppliers.
3. **Meeting Agenda**
 - a. Construction schedules.
 - b. Critical Work sequencing.
 - c. Designation of responsible personnel.
 - d. Project coordination.
 - e. Procedures and Processing of:
 - (1) Field decisions.
 - (2) Substitutions.
 - (3) Submittals.
 - (4) Change Orders.
 - (5) Applications for Payment.

- f. Procedures for testing.
- g. Procedures for maintaining record documents.
- h. **Use of Premises:**
 - (1) Office, work, and storage areas.
 - (2) Owner's requirements.
- i. Construction facilities, controls, and construction aids.
- j. Temporary utilities.
- k. Safety and first-aid.
- l. Security.

4. **Location of Meeting:** To Be Determined.

5. **Reporting:**

- a. Within 5 working days after the meeting, Engineer will prepare and distribute minutes of the meeting to Owner and Contractor.
- b. Contractor shall provide copies to Subcontractors and major Suppliers.

B. Coordination Schedules

1. Engineer will conduct a meeting at least 10 days before submission of the first Application for Payment to update the initial coordination schedules requested under ARTICLE 1.3 this Section.

2. **The meeting shall be attended by:**

- a. Contractor and his superintendent.
- b. Representatives of principal Subcontractors and Suppliers.
- c. Engineer.

d. Representative(s) of Owner.

C. Progress Meetings

1. Engineer will schedule and conduct a meeting weekly and at other times requested by Engineer. Representatives of the Owner, Engineer, and Contractor shall be present at each meeting. With Engineer's concurrence, Contractor may request attendance by representatives of Subcontractors, Suppliers, or other entities concerned with current program or involved with planning, coordination, or performance of future activities. All participants in the meeting shall be familiar with the Project and authorized to conclude matters relating to the Work.
2. Contractor and each Subcontractor represented shall be prepared to discuss the current construction progress report and any anticipated future changes to the schedule. Each Subcontractor shall comment on the schedules of Contractor and other Subcontractors and advise if their current progress or anticipated activities are compatible with that Subcontractor's Work.
3. If one Subcontractor is delaying another, Contractor shall issue such directions as are necessary to resolve the situation and promote construction progress.
4. **Meeting Agenda:**
 - a. Review of construction progress since previous meeting.
 - b. Field observations, interface requirements, conflicts.
 - c. Problems which impede construction schedule.
 - d. Off-site fabrication.
 - e. Delivery schedules.
 - f. Submittal schedules and status.
 - g. Site use.

- h.** Temporary facilities and services.
- i.** Hours of Work.
- j.** Hazards and risks.
- k.** Housekeeping.
- l.** Quality and Work standards.
- m.** Change Orders.
- n.** Documentation of information for payment requests.
- o.** Corrective measures and procedures to regain construction schedule if necessary.
- p.** Revisions to construction schedule.
- q.** Review of proposed activities for succeeding Work period.
- r.** Review proposed Contract modifications for:
 - (1)** Effect on construction schedule and on completion date.
 - (2)** Effect on other contracts of the Project.
- s.** Other business.

5. Location of Meetings: Meeting shall be held at the Lake Havasu North Regional Wastewater Treatment Plant.

North Regional Wastewater Treatment Plant
7001 Whelan Drive
Lake Havasu City, Arizona 86406

6. Reporting:

- a. Within 5 working days after each meeting, Engineer will prepare and distribute minutes of the meeting to Owner and Contractor.
- b. Contractor shall distribute copies to principal Subcontractors and Suppliers.

1.3 Schedules and Reports

A. Initial Coordination Schedules

- 1. Within 10 days after the Effective Date of the Agreement, Contractor shall submit to Engineer for review and acceptance:
 - a. A preliminary procurement schedule of Equipment and Materials.
 - b. A preliminary schedule of values for partial pay purposes.
 - c. A preliminary schedule of Submittals, as stated in Section 01330.
 - d. Preliminary cash requirement prediction.

B. Baseline Construction Schedule

- 1. Within 20 days after issuance the Notice of Award of the Contract, Contractor shall submit to Engineer for review and acceptance a detailed baseline construction schedule employing the critical path scheduling method.
 - a. The schedule shall show the Work in a horizontal bar chart, and indicate the start date, duration, and end date for each activity.
 - b. The Contractor shall submit to the Engineer, 7 paper copies and 1 electronic copy in Suretrak® Version 3.0 or approved compatible format for review. Sheet size shall be a minimum 11 x 17-inches
 - c. No single activity shall be more than 15 days in duration.

- d.** The Contractor shall include all work by Subcontractors in the baseline construction schedule.
 - e.** The schedule shall be resourced base and include work breakdown structures.
 - f.** The schedule shall indicate milestone from which the Contractor's progress will be measured for the purpose of determining liquidated damages.
 - g.** In addition to submitting the schedule on paper, the schedule shall be provided electronically in a format compatible with SureTrack® Version 3.0 scheduling software.
 - h.** Within each activity, indicate estimated completion percentage in 10% increments.
 - i.** Scale and spacing shall allow room for notations and revisions.
- 2.** After the construction schedule is approved, the schedule shall serve as the Contractor's Baseline Schedule for all Work on the project. Activity ID's shall not be changed without the Engineer's written permission from this point forward. New activity numbers will be allowed, but only for new work outside the original project baseline schedule activities.
 - 3.** If necessary, the Contractor shall provide subschedules to define in more detail, critical portions of the baseline schedule, including inspections and tests.
 - 4.** The Contractor shall coordinate the baseline construction progress schedule with the schedule of values, Submittal schedule, procurement schedule, progress reports, and payment requests.
 - 5.** The Contractor shall revise the construction baseline schedule after each meeting, event, or activity where revisions have been recognized and accepted in accordance with the GENERAL CONDITIONS.
 - 6.** The Contractor shall update and submit 7 paper copies and 1 electronic copy in SureTrak® Version 3.0 compatible format

of the revised schedule to the Engineer at least once each month to show actual progress compared to the originally accepted baseline construction schedule and any proposed changes in the schedule of remaining Work. The revised schedule shall be updated and submitted to the Engineer prior to each monthly payment request. Engineer's approval for payment will not be recommended to be paid by the Owner until the monthly revised schedule is accepted by the Engineer. Include the schedule with construction progress report (See Section 1320.1.3.D).

C. Procurement Schedule

- 1.** After submittal of preliminary procurement schedule as stated above under "Initial Coordination Schedules", submit a detailed schedule for procurement of Equipment and Materials to be furnished by Contractor, Subcontractors, manufacturers, and Suppliers. Do not include minor items which are known to be regularly stocked by local suppliers or readily available upon short notice. Submit to Engineer for review with the construction progress schedule.
- 2.** Engineer will review and comment on the schedule for procurement, and upon agreement with Contractor concerning any necessary revisions, the schedule will be accepted.
- 3.** Procurement schedule shall coincide with the construction progress schedule and the Submittal schedule, and shall indicate the date each item will be needed at the Site and the time required for delivery after order is placed.
- 4.** Update the accepted schedule for procurement at least once each month to show the status of orders placed, Submittals, and delivery. Submit with the construction progress report.
- 5.** If requested by Engineer, submit copies of purchase orders placed by Contractor or Subcontractors.

D. Construction Progress Reports

- 1.** Submit a report on actual construction progress on a weekly basis. More frequent reports may be required should the Work fall behind the accepted schedule.
 - a.** Format shall be on 11 x 17-inch paper, submitted to Engineer electronically.
- 2.** Construction progress reports shall consist of the revised construction progress schedule and a narrative report which shall include but not be limited to the following:
 - a.** Comparison of actual progress to planned progress shown on originally accepted schedule.
 - b.** Summary of activities completed since the previous construction progress report.
 - c.** Identification of problem areas.
 - d.** A description of current and anticipated delaying factors, if any.
 - e.** Impact of possible delaying factors.
 - f.** Proposed corrective actions.
- 3.** Submit a construction progress report to Engineer with each application for partial payment. Work reported complete but not readily apparent to Engineer must be substantiated with supporting data when requested by Engineer.
- 4.** If a schedule update reveals that, through no fault of Owner, the Work is likely to be completed later than the Contract completion date, Contractor shall:
 - a.** Establish a plan for making up lost time.
 - (1)** Increase number of workers, or
 - (2)** Increase amount or kinds of tools, or
 - (3)** Work overtime or additional shifts, or

- (4)** A combination of 2 or more of the above 3 actions.
- b.** Submit plan to Owner and Engineer before implementing the plan.
- c.** Take actions as necessary to get the Work back on schedule at no additional cost to Owner.

E. Schedule of Values

- 1.** Submit as set forth in GENERAL CONDITIONS, based on the preliminary schedule of values.
- 2.** Coordinate preparation of schedule of values with preparation and content of construction progress schedule.

3. Content

- a.** Schedule shall list the installed value of the component parts of the Work in sufficient detail to serve as a basis for computing values for progress payments during construction.
- b.** Follow the construction progress schedule breakdown of Work activities as format for listing component items and assigning values.
- c.** For each major line item list subvalues of major products or operations under the item.
 - (1)** Each item shall include a directly proportional amount of the Contractor's overhead and profit.
 - (2)** For items on which progress payments will be requested for stored materials received, but not installed, break down the value into:
 - (a)** The cost of the materials, delivered and unloaded, including taxes paid unless taxes are exempted.
 - (b)** The total installed value.

- d. The sum of all values listed in the schedule shall equal the total Contract Price.

F. Special Reports

1. When an event of an unusual and significant nature occurs at the site, prepare and submit a special report. List the chain of events, persons participating, response by Contractor's personnel, an evaluation of the results or effects, and similar pertinent information. Advise the Owner in advance when such events are known or predictable.
2. Submit original report to Owner and copy to Engineer.

PART 2 - PRODUCTS - Not Applicable.

PART 3 - EXECUTION - Not Applicable.

PART 4 - MEASUREMENT AND PAYMENT - Not Applicable.

**** END OF SECTION 01320 ****

SECTION 01325

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.1 Summary

- A.** This Section specifies administrative and procedural requirements for construction photographs.

1.2 Submittals

- A.** Submit CD's as specified in Section 01330, Submittals and in PART 3 - this Section.
- B.** Photographer shall submit a digital sample set of the type and quality required during construction, for review and acceptance by Engineer.

1.3 Quality Assurance

- A.** All photographs shall be taken and processed by a qualified photographer with experience in construction photography.

PART 2 - PRODUCTS

2.1 Photographic Requirements

Specified in PART 3, this Section.

PART 3 - EXECUTION

3.1 Photographs

- A.** Contractor shall be responsible for photographs of the entire construction site to show the existing and general condition of the site prior to construction. Each photo will be required to have a date stamp in the lower right corner.

B. Photographs shall be taken of the following areas and at the following times.

- 1.** Existing Site conditions before Site work is started. Number of views shall be adequate to cover the Site.
- 2.** Finished Project after completion of Work. Number of views shall be adequate to show the finished Work. It is particularly important to provide a view of the restoration of the property upon completion of construction.
- 3.** If Project is not completed during the Contract Time or authorized extensions, photographs shall continue to be taken at no increase in Contract Price.

C. The principal reason for obtaining photographs is so that items such as cracked curbs, and/or driveways, shrubs, trees, landscaping, decorative walls, privacy walls, mail boxes, lighting, broken pavement or sidewalks, or other problems along the construction route may be more clearly shown and recorded. This will to some degree preclude the possibility of post construction litigation between Contractor and property owners adjacent to the Work.

D. Digital Images

- 1.** Submit two (2) complete sets of digital image electronic files on a CD for each area of work prior to starting work.
 - a.** Provide images in JPEG format, with minimum sensor size of 5.0 mega pixels.
 - b.** Submit images that have same aspect ratio as the sensor, uncropped.
 - c.** The photos of each residence and areas adjacent shall be labeled electronically on each photograph by address.

E. Identification

- 1.** Each disk submitted shall be labeled with Project name, area and street
- 2.** Identify electronic media with date digital photographs were taken.

- F. Deliver prints to Engineer.

Jacobs Engineering
ATTN: Rick Edwards
1501 W. Fountainhead Parkway, Suite 401
Tempe, AZ 85282

3.2 Additional Photographs

- A. From time to time Engineer may issue requests for additional photographs, in addition to periodic photographs specified. Additional photographs will be paid for by Change Order, and are not included in the Contract Price or an Allowance.
1. Engineer will give the photographer 3 days' notice, where feasible.
 2. In emergency situations, the photographer shall take additional photographs within 24 hours of Engineer's request.
 3. Circumstances that could require additional photographs include, but are not limited to:
 - a. Substantial Completion of a major phase or component of Work.
 - b. Owner's request for special publicity photographs.
 - c. Special events planned at Project Site.
 - d. Immediate follow-up when on-site events result in construction damage or losses.
 - e. Photographs to be taken at fabrication locations away from Project Site.
 - f. Extra record photographs at time of final acceptance.

PART 4 - MEASUREMENT AND PAYMENT - Not Applicable

**** END OF SECTION 01325 ****

SECTION 01330

SUBMITTALS

PART 1 - GENERAL

1.1 Summary

A. This Section includes definitions, descriptions, transmittal, and review of Submittals.

B. Related Work Specified Elsewhere:

Project Meetings, Schedules, and Reports.....	Section 01320
Construction Photographs.....	Section 01325
Equipment and Materials	Section 01600
Substitutions.....	Section 01631
Contract Closeout	Section 01780

1.2 General Information

A. Definitions

1. Shop Drawings, product data, and Samples are technical Submittals prepared by Contractor, Subcontractor, manufacturer, or Supplier and submitted by Contractor to Engineer as a basis for approval of the use of Equipment and Materials proposed for incorporation in the Work or needed to describe installation, operation, maintenance, or technical properties.

a. Shop Drawings include custom-prepared data of all types including drawings, diagrams, performance curves, material schedules, templates, instructions, and similar information not in standard printed form applicable to other projects.

b. Product data includes standard printed information on materials, products, and systems; not custom-prepared for this Project, other than the designation of selections from available choices.

2. Documents submitted to Engineer that do not conform to specified requirements shall be subject to rejection by Engineer, and upon request by Engineer, Contractor shall resubmit conforming documents. If conforming Submittals cannot be obtained, such documents shall be retraced, redrawn, or photographically restored as may be necessary to meet such requirements. Contractor's (or his Subcontractor's) failure to initially satisfy the legibility quality requirements will not relieve Contractor (or his Subcontractors) from meeting the required schedule for Submittals.

C. Language and Dimensions

1. All words and dimensional units shall be in the English language.
2. Metric dimensional unit equivalents may be stated in addition to the English units. However, English units of measurement shall prevail.

D. Submittal Completeness

1. Submittals shall be complete with respect to dimensions, design criteria, materials of construction, and other information specified to enable Engineer to review the information effectively.
2. Where standard drawings are furnished which cover a number of variations of the general class of Equipment, each drawing shall be annotated to indicate exactly which parts of the drawing apply to the Equipment being furnished. Use hatch marks to indicate variations that do not apply to the Submittal. The use of "highlighting markers" will not be an acceptable means of annotating Submittals. Annotation shall also include proper identification of the Submittal permanently attached to the drawing.
3. Reproductions or copies of Contract Drawings or portions thereof will not be accepted as complete fabrication or erection drawings. Contractor may use a reproduction of Contract Drawings for erection drawings to indicate information on erection or to identify detail drawing references. Whenever the Drawings are revised to show this additional Contractor information, Engineer's title block shall

be replaced with a Contractor's title block, and Engineer's professional seal shall be removed from the drawing. The Contractor shall revise these erection drawings for subsequent Engineer revisions to the Contract Drawings.

1.3 Technical Submittals

A. Items shall include, but not be limited to, the following:

- 1.** Manufacturer's specifications.
- 2.** Catalogs, or parts thereof, of manufactured Equipment.
- 3.** Shop fabrication and erection drawings.
- 4.** Instruction books and operating manuals.
- 5.** Material lists or schedules.
- 6.** Performance tests on Equipment by manufacturers.
- 7.** Concrete mix design information.
- 8.** All drawings, catalogs or parts thereof, manufacturer's specifications and data, samples, instructions, and other information specified or necessary:
 - a.** For Engineer to determine that the Equipment and Materials conform with the design concept and comply with the intent of the Contract Documents.
- 9.** Equipment List.
- 10.** Hourly rate for equipment and labor.

B. Schedule of Submittals

- 1.** Schedule all submittals required prior to fabrication, manufacture, or installation for submission within 14 calendar days of the Notice to Proceed. Prepare for Engineer's concurrence, a schedule for submission of all Submittals specified or necessary for Engineer's approval of the use of Equipment and Materials proposed for incorporation in the Work or needed for proper installation, operation, or

maintenance. Submit the schedule with the procurement schedule and construction progress schedule. Schedule submission of all Submittals to permit review, fabrication, and delivery in time so as to not cause a delay in the Work of Contractor or his Subcontractors or any other contractors as described herein.

2. In establishing schedule for Submittals, allow 14 calendar days in Engineer's office for reviewing original Submittals and 5 calendar days in Engineer's office for reviewing resubmittals.
3. The schedule shall indicate the anticipated dates of original submission for each item and Engineer's approval thereof, and shall be based upon at least one resubmission of each item.
4. Schedule all Submittals required prior to fabrication or manufacture for submission within 45 calendar days of the Notice to Proceed. Schedule Submittals pertaining to storage, installation, and operation at the Site for Engineer's approval prior to delivery of the Equipment and Materials.
5. Resubmit Submittals the number of times required for Engineer's "Submittal Approved." However, any need for resubmittals in excess of the number set forth in the accepted schedule, or any other delay in obtaining approval of Submittals, will not be grounds for extension of the Contract Times, provided Engineer completes his reviews within the times specified.

C. Transmittal of Submittals

1. All Submittals for Equipment and Materials furnished by Contractor, Subcontractors, manufacturers, and Suppliers shall be submitted to Engineer by Contractor.
2. After checking and verifying all field measurements, transmit all Submittals to Engineer for approval as follows:
 - a. **Submittal Information Block:**
 - (1) Affix to all paper copies whether Submittal is prepared by Contractor, Subcontractor, or Supplier. Use transparent decal type Submittal

Information Blocks for Shop Drawings and use gummed paper type for product data Submittals. All Submittal Information Blocks needed for this Contract will be furnished to Contractor at no charge at the initial coordination conference.

(2) An example of the Submittal Information Block is included as an appendix to this Section.

- b.** Mark each Submittal by Project name and number, Contract title and number, and the applicable Specification Section and Article number. Include in the letter of transmittal the Drawing number and title, sheet number (if applicable), revision number, and electronic filename (if applicable). Unidentifiable Submittals will be returned for proper identification.
- c.** Check and include Contractor's approval for Submittals of Subcontractors, Suppliers, and manufacturers prior to transmitting them to Engineer. Contractor's approval shall constitute a representation to Owner and Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data, or Contractor assumes full responsibility for doing so, and that Contractor has coordinated each Submittal with the requirements of the Work and the Contract Documents.
- d.** At the time of each submission, call to the attention of Engineer in the letter of transmittal any deviations from the requirements of the Contract Documents.
- e.** Make all modifications noted or indicated by Engineer and return revised Submittals until approved. Direct specific attention in writing, or on revised Submittals, to changes other than the modifications called for by Engineer on previous Submittals. After paper copy Submittals have been approved, submit copies thereof for final distribution. Previously approved Submittals transmitted for final distribution will not be further reviewed and are not to be revised. If errors are discovered during manufacture or

fabrication, correct the Submittal and resubmit for review.

- f.** Following completion of the Work and prior to final payment, furnish record documents and approved Samples and Shop Drawings necessary to indicate "as constructed" conditions, including field modifications, in the number of copies specified. Furnish additional copies for insertion in Equipment instruction books and operating manuals as required. All such copies shall be clearly marked "PROJECT RECORD."
- g.** Keep a copy or sample of each Submittal in good order at the Site.

3. Quantity Requirements:

- a.** Except as otherwise specified, transmit all Shop Drawings in the following quantities:
 - (1) Initial Submittal:** Electronic pdf copy to Engineer.
 - (2) Resubmittals:** Electronic pdf copy to Engineer.
 - (3) Submittal for final distribution:** Electronic pdf copy to Engineer.
 - (4) As-constructed documents:** Electronic pdf copy to Engineer.
- b.** Transmit Submittals of product data as follows:
 - (1) Initial Submittal:** Email
 - (2) Resubmittals:** Email
 - (3) Submittal for final distribution:** Email
- c.** **Transmit Submittals for reference only:** Email to Engineer.
- d.** Owner may copy and use for internal operations and staff training purposes any and all document Submittals required by this Contract and approved for final distribution, whether or not such documents are copyrighted, at no additional cost to Owner. If

permission to copy any such Submittal for the purposes stated is unreasonably withheld from Owner by Contractor or any Subcontractor, manufacturer, or Supplier, Contractor shall provide to Engineer 50 copies plus the number of copies required by Contractor at each final distribution issue.

- 4. Information to Manufacturer's District Office:** Contractor shall arrange for manufacturers and Suppliers of Equipment and Materials to furnish copies of all agreements, drawings, specifications, operating instructions, correspondence, and other matters associated with this Contract to the manufacturer's district office servicing the Owner. Insofar as practicable, all business matters relative to Equipment and Materials included in this Contract shall be conducted through such local district offices.

D. Engineer's Review

- 1.** Engineer will review and take appropriate action on Submittals in accordance with the accepted schedule of Submittals. Engineer's review and approval will be only to determine if the items of Equipment and Materials covered by the Submittals will, after installation or incorporation into the Work, conform to information given in the Contract Documents and be compatible with the design concept of the completed Project as a functioning whole as indicated by the Contract Documents.
- 2.** Engineer's review and approval will not extend to design data reflected in Submittals, which is peculiarly within the special expertise of Contractor or Contractor's Subcontractors or Suppliers. Review and approval of a component item as such will not indicate approval of the assembly in which the item functions.
- 3.** Engineer's review and approval of Shop Drawings, product data, or Samples will not relieve Contractor of responsibility for any deviation from requirements of the Contract Documents unless Contractor has in writing called Engineer's attention to such deviation at the time of submission, and Engineer has given written approval of the specific deviation. Approval by Engineer shall not relieve Contractor from responsibility for errors or omissions in Submittals.

E. Submittal Action Stamp

- 1.** Engineer's review action stamp, appropriately completed, will appear on all Submittals of Contractor when returned by Engineer. Review status designations listed on Engineer's action stamp are defined as follows:

A - SUBMITTAL APPROVED: Signifies Equipment or Material represented by the Submittal conforms with the design concept and complies with the intent of the Contract Documents and is approved for incorporation in the Work. Contractor is to proceed with fabrication or procurement of the items and with related Work. Copies of the Submittal are to be transmitted to Engineer for final distribution.

B - SUBMITTAL APPROVED AS NOTED (RESUBMIT): Signifies Equipment and Material represented by the Submittal conforms with the design concept and complies with the intent of the Contract Documents and is approved for incorporation in the Work in accordance with Engineer's notations. Contractor is to proceed with fabrication or procurement of the items and with related Work in accordance with Engineer's notations and is to submit a revised Submittal responsive to notations marked on the returned Submittal or written in the letter of transmittal.

C - SUBMITTAL RETURNED FOR REVISION (RESUBMIT): Signifies Equipment and Material represented by the Submittal appears to conform with the design concept and comply with the intent of the Contract Documents but information is either insufficient in detail or contains discrepancies which prevent Engineer from completing his review. Contractor is to resubmit revised information responsive to Engineer's annotations on the returned Submittal or written in the letter of transmittal. Fabrication or procurement of items represented by the Submittal and related Work is not to proceed until the Submittal is approved.

D - SUBMITTAL NOT APPROVED (SUBMIT ANEW): Signifies Equipment and Material represented by the

Submittal does not conform with the design concept or comply with the intent of the Contract Documents and is disapproved for use in the Work. Contractor is to provide Submittals responsive to the Contract Documents.

E - PRELIMINARY SUBMITTAL: Signifies Submittals of such preliminary nature that a determination of conformance with the design concept or compliance with the intent of the Contract Documents must be deferred until additional information is furnished. Contractor is to submit such additional information to permit layout and related activities to proceed.

F - FOR REFERENCE, NO APPROVAL REQUIRED: Signifies Submittals which are for supplementary information only; pamphlets, general information sheets, catalog cuts, standard sheets, bulletins and similar data, all of which are useful to Engineer or Owner in design, operation, or maintenance, but which by their nature do not constitute a basis for determining that items represented thereby conform with the design concept or comply with the intent of the Contract Documents. Engineer reviews such Submittals for general content but not for basic details.

G - DISTRIBUTION COPY (PREVIOUSLY APPROVED): Signifies Submittals which have been previously approved and are being distributed to Contractor, Owner, Resident Project Representative, and others for coordination and construction purposes.

F. Instruction Books and Operating Manuals

- 1.** Equipment instruction books and operating manuals prepared by the manufacturer shall include the following:
 - a.** Index and tabs.
 - b.** Instructions for installation, start-up, operation, inspection, maintenance, parts lists and recommended spare parts, and data sheets showing model numbers.
 - c.** Applicable drawings.

- d. Warranties and guarantees.
 - e. Address of nearest manufacturer-authorized service facility.
 - f. All additional data specified.
 - 2. Information listed above shall be bound into hard-back binders of three-ring type. Sheet size shall be 8-1/2 x 11. Binder color shall be white. Capacity shall be a minimum of 1-1/2-inches, but sufficient to contain and use sheets with ease.
 - a. Provide with following accessories:
 - (1) Label holder.
 - (2) Business card holder.
 - (3) Sheet lifters.
 - (4) Horizontal pockets.
 - b. The following information shall be imprinted, inserted or affixed by label on the binder front cover:
 - (1) Equipment name.
 - (2) Manufacturer's name.
 - (3) Project name.
 - (4) Contract name and number.
 - c. The following information shall be imprinted, inserted, or affixed by label on the binder spine:
 - (1) Equipment name.
 - (2) Manufacturer's name.
 - (3) Volume number (if applicable).

G. Samples

- 1. **Office Samples shall be of sufficient size and quantity to clearly illustrate the following:**
 - a. Functional characteristics of the product, with integrally related parts and attachment devices.
 - b. Full range of color, texture, and pattern.

2. Field Samples and Mock-ups:

- a.** Contractor shall erect field Samples and mock-ups at the Project Site and at a location acceptable to Engineer.
- b.** Size or area shall be as specified in the respective Specification Section.
- c.** Fabricate each Sample and mock-up complete and finished.
- d.** Remove mock-ups at conclusion of Work or when acceptable to the Engineer if not a permanent part of construction.

1.4 Information Submittals

- A.** Informational Submittals are comprised of technical reports, administrative Submittals, and guarantees, which relate to the Work, but do not require Engineer approval prior to proceeding with the Work. Informational Submittals include:
 - 1.** Welder qualification tests.
 - 2.** Welding procedure qualification tests.
 - 3.** X-ray and radiographic reports.
 - 4.** Hydrostatic testing of pipes.
 - 5.** Field test reports.
 - 6.** Concrete cylinder test reports.
 - 7.** ASME pressure vessel test reports.
 - 8.** Certification on Materials:
 - a.** Steel mill tests.
 - b.** Brick and concrete masonry unit lab tests.
 - 9.** Soil test reports.

10. Piping stress analysis.

11. Warranties and guarantees.

B. Transmittal of Informational Submittals

1. All informational Submittals furnished by Subcontractors, manufacturers, and Suppliers shall be submitted to Engineer by Contractor unless otherwise specified.

a. Identify each informational Submittal by Project name and number, Contract title and number, and the Specification Section and Article number marked thereon or in the letter of transmittal. Unidentifiable Submittals will be returned for proper identification.

b. At the time of each submission, call to the attention of Engineer in the letter of transmittal any deviations from the requirements of the Contract Documents.

2. Quantity Requirements:

a. Technical reports and administrative Submittals except as otherwise specified:

(1) Engineer: Two copies.

b. Written Certificates and Guarantees:

(1) Engineer: Two copies.

3. Test Reports:

a. Responsibilities of Contractor, Owner, and Engineer regarding tests and inspections of Equipment and Materials and completed Work are set forth elsewhere in these Contract Documents.

b. The party specified responsible for testing or inspection shall in each case, unless otherwise specified, arrange for the testing laboratory or reporting agency to distribute test reports as follows:

- (1) Owner: Two copies.
- (2) Engineer: One copy.
- (3) Resident Project Representative: One copy.
- (4) Contractor: Two copies.
- (5) Manufacturer or Supplier: One copy.

C. Engineer's Review

- 1. Engineer will review informational Submittals for indications of Work or Material deficiencies.
- 2. Engineer will respond to Contractor on those informational Submittals, which indicate Work or Material deficiency.

PART 2 - PRODUCTS - Not Applicable.

PART 3 - EXECUTION – Not Applicable.

PART 4 - MEASUREMENT AND PAYMENT - Not Applicable

**** END OF SECTION 01330 ****

SECTION 01420

DEFINITIONS AND STANDARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Definitions

1. Basic contract definitions used in the Contract Documents are defined in the GENERAL CONDITIONS. Definitions and explanations are not necessarily either complete or exclusive, but are general for the Work.
2. General Requirements are the provisions or requirements of DIVISION 1 Sections, and which apply to the entire Work of the Contract.

B. Related Information Specified Elsewhere: Specification standards and associations applicable to the Work are specified in each Section.

1.2 Specification Format and Content Explanations

A. Specification Format: The Specifications are organized into Divisions and Sections based on the Construction Specifications Institute's (CSI) Section Format and MasterFormat numbering system. Some portions may not fully comply and no particular significance will be attached to such compliance or noncompliance.

1. **Divisions and Sections:** For convenience, a basic unit of Specification text is a "Section," each unit of which is numbered and named. These are organized with related Sections, into "Divisions," which are recognized as the present industry consensus on uniform organization and sequencing of Specifications. The Section title is not intended to limit meaning or content of Section, nor to be fully descriptive of requirements specified therein, nor to be an integral part of text.
2. **Section Numbering:** Used for identification and to facilitate cross-references in Contract Documents. Sections are placed

in numeric sequence; however, numbering sequence is not complete, and listing of Sections in Table of Contents at beginning of the Project Manual must be consulted to determine numbers and names of Specification Sections in these Contract Documents.

- 3. Page Numbering:** Numbered independently for each Section. Section number is shown with page number at bottom of each page, to facilitate location of text.
- 4. Parts:** Each Section of Specifications generally has been subdivided into three basic "parts" for uniformity and convenience (PART 1 - GENERAL, PART 2 - PRODUCTS, and PART 3 - EXECUTION). These "Parts" do not limit the meaning of text within. Some Sections may not contain all three "Parts" when not applicable, or may contain more than three "Parts" to add clarity to organization of Section.
- 5. Underscoring of Titles:** Used strictly to assist reader of Specification in scanning text for key words in content. No emphasis on or relative importance is intended except where underscoring may be used in body of text to emphasize a duty, critical requirement, or similar situation.
- 6. Project Identification:** Project file number and identification are recorded at bottom of each page of Specifications to minimize possible misuse of Specifications, or confusion with other Project Specifications.

B. Specification Content

- 1.** These Specifications apply certain conventions in the use of language and the intended meaning of certain terms, words, and phrases when used in particular situations or circumstances. These conventions are explained as follows:
 - a. Imperative and Streamlined Language:** These Specifications are written in imperative and abbreviated form. This imperative language of the technical Sections is directed at the Contractor, unless specifically noted otherwise. Incomplete sentences shall be completed by inserting "shall," "the Contractor shall," and "shall be," and similar mandatory phrases by inference in the same manner as they are applied

to notes on the Drawings. The words "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases. Except as worded to the contrary, fulfill (perform) all indicated requirements whether stated imperatively or otherwise.

- b. Specifying Methods:** The techniques or methods of specifying requirements varies throughout text, and may include "prescriptive," "compliance with standards," "performance," "proprietary," or a combination of these. The method used for specifying one unit of Work has no bearing on requirements for another unit of Work.
 - c. Overlapping and Conflicting Requirements:** Where compliance with two or more industry standards or sets of requirements is specified, and overlapping of those different standards or requirements establishes different or conflicting minimums or levels of quality, notify Engineer for a decision as specified in GENERAL CONDITIONS.
 - d. Abbreviations:** Throughout the Contract Documents are abbreviations implying words and meanings which shall be appropriately interpreted. Specific abbreviations have been established, principally for lengthy technical terminology and in conjunction with coordination of Specification requirements with notations on Drawings and in schedules. These are normally defined at first instance of use. Organizational and association names and titles of general standards are also abbreviated.
- C. Assignment of Specialists:** In certain instances, Specification text requires that specific Work be assigned to specialists in the operations to be performed. These specialists shall be engaged for performance of those units of Work, and assignments are requirements over which Contractor has no choice or option. These assignments shall not be confused with, and are not intended to interfere with, enforcement of building codes and similar regulations governing the Work, local trade and union jurisdictions, and similar conventions. Nevertheless, final responsibility for fulfillment of Contract requirements remains with Contractor.

- D. Trades:** Except as otherwise specified or indicated, the use of titles such as "carpentry" in Specification text, implies neither that the Work must be performed by an accredited or unionized tradesperson of corresponding generic name (such as "carpenter"), nor that specified requirements apply exclusively to work by tradespersons of that corresponding generic name.

1.3 Drawing Symbols

- A.** Except as otherwise indicated, graphic symbols used on Drawings are those symbols recognized in the construction industry for purposes indicated. Refer instances of uncertainty to Engineer for clarification.

1.4 Industry Standards

- A. Applicability of Standards:** Except where the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents. Such standards are made a part of the Contract Documents by reference and are stated in each Section.
 - 1.** Referenced standards, referenced directly in Contract Documents or by governing regulations, have precedence over nonreferenced standards which are recognized in industry for applicability to the Work.
 - 2.** Where compliance with an industry standard is required, standard in effect shall be as stated in GENERAL CONDITIONS.
 - 3.** Where an applicable code or standard has been revised and reissued after the date of the Contract Documents and before performance of Work affected, the Engineer will decide whether to issue a Change Order to proceed with the updated standard.
 - 4.** In every instance the quantity or quality level shown or specified shall be the minimum to be provided or performed. The actual installation may comply exactly, within specified tolerances, with the minimum quantity or quality specified, or it may exceed that minimum within reasonable limits. In complying with these requirements, indicated

numeric values are minimum or maximum values, as noted, or appropriate for the context of the requirements. Refer instances of uncertainty to the Engineer for a decision before proceeding.

5. Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to that entity's construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - a. Where copies of standards are needed for performance of a required construction activity, Contractor shall obtain copies directly from the publication source.

B. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where such acronyms or abbreviations are used in the Specifications or other Contract Documents, they mean the recognized name of the trade association, standards generating organization, authority having jurisdiction, or other entity applicable to the context of the text provision.

PART 2 - PRODUCTS - Not Applicable.

PART 3 - EXECUTION - Not Applicable.

PART 4 - MEASUREMENT AND PAYMENT - Not Applicable.

**** END OF SECTION 01420 ****

SECTION 01520

FIELD OFFICES AND SHEDS

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes requirements for temporary field offices and other structures required for office and storage space required by Contractor.

B. Related Work Specified Elsewhere

Equipment and MaterialsSection 01600
Temporary Utilities and FacilitiesSection 01560

PART 2 - PRODUCTS

2.1 Field Offices

A. General

- 1.** Provide trailers, mobile buildings, or buildings constructed with floors raised aboveground, with steps, landings, and railings at entrance doors.
- 2.** Buildings shall be structurally sound, secure, and weathertight.
- 3.** Provide appropriate type fire extinguishers at each office and storage area.
- 4.** Maintain offices during progress of the Work.
- 5.** Install office spaces ready for occupancy 15 days after date stated in Notice to Proceed.

B. Contractor's Office

- 1.** Provide a field office for Contractor's superintendent on the Site.

2. It shall be of size required for general use, with lights, heat, furnishings, telephone service, and other necessary facilities and utilities required by Contractor's operations.

2.2 Storage Sheds and Trailers

A. On Site

1. Provide temporary buildings or trailers needed for storage of Equipment and Materials installed under this Contract (and those furnished by Owner or others under separate contract).
2. Provide ventilation and heating as required by Equipment and Material stored.

B. Off Site

1. Advise Engineer of any arrangements made for storage of Equipment and Materials in a place other than Owner's Site. Furnish evidence of insurance coverage with Application for Payment in conformance with the GENERAL CONDITIONS.

PART 3 - EXECUTION

3.1 Location, Installation and Maintenance

A. General

1. Place temporary buildings, trailers, and stored materials in locations acceptable to Owner or Engineer.
2. Install field offices and sheds to resist winds and elements of the locality where installed.
3. Remove when no longer needed at the Site or when Work is completed.
4. Keep approach walks free of leaves, mud, water, ice, or snow.
5. At completion of Work, remove temporary buildings and trailers, foundations (if any), utility services, and debris.

6. Prepare ground or paved areas as specified in applicable Sections.

PART 4 - MEASUREMENT AND PAYMENT - Not Applicable

**** END OF SECTION 01520 ****

SECTION 01530

TEMPORARY BARRIERS AND CONTROLS

PART 1 - GENERAL

1.1 Summary

A. This Section includes General Requirements for:

- 1.** Safety and protection of Work.
- 2.** Safety and protection of existing property.
- 3.** Barriers.
- 4.** Environmental controls.
- 5.** Traffic control and use of roadways.

B. Related Work Specified Elsewhere

Temporary Utilities and Facilities.....Section 01560

PART 2 - PRODUCTS – Not Applicable

PART 3 - EXECUTION

3.1 Safety and Protection of Work and Property

A. General

- 1.** Provide for the safety and protection of the Work as set forth in GENERAL CONDITIONS. Provide protection at all times against rain, wind, storms, frost, freezing, condensation, or heat so as to maintain all Work and Equipment and Materials free from injury or damage. At the end of each day, all new Work likely to be damaged shall be appropriately protected.
- 2.** Notify Engineer immediately at any time operations are stopped due to conditions, which make it impossible to continue operations safely or to obtain proper results.

3. Construct and maintain all necessary temporary drainage and do all pumping necessary to keep excavations, floors, pits, trenches, manholes, and ducts free of water.
4. Protect floors from damage by proper covering and care when handling heavy equipment, painting, or handling mortar or other such materials. Use proper cribbing and shoring to prevent overloading of floors while moving heavy equipment. Provide metal pans under pipe-threading machines and clean such pans daily, keeping oil off floors. Restore floors to former condition where damaged or stained.
5. Concrete floors less than 28 days old shall not be loaded without written permission from Engineer.
6. Restrict access to roofs except as required by the Work. Where access is required, provide protection with plywood, boards, or other suitable materials.

B. Property Other than Owner's

1. Provide for the safety and protection of property as set forth in the GENERAL CONDITIONS. Report immediately to the owners thereof and promptly repair damage to existing facilities resulting from construction operations.
2. Names and telephone numbers of representatives of agencies and utilities having jurisdiction over streets and utilities in the Work area can be obtained from Engineer for the agencies listed below. Concerned agencies or utilities shall be contacted a minimum of 24 hours prior to performing Work, closing streets and other traffic areas, or excavating near underground utilities or pole lines.
 - a. Water.
 - b. Gas.
 - c. Sanitary sewers.
 - d. Storm drains.
 - e. Pipeline companies.

- f.** Telephone.
 - g.** Electric.
 - h.** Municipal streets.
 - i.** State highways.
 - j.** City engineer.
 - k.** Fire.
 - l.** Police.
- 3.** Operation of valves or other appurtenances on existing utilities, when required, shall be by or under the direct supervision of the owning utility.
 - 4.** Where fences are to be breached on private property, the owners thereof shall be contacted and arrangements made to ensure proper protection of any livestock or other property thus exposed.
 - 5.** The applicable requirements specified for protection of the Work shall also apply to the protection of existing property of others.
 - 6.** Before acceptance of the Work by Owner, restore all property affected by Contractor's operations to the original or better condition.

3.2 Barriers

A. General

- 1.** Furnish, install, and maintain suitable barriers as required to prevent public entry, protect the public, and to protect the Work, existing facilities, trees, and plants from construction operations. Remove when no longer needed or at completion of Work.
- 2.** Materials may be new or used, suitable for the intended purpose, but shall not violate requirements of applicable codes and standards or regulatory agencies.

3. Barriers shall be of a neat and reasonable uniform appearance, structurally adequate for the required purposes.
4. Maintain barriers in good repair and clean condition for adequate visibility. Relocate barriers as required by progress of Work.
5. Repair damage caused by installation and restore area to original or better condition. Clean the area.

B. Tree and Plant Protection

1. Preserve and protect existing trees and plants.
2. Provide temporary barriers around each, or around each group of trees and plants. Construct to a height of 6 feet around trees, and to a height to adequately protect plants.
3. Employ qualified tree surgeon to remove and to treat cuts.
4. Protect root zones of trees and plants as follows:
 - a. Do not allow vehicular traffic or parking.
 - b. Do not store materials or products.
 - c. Prevent dumping of refuse or chemically injurious materials or liquids.
 - d. Prevent puddling or continuous running water.
5. Carefully supervise excavating, grading and filling, and subsequent construction operations to prevent damage.
6. Remove and replace similar size & type (or agreed upon by homeowner), or suitably repair, trees and plants which are damaged or destroyed due to construction operations, and which were designated to remain.

3.3 Environmental Conditions

A. Dust Control

1. Provide proactive positive methods and apply dust control materials to minimize the raising of dust from construction operations; and to prevent airborne dust from dispersing into the atmosphere throughout the duration of the project day and night.
2. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.
3. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.

B. Water and Erosion Control

1. Provide methods to control surface water to prevent damage to the Project, the Site, or adjoining properties.
2. Plan and execute construction and earthwork by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
 - a. Hold the areas of bare soil exposed at one time to a minimum.
 - b. Provide temporary control measures such as berms, dikes, and drains.
3. Control fill, grading, and ditching to direct surface drainage away from excavations, pits, tunnels, and other construction areas; and to direct drainage to proper runoff.
4. Provide, operate, and maintain hydraulic equipment of adequate capacity to control surface and groundwater.
5. Dispose of drainage water in a manner to prevent flooding, erosion, or other damage to any portion of the Site or to adjoining areas.
6. Provide temporary drainage where the roofing or similar waterproof deck construction is completed prior to the

connection and operation of the permanent drainage piping system.

C. Debris Control and Clean-Up

- 1.** Keep the premises free at all times from accumulations of debris, waste materials, and rubbish caused by construction operations and employees. Responsibilities shall include:
 - a.** Adequate trash receptacles about the Site, emptied promptly when filled.
 - b.** Periodic cleanup to avoid hazards or interference with operations at the Site and to maintain the Site in a reasonably neat condition.
 - c.** The keeping of construction materials such as forms and scaffolding neatly stacked.
 - d.** Immediate cleanup to protect the Work by removing splattered concrete, asphalt, oil, paint, corrosive liquids, and cleaning solutions from walls, floors, and metal surfaces before surfaces are marred.
- 2.** Prohibit overloading of trucks to prevent spillages on access and haul routes. Provide periodic inspection of traffic areas to enforce requirements.
- 3.** Final cleanup is specified in Section 01780 - CONTRACT CLOSEOUT.

D. Pollution Control

- 1.** Provide methods, means, and facilities required to prevent contamination of soil, water, or atmosphere by the discharge of hazardous or toxic substances from construction operations.
- 2.** Provide equipment and personnel, perform emergency measures required to contain any spillages, and remove contaminated soils or liquids. Excavate and dispose of any contaminated earth off-Site in approved locations, and replace with suitable compacted fill and topsoil.

3. Take special measures to prevent harmful substances from entering public waters, sanitary, or storm sewers.

3.4 Traffic Control and Use of Roadways

A. Traffic Control:

1. Provide, operate, and maintain equipment, services, and personnel, with traffic control and protective devices, as required to expedite vehicular traffic flow on haul routes, at Site entrances, on-Site access roads, and parking areas. This includes traffic signals and signs, flagmen, flares, lights, barricades, and other devices or personnel as necessary to adequately protect the public. Any traffic control devices used during nighttime hours shall have functioning flashing lights.
2. Remove temporary equipment and facilities when no longer required. Restore grounds to original, better, or specified condition when no longer required.
3. Provide and maintain suitable detours or other temporary expedients if necessary.
4. Bridge over open trenches where necessary to maintain traffic.
5. Consult with governing authorities to establish public thoroughfares, which will be used as haul routes and Site access. All operations shall meet the approval of owners or agencies having jurisdiction.

B. Maintenance of Roadways

1. Repair roads, walkways, and other traffic areas damaged by operations. **Keep traffic areas as free as possible of excavated materials and maintain in a manner to eliminate dust, mud, and hazardous conditions.**
2. All operations and repairs shall meet the approval of owners or agencies having jurisdiction.
3. The CONTRACTOR will provide dust control, be required to grade, smooth-out, fill holes, and generally maintain the streets where the pavement has been removed. This

maintenance will be done daily, if necessary, to allow local traffic to travel through the area on an acceptable surface.

PART 4 - MEASUREMENT AND PAYMENT - Not Applicable.

**** END OF SECTION 01530 ****

SECTION 01560

TEMPORARY UTILITIES AND FACILITIES

PART 1 - GENERAL

1.1 Summary

A. This Section includes requirements of a temporary nature not normally incorporated into final Work. It includes the following:

- 1.** Utility services.
- 2.** Construction and support facilities.
- 3.** Construction aids.
- 4.** Safety and health.
- 5.** Fire protection.

B. Related Work Specified Elsewhere

Temporary Barriers and Controls.....Section 01530
Field Offices and ShedsSection 01520

1.2 Quality Assurance

A. Reference Standards and Specifications

1. American National Standards Association (ANSI)

A10 Series - Safety Requirements for Construction and Demolition.

2. National Electrical Contractors Association (NECA)

3. Electrical Design Library - Temporary Electrical Facilities.

4. National Fire Protection Association (NFPA)

10 - Portable Fire Extinguishers.

70 - National Electrical Code.

241 - Safeguarding Construction, Alterations, and Demolition Operations.

B. National Electrical Manufacturers Association (NEMA).

C. Underwriters Laboratories (UL).

D. Regulations: Comply with industry standards and applicable laws and regulations of authorities having jurisdiction, including but not limited to:

1. Building Code requirements.
2. Health and safety regulations.
3. Utility company regulations.
4. Police, Fire Department, and rescue squad rules.
5. Environmental Protection Regulations.

E. Standards

1. Comply with NFPA 10 and 241, and ANSI A10 Series standards "Temporary Electrical Facilities."
2. Comply with NEMA, NECA, and UL standards and regulations for temporary electric service. Install service in compliance with NFPA 70.

F. Inspections: Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits.

1.3 Submittals

A. Temporary Utilities

Submit reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

1.4 Project Conditions

- A. Conditions of Use:** Keep temporary services and facilities clean and neat in appearance. Operate in a safe and efficient manner. Take necessary fire prevention measures. Do not allow hazardous, dangerous, unsanitary conditions, or public nuisances to develop or persist on the Site.

PART 2 - PRODUCTS

2.1 Materials and Equipment

- A.** Provide new materials and equipment. If acceptable to Engineer, undamaged previously used materials and equipment in serviceable condition may be used. Provide materials and equipment suitable for the use intended, of capacity for required usage, and meeting applicable codes and standards. Comply with requirements of DIVISIONS 2 through 16.

PART 3 - EXECUTION

3.1 Temporary Utilities

A. General

- 1.** Furnish, install, and maintain temporary utilities required for adequate construction, safety, and security. Modify, relocate, and extend systems as Work progresses. Repair damage caused by installation or use of temporary facilities. Remove on completion of Work or until service or facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 Temporary Sanitary Facilities

A. Contractor-Furnished Facilities

- 1.** Furnish, install, and maintain temporary sanitary facilities for use through construction period. Remove on completion of Work.
- 2.** Provide for all construction workers under this Contract and representatives at the Site.

3. Toilet facilities shall be of the chemical, aerated recirculation, or combustion type, properly vented, and fully enclosed with a glass- fiber-reinforced polyester shell or similar nonabsorbent material.
4. Drinking Water Fixtures: Provide containerized tap dispenser type drinking water units.
5. Supply and maintain toilet tissue, paper towels, paper cups and similar disposable materials as appropriate for each facility. Provide appropriate covered waste containers for used material.

3.3 Temporary Safety and Health

- A. **General:** Contractor shall be responsible for development of safety and health programs for personnel at Project Site as specified in the GENERAL CONDITIONS.

3.4 Installation and Removal

- A. **Relocation:** Relocate construction aids as required by progress of construction, storage limitations, or Work requirements and to accommodate requirements of Owner and other contractors at the Site.
- B. **Removal:** Remove temporary materials, equipment, and services when construction needs can be met and allowed by use of permanent construction, or at completion of the Project.
- C. **Repair:** Clean and repair damage caused by installation or by use of temporary facilities.

PART 4 - MEASUREMENT AND PAYMENT - Not Applicable.

**** END OF SECTION 01560 ****

SECTION 01580

PROJECT IDENTIFICATION AND SIGNS

PART 1 - GENERAL

1.1 Summary

A. This Section includes basic requirements for temporary Project identification and informational signs required during construction.

B. Related Work Specified Elsewhere

SubmittalsSection 01330

1.2 Quality Assurance

A. Design sign and structure to withstand wind and environmental conditions of locality. Provide with finish adequate to withstand weathering, fading, chipping, and peeling for duration of construction.

1.3 Submittals

A. Submit as specified in Section 01330.

B. Includes, but not limited to, the following

1. Shop Drawings and product data as applicable.

2. Show content, layout, lettering, colors, structure, and foundation.

PART 2 - PRODUCTS

2.1 Identification Signs

A. Project Identification

1. Construct to design, size, and material indicated.

2. Construct structure and framing of wood, structurally adequate to resist design requirements of locality.

3. Construct sign surface of minimum 3/4-inch thickness exterior grade plywood with medium density overlay. Panels shall be of size to minimize joints. Overall size shall be 4' x 8'.
 4. Rough hardware shall be galvanized or aluminum.
 5. Coating: Paint as specified of colors selected by Engineer.
 6. Information Content:
 - a. Project title, logo, and name of Owner as shown on Contract Documents.
 - b. Names and titles of authorities.
 - c. Name and title of Engineer.
 - d. Name of prime Contractor and major Subcontractors.
- B. Contractor Identification:** If not part of Project identification sign, provide and install Contractor's standard sign.

2.2 INFORMATIONAL SIGNS

A. Construction

1. This includes signs for traffic, construction workers, and general public in regards to directions, warnings, hazards, locations of areas, facilities, equipment, and others of a similar nature.
2. Provide signs of design, size, color, and lettering as required by regulatory agencies. Signs shall be painted metal, wood, plastic, or fiberglass and of materials suitable for the conditions in which they are placed, such as weathering and fading.
3. Construct structure and framing of wood or metal, structurally adequate to resist design requirements of area of Project.

PART 3 - EXECUTION

3.1 Installation

A. Project and Contractor Identification Sign

- 1.** Install in appropriate location so as not to obstruct traffic, pedestrians, or construction operations.
- 2.** Erect on framing or foundation, and rigidly brace.
- 3.** Maintain sign in good repair, in a clean and neat condition.
- 4.** Remove upon completion of Project.

B. Informational Signs

- 1.** Install at appropriate locations and in sufficient quantities to assure visibility. Relocate as required by progress of Work.
- 2.** Maintain signs in good repair, in a neat, clean, readable condition.
- 3.** Remove all signs, framing, supports, and foundations upon completion of Project.

PART 4 - MEASUREMENT AND PAYMENT - Not Applicable.

**** END OF SECTION 01580 ****

SECTION 01600

EQUIPMENT AND MATERIALS

PART 1 - GENERAL

1.1 Summary

- A.** This Section includes administrative and procedural requirements governing Contractor's selection of products for use in the Project.
- B. Related Work Specified Elsewhere**
 - 1.** For the applicability of industry standards to products specified: DIVISIONS 2 through 16.
 - 2.** For submittal of Contractor's construction progress schedule and the Submittal schedule: Section 01320 and Section 01330.
 - 3.** For handling requests for substitutions made after award of the Contract: Section 01631.

1.2 Definitions

- A.** Definitions used in this Article are not intended to change the meaning of other terms used in these Contract Documents, such as "specialties," "systems," "structures," "finishes," "accessories," and similar terms. Such terms are self-explanatory and have well-recognized meanings in the construction industry.
 - 1.** "Products" are items purchased for incorporation in the Work, whether purchased for the Project or taken from previously purchased stock. The term "product" includes the terms "Material," "Equipment," "system," and terms of similar intent.
 - a.** "Named Products" are items identified by the manufacturer's product name, including make or model number or other designation, shown or listed in the manufacturer's published product literature, that is current as of the date of the Contract Documents.
 - b.** "Foreign Products," as distinguished from "domestic products," are items substantially manufactured (50% or more of value) outside the United States and its

possessions. Products produced or supplied by entities substantially owned (more than 50%) by persons who are not citizens of, nor living within, the United States and its possessions are also considered to be foreign products.

2. "Materials" are products substantially shaped, cut, worked, mixed, finished, refined or otherwise fabricated, processed, or installed to form a part of the Work.
3. "Equipment" is a product with operational or non-operational parts, whether motorized, or manually operated, that may require service connections, such as wiring or piping.

1.3 Submittals

- A. Submittal of preliminary procurement schedule is specified in Section 01320 - PROJECT MEETINGS, SCHEDULES, AND REPORTS.
- B. Submittals for products are specified in Section 01330 and in applicable Sections of DIVISIONS 2 through 16.

1.4 Quality Assurance

- A. **Source Limitations:** To the fullest extent possible, provide products of the same kind from a single source.
- B. **Nameplates:** Along with required labels and operating data, manufacturer or producer's nameplates, imprints, or trademarks may be placed on surfaces exposed to view.
 1. **Labels:** Locate required product labels and stamps on concealed surfaces or, where required for observation after installation, on accessible surfaces that are not conspicuous.
 2. **Equipment Nameplates:** Provide a permanent nameplate on each item of service-connected or power-operated Equipment. Locate on an easily accessible surface that is inconspicuous in occupied spaces. The nameplate shall contain the following information and other essential operating data:
 - a. Name of product and manufacturer including address (and telephone number).

- b.** Model and serial number.
- c.** Capacity.
- d.** Speed.
- e.** Ratings.

C. Electronic Equipment Compliance:

- 1.** Contractor warrants that all equipment, devices, items, systems, software, hardware, or firmware provided shall properly, appropriately, and consistently function and accurately process date and time data (including without limitation: calculating, comparing, and sequencing). This warranty supercedes anything in the Specifications or other Contract Documents, which might be construed inconsistently. This warranty is applicable whether the equipment, device, item, system, software, hardware, or firmware is specified with or without reference to a manufacturer's name, make, or model number.

1.5 Transportation and Shipment

A. Shipment Preparation

- 1.** Contractor shall require manufacturers and Suppliers to prepare products for shipment in a manner to facilitate unloading and handling, and to protect against damage, deterioration, or unnecessary exposure to the elements in transit and storage. Provisions for protection shall include the following:
 - a.** Crates or other suitable packaging materials.
 - b.** Covers and other means to prevent corrosion, moisture damage, mechanical injury, and accumulation of dirt in motors, electrical equipment, and machinery.
 - c.** Suitable rust-preventive compound on exposed machined surfaces and unpainted iron and steel.
 - d.** Grease packing or oil lubrication in all bearings and similar items.

- B. Marking:** Each product item shall be tagged or marked as identified in the delivery schedule or on Submittals. Complete packing lists and bills of material shall be included with each shipment. Each piece of every item need not be marked separately, provided that all pieces of each item are packed or bundled together and the packages or bundles are properly tagged or marked.

1.6 Product Delivery, Storage and Handling

- A.** Deliver, store, and handle products according to the manufacturer's recommendations, using means and methods that will prevent damage, deterioration, and loss, including theft.
 - 1.** Schedule delivery to minimize long-term storage at the Site and to prevent overcrowding of construction spaces. Allow ample time to avoid delay of the Work.
 - 2.** Coordinate delivery with installation time to assure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
 - 3.** Deliver products to the Site in an undamaged condition in the manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
 - 4.** Inspect products upon delivery to ensure compliance with the Contract Documents and to ensure that products are undamaged and properly protected. Inspect shipment to assure:
 - a.** Product complies with requirements of Contract Documents and reviewed Submittals.
 - b.** Quantities are correct.
 - c.** Containers and packages are intact and labels are legible.
 - d.** Products are properly protected and undamaged.

5. Store products at the Site in a manner that will facilitate inspection and measurement of quantity or counting of units. Mark deliveries of component parts of Equipment to identify the Equipment, to permit easy accumulation of parts, and to facilitate inspection and measurement of quantity or counting of units.
6. Store heavy Materials away from the Project structure in a manner that will not endanger the supporting construction.
7. Store products subject to damage by the elements above ground, under cover in a weather tight enclosure, and with ventilation adequate to prevent condensation. Maintain temperature and humidity within range required by manufacturer's instructions.
8. Protect motors, electrical Equipment, plumbing fixtures, and machinery of all kinds against corrosion, moisture deteriorations, mechanical injury, and accumulation of dirt or other foreign matter.
9. Protect exposed machined surfaces and unpainted iron and steel as necessary with suitable rust-preventive compounds.
10. Protect bearings and similar items with grease packing or oil lubrication.
11. Handle and store steel plate, sheet metal, and similar items in a manner to prevent deformation.
12. For storage of pipe and other products on easements and rights-of-way in residential and commercial areas, do not exceed the minimum required by scheduled laying operations, and conform to all requirements of public authorities. Store or place pipe along roads, set back from shoulder or curb, and at an angle tending to deflect vehicles if struck. Place or block pipe to preclude its accidental movement.

B. Handling

1. Provide equipment and personnel necessary to unload and handle products, by methods to prevent damage or soiling to products, or packaging.

2. Handle by methods to prevent bending or overstressing. Where lifting points are designated, lift components only at those points.
3. Provide additional protection to surrounding surfaces as necessary to prevent damage.

C. Maintenance of Storage

1. Inspect stored products on a scheduled basis.
2. Verify that storage facilities comply with manufacturer's product storage requirements, including environmental conditions continually maintained.
3. Verify that surfaces of products exposed to elements are not adversely affected; that any weathering of finishes is acceptable under requirements of Contract Documents.
4. For mechanical and electrical Equipment in long-term storage, provide manufacturer's service instructions to accompany each item, with notice of enclosed instructions on exterior of package. Service Equipment on a regularly scheduled basis.

- D. Protection After Installation:** Provide substantial coverings as necessary to protect installed products from damage from subsequent construction operations. Remove coverings when no longer needed or as specified.

PART 2 - PRODUCTS

2.1 Product Selection

- A. General Product Requirements:** Provide products that comply with the Contract Documents, that are undamaged and, unless otherwise specified or indicated, new at the time of installation.
1. Provide products complete with accessories, trim, finish, safety guards, and other devices and details needed for a complete installation and the intended use and effect.
 2. Where available, provide standard products of types that have been produced and used successfully in similar situations on other projects.

3. Continued Availability: Where, because of the nature of its application, 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 products for which the manufacturer has published assurances that the products and its parts are likely to be available to Owner at a later date.
4. Conform to applicable Specifications, codes, standards, and regulatory agencies.
5. Comply with size, make, type, and quality specified, or as specifically approved in writing by Engineer.
6. Manufactured and Fabricated Products:
 - a. Design, fabricate, and assemble in accordance with the best engineering and shop practices.
 - b. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.
 - c. Equipment and Materials shall be suitable for service conditions intended.
 - d. Equipment capacities, sizes, and dimensions indicated or specified shall be adhered to unless variations are specifically approved in writing by Engineer.
 - e. Provide labels and nameplates where required by regulatory agencies or to state identification and essential operating data.
7. Do not use products for any purpose other than that for which designed.
8. To the fullest extent possible, provide products of the same kind from a single source.

PART 3 - EXECUTION

3.1 Installation of Products

- A.** Comply with manufacturer's instructions and recommendations for installation of products in the applications indicated. Anchor each product securely in place except as required for proper movement and performance, and accurately located and aligned with other Work.
 - 1.** Obtain and distribute copies of manufacturer's printed instructions and recommendations if not a part of Submittals, containers, or packaging to parties involved in the installation, including a copy to Engineer (and Resident Project Representative).
 - 2.** Maintain one complete set of instructions at the Site during installation and until completion.
 - 3.** Handle, install, connect, clean, condition, and adjust products in accordance with such instructions and in conformance with specified requirements. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for further instructions.

- B.** Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Completion.

PART 4 - MEASUREMENT AND PAYMENT - Not Applicable

**** END OF SECTION 01600 ****

SECTION 01631

SUBSTITUTIONS

PART 1 - GENERAL

1.1 Summary

- A.** This Section includes administrative and procedural requirements for handling requests for substitutions made after award of the Contract.
- B.** Related Work Specified Elsewhere:
 - 1.** Requirements for submitting Contractor's Construction Schedule and the Submittal Schedule: SECTIONS 01320 and 01330.
 - 2.** Requirements governing Contractor's selection of products: SECTION 01600.

1.2 Definitions

- A.** Definitions in this Article do not change or modify the meaning of other terms used in the Contract Documents.
- B. Substitutions:** Changes in products, Materials, Equipment, and methods of construction required by the Contract Documents proposed by the Contractor after award of the Contract are considered to be requests for substitutions. The following are not considered to be requests for substitutions:
 - 1.** Revisions to the Contract Documents requested by Owner or Engineer.
 - 2.** Specified options of products and construction methods included in the Contract Documents.

1.3 Submittals

- A. Substitution Request Submittal:** Engineer will consider written requests for substitution if received within 14 calendar days of Notice to Proceed. Requests received more than 14 calendar days after Notice to Proceed may be considered or rejected solely at the discretion of the Owner.

- 1.** Submit 3 copies of each request for substitution for consideration. Submit requests in the form and according to procedures required for Change Order proposals. Requests for substitution shall not be submitted in the form of a Request for Information (RFI).
- 2.** Identify the Equipment or Material, the fabrication, or installation method to be replaced in each request. Include related Specification Section/Article and Drawing numbers.
- 3.** Provide complete documentation showing compliance with the requirements for substitutions, and the following information, as appropriate:
 - a.** Statement indicating why specified product or method of construction cannot be provided.
 - b.** Coordination information, including a list of changes or modifications needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate the proposed substitution.
 - c.** A detailed comparison of significant qualities of the proposed substitution with those of the Work specified. Significant qualities may include elements such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 - d.** Product data, including drawings and descriptions of products and fabrication and installation procedures.
 - e.** Samples, where applicable or requested.
 - f.** Identification of available sales, maintenance, repair, and replacement services.
 - g.** A statement indicating the effect of the substitution on Contractor's construction progress schedule compared to the schedule without approval of the substitution. Indicate the effect of the proposed substitution on the overall Contract Times. If specified product cannot be provided within the Contract Times, provide letter from

manufacturer, on manufacturer's letterhead, stating lack of availability or delay in delivery.

- h.** An itemized estimate of costs that will result directly or indirectly from approval of the substitution, including:

 - (1)** A proposal of the net change, if any, in the Contract Price.
 - (2)** Costs of redesign required by the proposed change.
 - (3)** Costs of resulting claims as determined in coordination with other contractors having work on the Project affected by the substitution.
 - i.** Statement indicating whether or not incorporation or use of the substitute is subject to payment of any license fee or royalty.
 - j.** Contractor's certification that the proposed substitution conforms to requirements in the Contract Documents, will perform adequately the functions and achieve the results called for by the general design, is similar in substance to that specified, and is suitable for same use as that indicated and specified.
 - k.** Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of the failure of the substitution to perform adequately.
- 4. Engineer's Action:** If necessary, Engineer will request additional information or documentation for evaluation within one week of receipt of a request for substitution. Engineer will notify Contractor of acceptance or rejection of the substitution within 14 calendar days of receipt of the request, or one week of receipt of additional information or documentation, whichever is later. Acceptance, if granted, will be in the form of a Change Order.

PART 2 - PRODUCTS

2.1 Substitutions

- A. Conditions:** Engineer will receive and consider Contractor's request for substitution when one or more of the following conditions are satisfied, as determined by Engineer. If the following conditions are not satisfied, Engineer will return the requests without action except to record noncompliance with these requirements.
- 1.** Extensive revisions to the Contract Documents are not required.
 - 2.** Proposed substitution is in keeping with the general intent of the Contract Documents and will produce indicated results.
 - 3.** Substitution request is timely, fully documented, and properly submitted.
 - 4.** The specified product or method of construction cannot be provided within the Contract Times. Engineer will not consider the request if the product or method cannot be provided as a result of failure to pursue the Work promptly or coordinate activities properly.
 - 5.** The requested substitution offers Owner a substantial advantage, in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Engineer for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
 - 6.** The specified product or method of construction cannot receive necessary approval by a governing authority, and the requested substitution can be approved.
 - 7.** The specified product or method of construction cannot be provided in a manner that is compatible with other materials and where Contractor certifies that the substitution will overcome the incompatibility.
 - 8.** The specified product or method of construction cannot be coordinated with other materials and where Contractor certifies that the proposed substitution can be coordinated.

9. The specified product or method of construction cannot provide a warranty required by the Contract Documents and where Contractor certifies that the proposed substitution provides the required warranty.

B. Engineer's review and acceptance of Submittals shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents. Engineer's acceptance of Submittals not complying with the Contract Documents does not constitute an acceptable or valid request for substitution, nor does it constitute approval of a substitution. Acceptance by Engineer shall not relieve Contractor from responsibility for errors or omissions in the Submittals.

PART 3 - EXECUTION - Not Applicable.

PART 4 - MEASUREMENT AND PAYMENT - Not Applicable.

**** END OF SECTION 01631 ****

SECTION 01780

CONTRACT CLOSEOUT

PART 1 - GENERAL

1.1 Summary

- A.** This Section includes administrative and procedural requirements for Contract closeout including, but not limited to, the following:
 - 1.** Inspection procedures.
 - 2.** Project record document submittal.
 - 3.** Instruction book and operating manual submittal.
 - 4.** Submittal of warranties.
 - 5.** Final cleaning.
- B.** Closeout requirements for specific construction activities are included in the appropriate Sections of the Specifications.
- C. Related Work Specified Elsewhere**
 - 1.** Prerequisites to Contract Completion and Final Acceptance: GENERAL CONDITIONS.
 - 2.** Submittals: SECTION 01330.

1.2 Contract Completion

- A. Preliminary Procedures:** Before requesting inspection for Notice of Completion, complete the following. List exceptions in the request.
 - 1.** In the Application for Payment that coincides with, or first follows, the date Final Acceptance is claimed, show 100% completion for the portion of the Work.
 - a.** Include supporting documentation for completion as indicated in these Contract Documents and a

statement showing an accounting of changes to the Contract Price.

- b.** If 100% completion cannot be shown, include a list of incomplete items, the value of incomplete Work, and reasons the Work is not complete.
 - 2.** Advise Owner of pending insurance changeover requirements.
 - 3.** Submit specific warranties, workmanship Bonds, maintenance agreements, final certifications, and similar documents.
 - 4.** Obtain and submit releases enabling Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 5.** Submit record drawings, instruction books and operating manuals, final project photographs, damage or settlement surveys, property surveys, and similar final record information.
 - 6.** Deliver tools, spare parts, extra stock, and similar items.
 - 7.** Make final changeover of permanent locks and transmit keys to Owner. Advise Owner's personnel of changeover in security provisions.
 - 8.** Complete start-up testing of systems and instruction of Owner's operation and maintenance personnel. Discontinue and remove temporary facilities from the Site, along with mockups, construction tools, and similar elements.
 - 9.** Submit consent of Certificate of Completion from Contractor.
- B. Inspection Procedures:** On receipt of a request for inspection, Engineer will either proceed with inspection or advise Contractor of unfilled requirements. Owner will prepare the Notice of Completion following inspection or advise Contractor of construction that must be completed or corrected before the notice will be issued.
- 1.** Engineer will repeat inspection when requested and assured by Contractor that the work is complete.

2. Results of the completed inspection will form the basis of requirements for Final Acceptance.

1.3 Final Acceptance

A. Preliminary Procedures: Before requesting final inspection for Notice of Completion of Final Acceptance and final payment, complete the following. List exceptions in the request.

1. Submit the final payment request with releases and supporting documentation not previously submitted and accepted. Include insurance certificates for products and completed operations where required.
2. Submit an updated final statement, accounting for final additional changes to the Contract Price.
3. Submit a certified copy of Engineer's final inspection list of items to be completed or corrected, endorsed and dated by Engineer. The certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance and shall be endorsed and dated by Engineer.
4. Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the Date of Contract Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
5. Submit consent of surety to final payment.
6. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
7. Submit a final liquidated damages settlement statement.

B. Reinspection Procedure: Engineer will re-inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except for items whose completion is delayed under circumstances acceptable to Engineer.

1. Upon completion of re-inspection, Owner will prepare a Notice of Completion of Final Acceptance. If the Work is incomplete,

Engineer will advise Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for Final Acceptance.

2. If necessary, re-inspection will be repeated.

1.4 Record Document Submittals

- A. **General:** Do not use record documents for construction purposes. Protect record documents from deterioration and loss in a secure, fire-resistant location. Provide access to record documents for Engineer's reference during normal working hours.
- B. **Record Drawings:** Maintain a clean, undamaged set of blue or black line white-prints of Contract Drawings and Shop Drawings. Mark the set to show the actual installation. This will require an "as constructed" elevation of the manhole top and invert elevations of all pipes entering and leaving the manhole.
 1. Record information concurrently with construction progress.
 2. Mark record sets with red erasable pencil. Use other colors to distinguish between variations in separate categories of the Work. Mark each document "PROJECT RECORD" in neat, large, printed letters.
 3. Mark new information that is important to Owner but was not shown on Contract Drawings or Shop Drawings.
 4. Note related Change Order numbers where applicable.
 5. Organize record drawing sheets into manageable sets. Bind sets with durable-paper cover sheets; print suitable titles, dates, and other identification on the cover of each set.
 6. Upon completion of the Work, submit record drawings to Engineer for Owner's records.
 7. Include the following:
 - a. Depths of various elements of foundation in relation to finish first floor datum.

- b.** Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - c.** Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of construction.
 - d.** Where Submittals are used for mark-up, record a cross-reference at corresponding location on Drawings.
 - e.** Field changes of dimension and detail.
 - f.** Changes made by Change Order or other Modifications.
 - g.** Details not on original Contract Drawings.
 - h.** As constructed information shall include a GPS coordinate of the sanitary manhole including the invert elevation of the pipes entering and leaving the manhole. The GPS level of accuracy shall be to centimeters. A registered land surveyor of the state of Arizona shall conduct the survey. This information shall be recorded on the record information set submitted to the Engineer. The information shall also be provided in an electronic format compatible with AUTOCAD latest release.
 - i.** Provide a record location of all service laterals where they connect to the main sewer. The separation distance between the service lateral at the crossing of a water line shall be recorded by the Contractor on his record documents.
- C. Record Specifications:** Maintain one complete copy of the Project Manual including Addenda. Include with the Project Manual one copy of other written construction documents, such as Change Orders and Modifications issued in printed form during construction.

1. Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
 2. Give particular attention to substitutions and selection of options and information on concealed construction that cannot otherwise be readily discerned later by direct observation.
 3. Note related record drawing information and product data.
 4. Upon completion of the Work, submit record Specifications to Engineer for Owner's records.
 5. Include the following:
 - a. Manufacturer, trade name, catalog number, and Supplier of each product and item of Equipment actually installed, particularly optional and substitute items.
 - b. Changes made by Addendum, Change Order, or other Modifications.
 - c. Related Submittals.
- D. Record Product Data:** Maintain one copy of each product data Submittal. Note related Change Orders and markup of record drawings and specifications.
1. Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the Site and from the manufacturer's installation instructions and recommendations.
 2. Give particular attention to concealed products and portions of the Work that cannot otherwise be readily discerned later by direct observation.
 3. Upon completion of markup, submit complete set of record product data to Engineer for Owner's records.

- E. Miscellaneous Record Submittals:** Refer to other Specification Sections for requirements of miscellaneous record keeping and Submittals in connection with actual performance of the Work. Immediately prior to the date or dates of Substantial Completion, complete miscellaneous records and place in good order. Identify miscellaneous records properly and bind or file, ready for continued use and reference. Submit to Engineer for Owner's records.

- F. Warranties and Bonds:** Specified in GENERAL CONDITIONS, Section 01330.

PART 2 - PRODUCTS - Not Applicable.

PART 3 - EXECUTION

3.1 Closeout Procedures

- A. Operation and Maintenance Instructions:** Arrange for each installer of Equipment that requires regular maintenance to meet with Owner's personnel at Project Site to provide instruction in proper operation and maintenance. Provide instruction by manufacturer's representatives if installers are not experienced in operation and maintenance procedures. Include a detailed review of the following items:
 - 1.** Instruction books and operating manuals.
 - 2.** Record documents.
 - 3.** Tools.
 - 4.** Lubricants.
 - 5.** Fuels.
 - 6.** Identification systems.
 - 7.** Control sequences.
 - 8.** Hazards, hazardous chemicals data sheets.
 - 9.** Cleaning.

10. Warranties and bonds.
11. Maintenance agreements and similar continuing commitments.

B. As part of instruction for operating Equipment, demonstrate the following procedures:

1. Start-up.
2. Shutdown.
3. Emergency operations.
4. Noise and vibration adjustments.
5. Safety procedures.
6. Economy and efficiency adjustments.
7. Effective energy utilization.

3.2 Final Restoration

- A. General:** The GENERAL CONDITIONS requires general cleaning during construction.
1. Remove temporary structures, tools, equipment, supplies, and surplus materials.
 2. Remove temporary protection devices and facilities, which were installed, to protect previously completed Work.
 3. Restore the entire construction area to pre-construction condition.
- B. Removal of Protection:** Remove temporary protection and facilities installed for protection of the Work during construction.
- C. Compliance:** Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the Site and dispose of lawfully.

PART 4 - MEASUREMENT AND PAYMENT - Not Applicable.

**** END OF SECTION 01780 ****

DIVISION III
TECHNICAL SPECIFICATIONS

SECTION 02100

CLEARING AND GRUBBING

PART 1 - GENERAL

1.1 Description

A. Description of Work

The work to be performed in accordance with this section includes clearing, grubbing, and disposal of materials, for all ground surfaces within the limits designated on the plans. The work shall include the furnishing of all labor, tools, equipment, materials and the performing of all operations required to provide a complete item in accordance with the project plans and these specifications.

Clearing and grubbing includes the removal of all brush, undergrowth, heavy growth of grass or weeds, debris, rubbish of any nature, obstructions or material which is unsuitable for the foundation of fills, pavements, or other required structures and the disposal of all spoil materials resulting from clearing and grubbing in an approved landfill.

B. Related Work Specified Elsewhere

Removal of Existing Improvements.....Section
02110
Earthwork.....Section
02200

1.2 Protection of Property

Protect existing improvements, adjacent property, utilities, trees, plants, or any other existing items which are not specifically intended to be removed.

1.3 Submittals

A. Disposal Area

Describe the location of the disposal area and provide written approval for the use of the area for disposing of waste from
LHC 02100-1

the operation. Work performed at the disposal area shall meet all local codes and ordinances.

PART 2 - MATERIALS (NOT APPLICABLE)

PART 3 - EXECUTION

3.1 Limits of Work

Clearing and grubbing operations are to remain within the limits of construction and/or the right-of-way as shown on the plans. Clear and grub only in areas that are affected by excavation or other earthwork operations.

3.2 Construction Methods

Remove all stumps, roots, buried logs, brush, grass, and other unsuitable materials. Grub roots and other projections over 1-1/2 inches in diameter to a depth of at least 18 inches below the finished subgrade or slope elevation.

Backfill all holes remaining after the grubbing operation in accordance with Section 2200, Earthwork.

3.3 Disposal

Dispose of all debris at an approved landfill.

3.4 Burning

No burning shall be permitted.

3.5 Existing Vegetation to Remain

Save all trees and shrubs which will not interfere with excavation or embankment or cause disintegration of the improvements. Coordinate removal of vegetation with the **OWNER**. Protect trees, shrubbery, vines, plants, grasses and other vegetation growing outside of the limits of construction.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

LHC 02100-2

No measurement will be made for this item.

4.2 Payment

Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

****END OF SECTION****

SECTION 02110

REMOVAL OF EXISTING IMPROVEMENTS

PART 1 - GENERAL

1.1 Summary

A. Description of Work

The work to be performed in accordance with this section includes the removal and disposal of various existing improvements, such as pavements, structures, pipes, curbs and gutters, and other items necessary for the accomplishment of the improvement. The work shall include the furnishing of all labor, tools, equipment, materials and the performing of all operations required to provide a complete item in accordance with the project plans and these specifications.

B. Related Work Specified Elsewhere

Clearing and Grubbing.....Section 02100

1.2 Protection of Property

Protect existing improvements, adjacent property, utilities, trees, plants, or any other existing items which are not specifically intended to be removed.

1.3 Disposal

All materials shall be disposed of at an approved landfill, unless otherwise approved by the Owner.

1.4 Submittals

A. Landfill

Provide a copy of the permit to use the landfill.

B. Disposal Area

For sites other than the landfill, describe the location of the disposal area and provide written approval for the use of the area for disposing of waste from the operation. Work performed at the disposal area shall meet all local codes and ordinances.

PART 2 - MATERIALS

2.1 General

Materials required for relocation work shall be as specified herein or as otherwise indicated.

PART 3 - EXECUTION

3.1 Limits of the Work

Confine removal of existing improvements to within the area of construction. Pavement removal shall be limited to an area that is no more than the one week ahead of the projected work. At no time shall the Contractor have asphalt removed from any street longer than 60 days.

3.2 Construction Methods

A. Removal of Existing Portland Cement Concrete Sidewalks, Curb and Gutter and Pavements.

1. Saw cut concrete to neat, vertical, true lines in such a manner that the adjoining surface will not be damaged. The full depth of the existing concrete shall be saw cut.

B. Removal of Existing Asphalt Concrete Pavement

1. Saw cut asphalt concrete to neat, vertical, true lines in such a manner that the adjoining surface will not be damaged. The full depth of the existing asphalt shall be saw cut.
2. Existing asphalt concrete not used in fill areas shall be removed from the site and disposed in an approved landfill or used in a recycling operation.

3.3 Miscellaneous Relocations and Removals

Perform all miscellaneous removals as required by the Owner or where indicated on the plans. The miscellaneous removals shall include but not be limited to the following tasks:

A. Relocate

1. Existing fences, gates, and lights as shown on the Drawings.

B. Remove

1. Planter boxes, block walls, concrete walls and footings.

2. Existing irrigation systems and replace or plug.

C. Removal and Relocation of Signs and Mailboxes

1. All City owned signs shall be removed from the areas of construction and delivered to the City as directed. All privately owned signs located within the areas of construction shall be removed and delivered to the property Owner or placed on the adjacent property as directed.
2. All mailboxes located within the areas of construction shall be removed and temporarily reset on the adjacent property for use. When grading and construction is adequately completed, the mailboxes shall be permanently reset at the back of the curb and restored to a better than or equal condition than existing.

3.4 Backfill and Densification

Backfill all holes remaining after removal of existing improvements.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

No measurement will be made for this item.

4.2 Payment

Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

**** END OF SECTION 02110 ****

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.1 Description

A. Description of Work

The work to be performed in accordance with this section includes excavation, fill, borrow, spoil and compaction for roadways, structures, channels and embankments. The work shall include the furnishing of all labor, tools, equipment, materials and the performing of all operations required to provide a complete item in accordance with the project plans and these specifications.

B. Related Work Specified Elsewhere

Clearing and Grubbing..... Section 2100
Removal of Existing Improvements Section 2110
Trench Excavation and Backfill..... Section 2300
Subgrade Preparation..... Section 2600

1.2 Quality Assurance

A. Reference Test Standards and Specifications

ASTM D698, Test Methods for Moisture Density of Soils and Soil-Aggregate Mixtures Using 5.5 lb. Rammer and 12-inch Drop.

ASTM D1556, Density of Soil in Place by the Sand-Cone Method.

ASTM D6938-08a, Density of Soil and Soil-Aggregate in Place by Nuclear Methods.

ASTM D6938-08a, Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods.

Rock Correction Procedure for Maximum Density Determination, ARIZ 227.

B. Frequency of Testing

1. Maximum Dry Density and Optimum Moisture Content, ASTM D698.

- a. One test for each different class or type of material shall be provided by the **CONTRACTOR** prior to any earthwork operations.
- b. **CONTRACTOR** shall provide additional test when previous test is suspect, due to subtle changes in the material, as determined by the **OWNER**.

2. Density of Soil In-Place by the Sand Cone or by Nuclear Methods, ASTM D1556 or D6938-08a.

- a. **OWNER** will perform a minimum of one test per lift per 5,000 square yards per each type of material.
- b. **OWNER** will perform additional tests as required to ensure proper compaction.

C. Testing Tolerances

1. Relative Percent Compaction

Not less than as specified on plans or in these specifications.

2. In-Place Moisture Content

As required to achieve minimum relative compaction.

3. Soft or Yielding Surfaces

Regardless of the percent compaction obtained by test, areas which are soft and yield under the load of construction equipment are to be removed and replaced at no additional cost.

1.3 Submittals

A. Materials Test Reports

Report on maximum dry density and optimum moisture content of soils proposed for use in the work prior to beginning of construction.

B. Disposal Area

Provide the location of the disposal area(s) and provide written approval for the use of the area(s) for disposing of excess soils from the operation. Work performed at the disposal areas shall meet all local codes and ordinances.

PART 2 - MATERIALS

2.1 Soil and Soil Aggregate Materials

A. Unsuitable materials not to be incorporated in the work.

1. Organic matter such as peat, mulch, organic silt or sod.
2. Soils containing expansive clays.
3. Material containing excessive moisture.
4. Poorly graded coarse material.
5. Material with particle sizes in excess of 12 inches.
6. Material which will not achieve density and/or bearing requirements.
7. Asphalt concrete or Portland cement concrete that does not conform to 3.5 Engineered Fill under Section 2200, Earthwork.

2.2 Earthwork Balance

No attempt has been made to estimate cut and fill earthwork quantities. The **CONTRACTOR** is solely responsible for the estimation of the earthwork quantities required to construct the project as indicated on the plans and described herein.

PART 3 - EXECUTION

3.1 Preliminary Investigation of the Work

Verify that all preliminary work including clearing, grubbing and staking has been performed in accordance with these specifications prior to earthwork operations.

3.2 Blasting

No blasting will be permitted unless approved by the **OWNER**. All permits shall be obtained by the CONTRACTOR at his own expense.

3.3 Spoil Disposal Area

Disposal of surplus excavated material shall be in an approved spoil area, outside of the project right-of-way. Make all arrangements necessary for disposal of material at an off-site location. The disposal of surplus materials in the designated area shall meet all local codes and ordinances.

3.4 Excavation

A. Unsuitable Material

Overexcavate existing unsuitable material below the lower limit of excavation to a depth that will provide adequate bearing, as determined by the **OWNER**. Remove unsuitable material from the site and dispose of the material at approved spoil area. Replace the overexcavated material with suitable material in accordance with Subsection 3.5 Engineered Fill.

B. Slides and Slipouts

Excavate and grade material outside the finished work which is unstable, or which has slipped out, to the slope and elevation determined by the **OWNER**. Dispose of excess material at approved spoil disposal area.

C. Slopes

Finish excavation slopes to the lines and grades shown on the plans. Remove all debris and loose materials. Round all grade breaks and slope transitions. Finish elevations on slopes shall not deviate from the plan elevation by more than 0.25 feet. Variations from the plan

grade and cross section shall be compensating so that the average grade and cross section are obtained.

D. Foundation Excavation

1. Cast in Place Concrete on Rock

Remove sufficient depth of rock surface to expose sound rock. Cut rock to approximate horizontal and vertical steps to provide minimum dimensions. Grout seams and faults in rock surfaces as directed by the OWNER.

2. Cast in Place Concrete on In-Situ Soil

Excavate to the lines shown such that the surface on which the concrete is to rest is undisturbed native material with no loose materials or debris. Replace over excavation with concrete as specified for the structure.

E. Roadway Excavation

Remove the existing pavement and excavate the existing base course and subgrade materials to the new subgrade elevation. Excavate to the cross section as shown on the plan. Prepare the existing soil at the new subgrade elevation in accordance with Section 02600, Subgrade Preparation.

F. Shoring and Sheeting

Provide such bracing, sheeting or shoring necessary to perform and protect the excavation as required for safety. Shore, sheet and brace excavations as set forth in the rules, orders and regulations of the United States Department of Labor Occupational Health and Safety Administration (OSHA). Provide detailed plan and calculations as prepared by a registered professional engineer for excavations 20 feet in depth or greater or when shoring, sheeting or bracing deviates from OSHA standards. Place and remove shoring, sheeting and bracing so as not to damage adjacent improvements, utilities or utility being placed. Costs for shoring, sheeting and bracing to be incidental to the other items.

3.5 Engineered Fill

A. Subgrade Preparation

Prior to fill placement, plow or scarify the surface to a minimum depth of 6 inches. Moisture condition and compact surface to 95 percent of the maximum density in accordance with Section 02600, Subgrade Preparation.

B. Moisture Conditioning

Condition the soil by aerating or wetting to obtain the moisture content required to achieve the relative percent compaction. Mix the soil such that the moisture content is uniform throughout the lift.

C. Fill Placement

1. Lift Thickness

The uncompacted lift thickness shall not exceed eight (8) inches. When material contains more than 25 percent of rock larger than six (6) inches, the uncompacted lift thickness shall not exceed the maximum particle size dimension.

2. Rock Fill

Rock, broken portland cement concrete and crushed asphalt concrete is permitted in fill areas when conforming to the following:

- a. Place earth or other fine material around the interstices of the pieces to form a dense fill layer. Nesting is not permitted.
- b. Do not place pieces larger than 4 inches closer than 12 inches from any structure.
- c. Do not place pieces larger than 2-1/2 inches closer than 12 inches from the finish subgrade.
- d. Existing asphalt concrete conforming to these requirements for rock fill may be used as fill material only in areas to receive pavement.

3. Benching

When fill is to be placed and compacted on slopes steeper than 5:1 or where new fill is to be compacted against existing fill or where embankment is built 1/2 width at a time, the slopes of original and old or new fills shall be benched as the fill is placed. A new bench shall be started wherever the vertical cut of the next lower bench intersects the existing ground. Material thus cut out shall be recompacted along with the new embankment material by the CONTRACTOR at no additional cost. The vertical bench cut shall not exceed three (3) feet.

D. Compaction

1. Compaction Methods

Water consolidation will not be permitted.

2. Percent Relative Compaction

Compact fill and backfill as indicated on the plan. When not indicated on the plan, compact as specified herein.

- a. 95% of maximum dry density
 1. Areas to receive fill
 2. Areas to receive structures, including pavement, upper two feet of fill
 3. Structural backfill
- b. 90% of maximum dry density
 1. All other areas

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

- A. No measurement will be made for this item.

4.2 Payment

- A.** Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

** END OF SECTION 02200 **

SECTION 02300

TRENCH EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 Description

A. Description of Work

The work to be performed in accordance with this section includes the excavation, trenching, backfilling, and surface repair for all pipelines, pipe culverts, box culverts, accessories and lines connected thereto, complete including sheeting and shoring, dewatering, grading and cleanup.

Excavation for appurtenant structures such as manholes, inlets, transition structures, junction structures, vaults, valve boxes, catch basins, etc. shall be included in this section.

The work shall include the furnishing of all labor, tools, equipment, materials and performing all operations to provide a complete item in accordance with the project plans and these specifications.

B. Related Work Specified Elsewhere

Earthwork.....	Section 02200
Water Piping Systems.....	Section 02550
Valves.....	Section 02515
Pipe Install.....	Section 02535

C. Definitions

1. Trench

An excavation in which the depth is greater than the width of the bottom of the excavation.

2. Foundation

Material on which bedding is to be directly placed.

3. Bedding

Granular material on which pipe or structure is to be directly placed. The bedding extends from 6 inches below the pipe to 12 inches above the top of the pipe.

4. Select Backfill

Material placed from top of the bedding to finished subgrade.

1.2 Quality Assurance

A. Reference Test Standards and Specifications

ASTM C94, Standard Specification for Ready Mix Concrete.

ASTM C117, Standard Test Method for Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing.

ASTM C131, Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregate.

ASTM D1556, Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method.

ASTM D698, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft³).

ASTM D6938, Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

ASTM D4215, Standard Specification for Cold Mixed, Cold Laid Bituminous Paving Mixture.

ASTM D4318, Standard Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

Rock Correction Procedure for Maximum Density Determination, ARIZ 227.

Moisture – Density Relationship Using Typical Moisture – Density Curves (One Point Proctor) Method A, ARIZ 232

B. Frequency of Testing

1. Maximum Dry Density and Optimum Moisture Content, ASTM D698.

- a. One test for each different class or type of material shall be provided by the **CONTRACTOR**.
- b. **CONTRACTOR** shall provide additional test when previous test is suspect, as determined by the **ENGINEER**.
- c. The **ENGINEER** at the discretion of the **OWNER** may perform quality assurance testing for compaction, gradation and plasticity index of bedding sand and select backfill. If any test results show non-compliance with the project specifications, the non-complying materials shall be removed and replaced or reworked by the **CONTRACTOR**. The **CONTRACTOR** shall perform additional tests at his cost to verify an acceptable condition prior to acceptance by the **ENGINEER**.

2. Density of Soil In-Place by Sand Cone or by Nuclear Methods

- a. **CONTRACTOR** shall perform a minimum of one test per lift per 500 linear feet of trench for each type of material.
- b. **CONTRACTOR** shall perform additional tests as required to ensure proper compaction.

3. Sieve Analysis of Aggregate, ASTM C136

- a. **CONTRACTOR** shall perform one test per 1,000 cy per material type of Bedding Sand Material incorporated into the WORK.
- b. **CONTRACTOR** shall perform one test per 1,000 cy per

material type of Select Backfill Material incorporated into the WORK.

4. Plasticity Index of Soils, ASTM D4318

- a. **CONTRACTOR** shall perform one test per 1,000 cy per material type of Bedding Sand material incorporated into the WORK.
- b. **CONTRACTOR** shall perform one test per 1,000 cy per material type of Select Backfill material incorporated into the WORK.

5. Moisture – Density Relationship Using Typical Moisture – Density Curves (One Point Proctor) Method A, ARIZ 232

- a. **CONTRACTOR** shall perform this test any time the fill material appears to have changed or as directed by the **ENGINEER** verify the appropriate proctor is being utilized.

C. Testing Tolerances

1. Percent Relative Compaction

Not less than as specified on plans or in these specifications.

2. In-Place Moisture Content

As required to achieve specified percent relative compaction.

3. Soft or Yielding Surfaces

Regardless of percent relative compaction obtained by test, areas which are soft and yield under the load of construction equipment are to be removed and replaced at no additional cost.

1.3 Submittals

A. Materials Test Reports

1. Report on maximum dry density and optimum moisture content prior to beginning of construction.
2. Report on bedding and backfill materials compliance tests as required. Compaction test reports shall be submitted to the **ENGINEER** within two (2) business days of completion of each test.

B. Spoil Disposal Area

Provide location and written approval for area to dispose of spoil from operation, as approved by **ENGINEER**.

C. Shoring Plan

Provide plans, details, and calculations by a professional Engineer registered in the State of Arizona if shoring or sheeting is required. See Section 02254

D. Dewatering Plan

Provide plans, details and calculations by a professional Engineer registered in the State of Arizona if dewatering is required.

1.4 Job Conditions

A. Dewatering

It is the **CONTRACTOR'S** responsibility to dewater if groundwater is encountered.

B. Protection of Existing Utilities

Maintain all utilities both underground and overhead in continuous service throughout the contract period. Liability for damages to, or interruption of services caused by the construction shall be borne by the **CONTRACTOR**.

PART 2 - MATERIALS

2.1 Soil and Soil Aggregate Materials

A. Unsuitable materials not to be incorporated in the work include:

1. Organic matter such as peat, mulch, organic silt or sod.
2. Soils containing expansive clays.
3. Material containing excessive moisture.
4. Poorly graded coarse material.
5. Particle size in excess of 6-inches.
6. Material which will not achieve density and/or bearing requirements.
7. Material containing asphalt concrete or Portland cement concrete.

B. Bedding

Bedding for all water, sewer, storm drain lines, and manholes specified in Sections 2500, 2551, 2550, 2560, and 2570 shall be bedded in bedding sand. Culverts, specified in Section 2520, shall be bedded on aggregate base course per subsection 2.1.E unless otherwise specified.

1. Bedding Sand

Bedding sand shall consist of non-plastic sandy material conforming to the following requirements:

Sand Equivalent (SE), 30 Minimum
PH 6.5 – 8.5
Resistivity 2,000 – 50,000 ohm-cm
Sulfate (optional) 1500 PPM or less

SIEVE SIZES	PERCENTAGE BY WEIGHT
3/8"	100
No. 4	90-100
No. 50	10-40
No. 100	3-20
No. 200	0-15

C. Granular Backfill

Native excavated or approved import granular material, free draining and free of unsuitable materials defined herein. Granular backfill shall be non-plastic, well graded and meet the following requirements:

Sieve Size	Percent by Weight Passing
4 inches	100
No. 4	30-75
No. 8	20-60
No. 30	10-40
No. 200	0-12

D. Aggregate Base Course

Crushed aggregate or processed natural material, clean, hard, sound, and free of any detrimental quantity of soft, friable, elongated, or laminated pieces, organic matter or other deleterious substances. Properties of which shall meet the following requirement:

Grading, ASTM C136 and ASTM C117.

Sieve Size	Percent by Weight
1 1/2"	100
No. 4	30-70
No. 8	20-60
No. 30	10-40
No. 200	0-12

Percentage of Wear, ASTM C131, maximum percentage of wear of 40 after 500 revolutions.

Plasticity Index and Liquid Limit, ASTM D4318, maximum plasticity index of 5, maximum liquid limit of 25 percent.

2.2 Portland Cement Concrete

ASTM C94 and Specification Section 3300.

2.3 Asphalt Cement Concrete

As required in Specification Section 2630.

2.4 Cold Mix, Cold Laid Bituminous Paving Mixture

ASTM D4215.

2.5 Buried Warning and Identification Tape

Polyethylene plastic and metallic core or metallic-faced, acid- and alkali-resistant, polyethylene plastic warning tape manufactured specifically for locating, warning, and identification of buried utility lines. Provide tape on rolls, 3-inch minimum width, color coded as stated below for the intended utility with warning and identification imprinted in bold black letters continuously over the entire tape length. Warning and identification to read, "CAUTION, BURIED (intended service) LINE BELOW" or similar wording. Color and printing is to be permanent, unaffected by moisture or soil.

WARNING TAPE COLOR CODES	
RED	ELECTRIC
YELLOW	GAS, OIL, DANGEROUS MATERIALS
ORANGE	TELEPHONE AND OTHER COMMUNICATIONS
BLUE	WATER
GREEN	SEWER
WHITE	STEAM, AIR
PURPLE	REUSE

A. Warning Tape for Metallic Piping

Acid and alkali-resistant polyethylene plastic tape conforming to the width, color, and printing requirements indicated above. Minimum thickness of the tape shall be 0.003 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise with a maximum 350 percent elongation.

B. Detectable Warning Tape for Non-Metallic Piping

Polyethylene plastic tape to the width, color, and printing

requirements indicated above. Minimum thickness of the tape shall be 0.004 inch. Tape shall have a minimum strength of 1500 psi lengthwise and 1250 psi crosswise.

PART 3 - EXECUTION

3.1 Preliminary Investigation of the Work

Verify that all of the preliminary work including construction staking has been performed in accordance with the plans and specifications prior to trenching and backfill operations.

3.2 Trenching in Fill Areas

Grade fill areas to within 1 foot of the finish grade prior to trenching and placement of the pipeline.

3.3 Excavation

A. General

Perform all excavations of every description and of whatever substances encountered to the depths indicated on the plans and including excavation ordered by the **ENGINEER** of compacted fill for the purpose of performing tests. Use open cut excavation methods unless otherwise indicated on the plans or approved by the **ENGINEER**.

B. Trench Widths

Trenches shall be excavated per LHC Standard Detail 200A

Maintain trench walls as vertical as possible except as required by safety standards and as required for sheeting and shoring.

If the maximum trench width is exceeded at the top of the pipe, the **CONTRACTOR** shall provide necessary additional load bearing capacity by means approved by the **ENGINEER** at no additional cost to the **OWNER**.

C. Over Excavation

1. Unauthorized

Fill and compact unauthorized excavation beyond the specified grade line, at the **CONTRACTOR'S** expense, with bedding material, compact to 95 percent of the maximum density. No payment will be made for unauthorized over excavation.

2. Rock

Over excavate rock encountered in the trench to provide a minimum of six inches of bedding below the pipe and the minimum width at the spring line.

3. Unsuitable Material

Over excavate unsuitable material to the depth necessary to provide the required support as determined by the **ENGINEER**. Backfill the over excavation with bedding material and compact to at least 95 percent of the maximum density.

D. Excavation for Manholes, Valves, Inlets, Catch Basins and Other Accessories

Provided the excavated surfaces are firm and unyielding, the **CONTRACTOR** may elect to cast concrete for the structure directly against excavated surfaces. Over excavate to provide bedding where shown on the plans.

E. Pavement and Concrete Cutting and Removal

Sawcut, remove and dispose of existing pavements and concrete per Specification Section 2110.

F. Grading and Stockpiling

1. Grading

Grade in the vicinity of the trench to prevent surface water from flowing into the trench. Remove any water accumulated in the trench by pumping or by other approved methods. Stockpile excavated material in an orderly manner a sufficient distance back from the edges of the trench to avoid

overloading and to prevent slides or cave-ins.

2. Topsoil

Excavate topsoil and stockpile separately. Replace topsoil upon completion of backfill and grade to the elevations indicated on the plans.

G. Shoring and Sheeting

Shore, sheet and brace excavations as set forth in the rules, orders and regulations of the United States Department of Labor Occupational Health and Safety Administration (OSHA), and as specified in section 02254 of these specifications. Provide detailed plan and calculations as prepared by a registered professional Engineer for excavations 20 feet in depth or greater or when shoring, sheeting or bracing deviates from OSHA standards. Place and remove shoring, sheeting and bracing so as not to damage adjacent improvements, utilities or utility being placed. Costs for shoring, sheeting, and bracing is considered incidental.

H. Open Trench

1. Maximum Length

The maximum length of open trench within developed, dedicated right of way is not to exceed 500 feet per trench and pipeline crew, provided that all proper barricades and safety procedures have been addressed. The trench is considered to be open until backfill is completed to adjacent finish grade elevation.

2. Street Crossing

Complete backfill of trench across streets at the end of each work day. Use temporary patch material (cold mix asphalt concrete) or steel plates as required.

3. Temporary Provisions

Furnish and install trench bracing and steel plating required to provide safe and convenient vehicular and pedestrian passage across trenches where required. Maintain access to and from emergency facilities at all times.

3.4 Foundation, Bedding, Backfilling and Compaction

A. Foundation

Excavate trench bottom to the depth and width as shown. Remove all loose, disturbed material from the bottom of the trench such that the bedding shall rest on firm, undisturbed soil.

B. Bedding

Moisture condition and place bedding material to required thickness. Compact bedding material to the specified density.

C. Fine Grading

Accurately grade the bottom of the trench to provide uniform bearing and support for each section of pipe at every point along its entire length, except where it is necessary to excavate for joints.

D. Moisture Conditioning

Moisture condition all bedding and backfill materials by aerating or wetting to obtain the moisture content required to achieve specified percent relative compaction. Completely mix the material until the moisture content is uniform throughout the lift.

E. Lift Thickness

1. The following table applies when using mechanical compaction:

LIFT DESCRIPTION	MAXIMUM LOOSE LIFT THICKNESS, INCHES
Bedding	8-Inches in all cases
Backfill	
Aggregate Base Course	

Lift thickness may be increased if **CONTRACTOR** can prove, through a series of density tests, to be approved by the Engineer, that minimum density is achieved throughout the lift thickness.

F. Compaction

1. Compaction Methods

Construction shall be accomplished by mechanical methods. Rubber tire wheel rolling will not be allowed.

2. Pipe Haunch

When using mechanical methods, hand compact initial backfill in pipe haunch with a pipe haunch compactor (J-bar) or mechanical vibrator sized to fit the narrow width between the pipe and the trench. Give special attention to provide proper compactive effort in the pipe haunch zone.

3. Compaction Densities

Thoroughly compact trench bedding and backfill to not less than the percent relative compaction as presented in the following table, unless more stringent requirements are called for on the plans.

PERCENT RELATIVE COMPACTION MINIMUM				
Backfill Type	Location	From Subgrade Surface To 2' Below Surface	From 2' Below Surface To 1' Above Top of Pipe	From 1' Above Top of Pipe To Bottom of Trench
I	Under any existing or proposed pavement, curb, gutter, sidewalk, or such construction included in the contract or when any part of the trench excavation is within 2' of the above.	95%	95%	95%
II	On any utility easement, street, road or alley right-of-way out- side of (I).	95%	95%	95%

III	Around any structures or exposed utilities.	95% in all cases
IV	Outside of right-of-way and not below any curb, gutter sidewalk or other structures.	90% in all cases

3.5 Buried Warning and Identification Tape

Place warning and identification tape to the depth indicated on the plan. Center tape over pipeline.

3.6 Backfill for Manholes, Valves, Inlets, Catch Basins and Other Accessories

Backfill appurtenances and structures including bedding, backfill, lift thicknesses and compaction as indicated.

3.7 Pavement Replacement and Surface Restoration

A. Grading

Perform all grading adjacent to backfilled trenches and structures necessary to leave the area in a neat and satisfactory condition as approved by the **ENGINEER**.

B. Surface Restoration

Restore all streets, alleys, driveways, sidewalks, curbs or other surfaces which were broken or damaged by the installation of the new work, to a condition as good as or better than originally encountered in accordance with these specifications, accepted standards and as acceptable to the **ENGINEER**.

1. Landscape

Replace landscape rock, sod, shrubs, trees, grass, sprinkler systems as required to a condition as good as or better than originally encountered in accordance with these specifications, accepted standards and as acceptable to the Engineer.

2. Temporary Pavement

Place cold mix, cold laid bituminous paving mixture in accordance with ASTM D4215 immediately following backfilling and compaction of trenches through existing pavement. Maintain pavement in safe and smooth condition until final pavement can be placed.

3. Pavement Replacement

Replace permanent asphalt cement, concrete pavement per the requirements of Specification Section 2630, Asphalt Concrete Pavement.

4. Clean Up

Remove all excess soil, concrete, etc. from the premises. Leave job site in a neat and clean condition.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

No measurement will be made for this item.

4.2 Payment

Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

****END OF SECTION 02300****

SECTION 02321

EXCAVATION, FILLING, AND BACKFILLING FOR STRUCTURES

PART 1 - GENERAL

1.1 Summary

A. This Section includes all necessary excavation, filling, and backfilling for structures and all related Work, including duct banks and manholes.

B. Related Work Specified Elsewhere

Trench Excavation and Backfill.....Section 02300
Concrete.....Section 03300

1.2 Quality Assurance

A. Reference Standards and Specifications

1. American Society for Testing and Materials (ASTM)

ASTM D1557 - Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

ASTM D4253 - Test Method for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.

ASTM D4254 - Test Method for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.

2. Occupational Safety and Health Administration (OSHA)

Part 1926 - Safety and Health Regulations for Construction.

1.3 Submittals

A. Submit as specified in Section 01330.

B. Where selecting an option for excavation, trenching, and shoring in compliance with local, state, or federal safety regulations such as "OSHA Part 1926" or successor regulations, which require design by

a registered professional engineer, submit (for information only and not for Engineer approval) the following:

1. Copies of design calculations and notes for sloping, benching, support systems, shield systems, and other protective systems prepared by or under the supervision of a professional engineer legally authorized to practice in the jurisdiction where the Project is located.
2. Documents provided with evidence of registered professional engineer's seal, signature, and date in accordance with appropriate state licensing requirements.

PART 2 - MATERIALS

2.1 Fill and Backfill Material

A. Earth Backfill:

Use suitable material as specified in SECTION 02300, PART 2 for granular backfill.

B. Granular Fill:

Native excavated or approved import granular material, free draining and free of unsuitable materials defined herein. Granular backfill shall be non-plastic, well graded and meet the following gradation:

Sieve Size	Percent by Weight Passing
¾ inches	100
No. 4	40 - 85
No. 8	30 - 75
No. 40	10 - 50
No. 100	5 - 20
No. 200	3 - 12

2.2 Concrete

- A. Includes all concrete used to restore bottom of excavation to proper elevation, and in concrete seal coats.
- B. Concrete shall be as specified in Section 03300.

PART 3 - EXECUTION

3.1 Excavation

A. Perform as specified in Section 02300 and as follows:

1. Excavate area adequate to permit efficient erection and removal of forms.
2. Trim to neat lines where details call for concrete to be deposited against earth.
3. Excavate by hand in areas where space and access will not permit use of machines.
4. Notify Engineer immediately when excavation has reached the depth indicated. Do not proceed further until approved.
5. Restore bottom of excavation to proper elevation with compacted fill in areas overexcavated, as approved.
6. Top with 75-mm (3-inch) concrete seal coat if required to provide satisfactory subgrade for structural base slabs:
 - a. Seal coat shall conform to applicable requirements of Section 03300.
7. Use sides of trenches to form sides of duct banks where possible and where sides of trench are vertical, stable, and excavated to the proper line.

B. Sheeting and Shoring:

1. Sheeting and Shoring shall be provided when soil conditions indicate the need for sheeting and shoring.

2. Damages:

- a. Repair all damage resulting from Contractor's excavation and remove and replace all undermined pavements with Owner-approved equal, either concrete or asphalt, at Contractor's expense and in accordance with Section 02630.

3.2 Filling and Backfilling

A. Granular Fill:

1. Place on prepared subgrade where indicated, prior to placing concrete in slabs on grade.
2. Lifts shall not exceed 150 mm (6 inches) in loose-layer thickness.
3. Compact to 95% relative density as referenced to ASTM D4253 and D4254.

B. Earth Backfill:

1. Backfill only after concrete has attained 70% design strength.
2. Backfill adjacent to structures only after, in the opinion of Engineer, a sufficient portion of the structure has been built to resist the imposed load.
3. Remove all debris from excavation prior to placement of material.
4. The slope bounding the excavation, if steeper than 6 horizontal: 1 vertical, shall be stepped or serrated prior to placing the backfill material.
5. Perform backfilling simultaneously on all sides of structures.
6. Place backfill in level layers not exceeding 100 to 200 mm (4 to 8 inches) in loose-layer thickness.
7. Exercise extreme care in the use of heavy equipment in areas adjacent to structures.

8. Compact to 95% of maximum dry density within the moisture content range from 2% below optimum to 2% above optimum. Optimum moisture and maximum dry density shall be determined by ASTM D1557. Accomplish without inundation or flooding.

3.3 Field Quality Assurance

A. Compaction:

1. Contractor shall, through services of an independent laboratory, test all filling and backfilling for structures to determine conformance with density relationships specified.
2. Method of test shall be as specified in SECTION 02300, PART 3.
3. The frequency of tests shall be in compliance with jurisdictional requirements.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

- A. No measurement will be made for this item.

4.2 Payment

- A. Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

****END OF SECTION****

SECTION 02515

UTILITY VALVES AND ACCESSORIES

PART 1 - GENERAL

1.1 Summary

A. Description of the Work

The work to be performed in accordance with this Section includes all work associated with the installation and testing of all valves, hangers and supports, gauges, and other accessories associated with the project piping.

The work shall include the furnishing of all labor, tools, equipment, materials and performing all operations to install all valves hangers and supports, gauges, and other accessories.

B. Related Work Specified Elsewhere

Water Piping Systems..... Section 2550
Electrical.....Section 16010 thru 16950

1.2 Quality Assurance

A. Reference Standards and Specifications

1. American National Standards Institute (ANSI)

ANSI B16.1 - Cast-Iron Pipe Flanges and Flanged Fittings,
Class 25, 125, 250 and 800.

2. American Society for Testing and Materials (ASTM)

ASTM A126 - Gray Iron Castings for Valves, Flanges and
Pipe Fittings.

ASTM A276 - Stainless and Heat Resisting Steel Bars and
Shapes.

ASTM A536 - Ductile Iron Castings.

3. American Water Works Association (AWWA)

AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.

AWWA C207 - Steel Pipe Flanges for Waterworks Service, Sizes 4 Inch through 144 Inch.

AWWA C504 - Rubber Seated Butterfly Valves.

AWWA C507 - Ball Valves, 6 Inch through 48 Inch.

AWWA C508 - Swing-Check Valves for Waterworks Service, 2 Inch through 24 Inch NPS.

AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.

AWWA C512 - Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.

AWWA C550 - Protective Epoxy Interior Coatings for Valves and Hydrants.

AWWA C600 - Installation of Ductile-Iron Water Mains and their Appurtenances.

B. Manufacturer Quality Assurance

Manufacturers shall be experienced in the design and manufacture of specific valves and accessories for a minimum period of 5 years and all valves and fittings shall be manufactured in U.S.

C. Field Testing

- 1.** Perform on piping and valves as specified including:
 - a.** Check valves.
 - b.** Gate valves.
 - c.** Butterfly valves
 - d.** Ball valves.

- e. Air and air/vacuum valves.
 - f. Control valves.
 - g. Gauges.
2. Valves may be either tested while testing pipelines, or as a separate step.
 3. Test that valves open and close smoothly under operating pressure conditions. Test that two-way valves open and close smoothly under operating pressure conditions from both directions.
 4. Inspect air and vacuum valves as pipe is being filled to verify venting and seating is fully functional.
 5. Count and record number of turns to open and close valve; account for discrepancies with manufacturer's data.
 6. Set, verify, and record set pressures for relief and regulating valves.
 7. Automatic valves to be tested in conjunction with control system testing. Set opening and closing speeds, limit switches, as required or recommended by Engineer.

1.3 Submittals

- A. Submit as specified in Section 1330.
- B. Include, but not limited to, the following:
 1. Catalog data or illustrations showing principal dimensions, parts, and materials.
 2. Spare parts list referenced to illustration of parts.
 3. Assembly and disassembly or repair instructions.
 4. Dimensions of the clearance required for butterfly valve discs, handwheels, actuators or any other moving part.

5. Manufacturers published operation and maintenance instructions.

C. Certificates and Affidavits: Furnish prior to shipment. Include the following:

1. Test certificates.

2. Affidavit of compliance with applicable AWWA Standard.

1.4 Delivery, Storage, and Handling

A. Ship all valves with suitable end covers to prevent entrance of foreign material into valve body.

B. Protect valve threads, flanges, stems, and operators from damage.

C. Ship valves 2-1/2-inch and larger to the Project Site tagged with the valve number shown on the Drawings and valve schedule. Tag smaller valves to show the piping system in which it is to be used.

1.5 Responsibility

Actuators, their controls, and accessories shall be the responsibility of the valve manufacturer for sizing, assembly, certification, field testing, and any adjustments necessary to operate the valve as specified.

PART 2 - MATERIALS

2.1 Gate Valves

A. General:

1. AWWA gate valves to be in full compliance with stated AWWA standard and the following requirements:

2. Provide 2-inch operating nut and handwheel for AWWA gate valves 12 inches and smaller.

3. Provide Affidavit of Compliance per the applicable AWWA standard for AWWA gate valves.

4. Mark AWWA gate valves with manufacturer's name or mark, year of valve casting, valve size, and working water pressure.

5. Repaired AWWA gate valves shall not be submitted or supplied.

2.2 Exposed Gate Valves

- A. AWWA C509, iron body, bronze mounted, flanged ends, double-disc gate, non-rising bronze stem, resilient seated. working water pressure 200 psi for 3 inches through 12 inches and 150 psi for 14 inches through 48 inches.
- B. Manufacturers and Products:
 1. Mueller Valve Company.

2.3 Buried Gate Valves

- A. AWWA C509, iron body, bronze mounted, mechanical joint ends, double-disc gate, non-rising bronze stem, resilient seated, 2-inch operating nut, and O-ring sealed stuffing box, working water pressure of 200 psi for 3 inches through 12 inches and 150 psi for 14 inches through 48 inches.
- B. Manufacturers and Products:
 1. Mueller Valve Company.

2.3 Exposed Butterfly Valves

- A. High Performance Butterfly Valves, ANSI Class 150, 10-inch valves, lug style body, CF8M body and disc, offset disc design, 360 degree Class VI bubble tight pressure assisted soft seating. Provide with gear driven 90 degree handwheel operator.
- B. Manufacturers and Products:
 1. Pratt, HP Series.
 2. DeZurik, Model BHP

2.4 Buried Butterfly Valves

- A. AWWA C504, Class 150B, Mechanical joint ends, Cast-iron body, cast or ductile iron disc, Type 304 stainless steel shafts, rubber seat

bonded or molded in body only, and stainless steel seating surface. Provide epoxy lining and coating in compliance with AWWA C550.

B. Manufacturers and Products:

1. Pratt.
2. DeZurik.

2.2 Cushioned Swing Check Valves

A. Acceptable Manufacturers

1. APCO, Valve and Primer Corporation, CVS type.
2. GA Industries, Inc.

B. Operational Requirements

1. Prevent reverse flow without shock or hammer.
2. Drip Tight Seat with internal pipeline forces.
3. Cushioned with air cylinder controls in manner permitting adjustment of speed of closure.

C. Design: Conform to AWWA C508 and as specified.

1. Swing disc type with single shaft and flanged body. Flanges shall be ANSI B16.1, Class 125.
2. Cushion chamber shall be mounted externally on valve body.
3. Valve disc shall have external lever and counterweight to initiate closure.
4. Suitable for 250 psi operating pressure.

D. Materials and Construction

1. Valve body shall be cast iron, ductile iron, or steel.
2. Valve disc shall be cast iron, ductile iron, or stainless steel.

3. Seats and seat ring shall be renewable. Seats shall be bronze or stainless steel. Seat rings shall be Buna-N or bronze.

2.3 Bronze Swing Check Valves

A. Acceptable Manufacturers

1. Crane
2. Nibco
3. Approved equal.

B. Design

1. "Y" Pattern check swing type.
2. Rated for 200 psi cold working pressure.

C. Operation

1. Prevent reverse flow without shock or hammer.
2. Seat tightly with internal pipeline forces.
3. For use on service water lines 2" and less.

D. Materials and Construction

1. Valve body shall be bronze ASTM B62.
2. Valve disc shall be composition or PTFE.
3. Seats and seat ring shall be renewable. Seats shall be bronze.
4. Bonnet to be screwed cap type.

E. Connections

1. Connections to be threaded.

2.4 Air/Vacuum Release Valves

A. Acceptable Manufacturers

1. A.R.I.
 - a. K-060 HF
2. or Approved Equal.

B. Design: Conform to the following:

1. Valve shall be a water service air/vacuum valve.
2. Body shall be ductile iron.
3. Float shall be SAE 316 stainless steel. Orifice seats shall be SAE 316 stainless steel. Seal assembly shall be of reinforced nylon and E.P.D.M. rubber.
4. All other internal parts shall be 316 stainless steel.
5. Single body construction built for 3 - 250 psi service.

C. Operation

1. Discharge air when filling line and at water column return.
2. Admit air when draining the line and at water column separation.

D. Connection

1. Connect air valves using threaded connection as shown on the Drawings.
3. Connecting fittings and pipe shall be bronze, brass, or copper rated for 250 psi service.
5. Couplings or unions indicated between pipeline and air valve piping shall be insulated style.

2.6 Isolation Valves

- A. Isolation valves shall be provided for all air/vacuum valves and pressure switches and shall be bronze gate valve, Crane No. 424 or Engineer-approved equal for sizes 3 inches and smaller unless otherwise noted. Isolation valves 4 inches and larger shall be flanged AWWA C504 butterfly valves.

2.5 Pipe Supports

- A. Pipe supports shall meet the requirements of Section 5, Chapter II of ANSI B31.1 and shall be types as given for MSS Standard Practice SP-58 and SP-69.
- B. **Constant Support:** Bergen, Blaw Knox, Fee and Mason, Grinnell, or NAVCO.
- C. Pipe supports shall be of the types listed in Table 1 "Hanger and Support Selection," MSS Standard Practice SP-69 except that the following figure types given in Fig. 1 will not be acceptable: Types 5, 6, 11, 12, 7, 9, 10, and 25.

2.6 Meters and Gauges

A. General

- 1. Provide all instruments, meters, gauges, and thermometers, complete with interconnecting stainless steel tubing, piping, valves, as specified and as indicated.
- 2. Provide gauge stainless steel cock in the piping for all instruments, meters, and gauges, both at point of takeoff and at the instruments, meters and gauges. Gauge cock shall be of the same design requirements as the lines they serve.

B. Indicating Pressure Gauges

- 1. Ashcroft "Duragauge," Crosby or Marsh.
- 2. **Bourdon Tube**
 - a. **160-psi maximum graduation:** Stainless steel Grade A phosphor bronze, brazed joints stress relieved.

- b. **200-psi to 800-psi maximum graduation:** 316 stainless steel threaded.
- 3. Socket and Tip**
- a. **160-psi maximum graduation:** 316 stainless steel.
 - b. **200 psi and over graduation:** 316 stainless steel.
- 4. Case:** High-impact glass-fiber-reinforced polypropylene, weatherproof with safety blowout discs or release back plate.
- 5. Ring:** Bayonet-locking type.
- 6. Movement:** All stainless steel mounted on socket with milled teeth on pinion and sector.
- 7. Dial:** 6 inches, white laminated phenol with black markings.
- 8. Pointer:** Aluminum with micrometer adjustment.
- 9. Accuracy:** 1/2 of 1% over full range of scale.
- 10. Range:** As required for the pressure range to be measured.
- 11.** Mount all pressure gauges on rigid surfaces. Differential strainer gauges shall be line-mounted. Mount outdoor gauges on pump flange. Install an instrument needle valve with each gauge.
- 12.** Be solid-front type recalibrated from back without removing dial.
- 13.** Ashcroft Type 45-2464 with back connection for flush mounting on gauge boards.
- 14.** Ashcroft Type 45-2462 with lower connection for differential strainer on line or pump-mounted gauges.

2.7 Valve Boxes

A. Acceptable Manufacturers

1. Clay and Bailey Manufacturing Company.
2. Dresser Industries, Inc.

3. Mueller Company.
 4. Neenah Foundry Company.
 5. Tyler Company.
- B.** Provide for all buried valves.
- C. Design**
1. Boxes shall be three-piece cast-iron screw type with 5-1/4-inch shaft.
 2. Provide extension stem to bring operating nut within 2 feet of valve box top.

2.8 Shop Painting

- A.** Prepare surfaces and paint or coat all valves, corporation stops, and all related accessories to the standard of the manufacturer unless otherwise specified herein.
- B.** Paint and coatings shall be suitable for the service intended.
- C.** Submit type of paint or coating proposed with drawings and data for Engineer approval prior to fabrication.

PART 3 - EXECUTION

3.1 Installation

- A.** Comply with provisions of AWWA C600 and as specified.
- B.** Thoroughly clean and remove all shipping materials prior to setting. Operate all valves from fully opened to totally closed.
- C.** Equip with anchorage where indicated.
- D.** In accordance with Section 2550 Water Line Construction.

3.2 Field Painting

- A. Manufacturer shall provide adequate coating system equal to shop coating for field touch-up.

3.3 Hangers, Supports and Anchors

A. General

1. The design, selection, spacing, and application of pipe supports shall be in accordance with the codes and standards specified except the ANSI B31.1 - Code for Power Piping shall take precedence over the MSS SP-69 standard.
4. Furnish and install for all pipe installed under this Contract.
5. Include all necessary structural aluminum or 316 stainless steel, brackets, concrete inserts, and similar items which are not a part of the building, or specified but required to properly support the piping systems.
6. Include necessary temporary supports, pins, and related items for the hydrostatic testing of any lines that are spring supported.
7. Install piping and provide necessary supports and anchors to prevent the forces and mounting imposed on Equipment from exceeding the limits specified by the Equipment manufacturer.

B. Adjustment

1. Prior to putting the piping systems into service, adjust all solid hangers to correct position and remove all temporary hangers used in erection and testing.
2. After and during the time the piping systems are being put into service, align all hanger rods to the vertical position.

- C. **Hangers, and Related Items Not on Drawings:** Pipe hanger assemblies, anchors, and sway braces other than those indicated on the Drawings shall be designed, selected, and located by Contractor or hanger manufacturer in accordance with the following:

1. Make accurate weight balance calculations to determine the required supporting force on each hanger and to show the

SECTION 02550

WATER PIPING SYSTEMS

PART 1 GENERAL

A. Description of Work:

This work consists of furnishing and installing water mains, service lines, and appurtenances. This includes all equipment, tools, materials, labor, and other incidentals to provide water mains and service lines complete and ready for immediate and continuous use. The work includes, but is not limited to, all necessary excavation, backfilling, compaction, testing, clean up, and restoration required for a complete installation of water mains, service lines, and appurtenances.

B. Related Work:

Section 02300 -	Trench Excavation and Backfill
Section 02310 -	Flowable Fill
Section 02650 -	Traffic Control
Section 03300 -	Concrete Structures

C. Definitions:

1. Distribution main means a water main that supplies one or more branch mains.
2. Fire Service Line means pipe and appurtenances delivering water from the City water distribution system to a building fire extinguishing system. Fire service lines may be located on private property or in public ROW and are owned, operated, and maintained by the property being served.
3. Fire hydrant assembly means the materials located from the city main to the fire hydrant including the tee or tap, piping, auxiliary valve hydrant and all other equipment constructed for the purpose of providing the fire hydrant.

4. "L" length for Joint restraining devices means the length of pipe from a fitting, valve, or feature that needs to have each pipe joint within that length restrained.
5. Private Fire Protection System means hydrants, valves, water pipes, and appurtenances, sprinkler systems, hose connections, and other equipment constructed for the purpose of providing fire protection for a building or group of buildings and supplied with water from a public water supply system. Private Fire Protection Systems are located on private property, although some components may be located in public ROW, and are owned, operated, and maintained by the property being served.
6. Transmission Main means a water main that supplies many tributary branches, serves a large area, and has few taps.
7. Water mains are those pipes of at least four (4) inches in diameter, which will be installed in public right-of-way or easements and will become a part of the City water distribution system and which will be owned, operated, and maintained by Lake Havasu City.
8. Water service line shall mean the line from the main to the meter box which is normally entirely located within the right-of-way and is owned and maintained by the City. The water meter is then connected to the property water distributing system and which the property owner is responsible for repair and maintenance.

D. Submittals:

1. Submittals shall be required per Section 01330 unless otherwise specified in the Plan Notes or Special Provisions. The term "Submittals" includes, but is not necessarily limited to, manufacturer's product data sheets of pipe, appurtenances, and fittings. Submittals shall be submitted for, but not limited to, the following items:
2. Fire hydrants, pipe, pipe fittings and their appurtenances including T- bolts, joint restraints, polyethylene encasement, and any other pertinent information concerning construction materials that the Engineer deems necessary for the review of the materials used on the project in accordance with the specifications and drawings.
3. Resubmittals shall be made in the same manner as submittals, with

changes clearly shown.

PART 2 MATERIALS

2.1 Pipe:

General: Pipe for water mains shall be Polyvinyl Chloride (PVC) or ductile iron with push on joints as specified on the plans or in the Special Provisions.

A. PVC

PVC pipe shall have bell ends with elastometric gaskets. Pipe joints shall use the Rieber joining system, which has the gasket formed into the pipe during the pipe manufacturing process. Installation procedures shall conform to AWWA C-605 Standards.

1. PVC pressure pipe, 4 inches through 12 inches, shall conform to the requirements of AWWA Specification C-900, Pressure Class 305 DR-14.
2. PVC pressure pipe, 14 inches through 36 inches, shall conform to the requirements of AWWA Specification C-905, Pressure Class 305 DR-14.

B. Ductile Iron Pipe

Ductile iron pipe shall conform to the requirements of AWWA Specifications C-150 and C-151, Pressure Class 350 unless specified otherwise on the plans or Detailed Specifications. Ductile iron pipe shall be coated on the outside with a bituminous coating 1-mil thick, minimum, and shall be cement-mortar lined in accordance with AWWA Specification C-104. Linings shall be full thickness to the end of the spigot and to the seat of the bell, or shall be tapered for a length of not more than two inches.

Rubber gasket joints for all Ductile Iron pipe shall meet the requirements of AWWA C-111. Installation procedures shall conform to AWWA C-600 Standards.

C. Water Service

1. 1" diameter service pipe shall be Type "K" soft copper tubing.
Type "K" soft copper tubing shall be US Government Type K

Soft Tubing. Tubing shall be supplied in 100 ft single or double pancake coils. The minimum center coil diameter shall be 16".

2. 1½" and 2" diameter service pipe shall be Polyethylene Plastic tubing. Polyethylene Tubing shall conform to AWWA C901 and have a pressure class of 200 psi.
3. Water service pipe with a diameter greater than 2" shall meet the above listed specifications for PVC or Ductile Iron pipe.

2.2 Fittings:

A. Water Main Fittings

1. All bolts and nuts shall be low-alloy, corrosion-resistant, high-strength steel in conformance with AWWA C111.
2. Fitting types applicable to this specification consist of bends, crosses, tees, reducers/increasers, plugs, caps, couplings, and sleeves.
3. Unless specified otherwise on the plans or Detailed Specifications the following fitting joint shall be provided:
4. Fittings 8 inches and smaller shall be push-on joint.
5. Fittings 10 inch and 12 inch shall be push-on joint or mechanical joint. If the fitting is going to be restrained then it shall be a mechanical joint.
6. Fittings 14 inches and larger shall be mechanical joint.
7. Push-on joint fittings shall be furnished with restraining lugs. The lug pattern for all sizes shall accommodate gripper-type restrainers.

B. Ductile Iron Water Main Fittings

1. Fittings shall be ductile-iron with 350-psi pressure rating and rubber gasket joints meeting all applicable requirements of the latest edition of AWWA C110, C111, and/or C153 Specifications. All fittings shall be coated on the outside with a bituminous coating 1-mil thick, minimum, and shall be

cement-mortar lined in accordance with AWWA Specification C-104.

C. PVC Water Main Fittings

1. PVC fittings may be used in-lieu of ductile iron fittings for PVC pipe installations 12 inches and smaller. PVC fittings shall meet all applicable requirements of the latest edition of AWWA C900 Pressure Class 305 and AWWA C907. The PVC fitting bell ends shall have elastometric gaskets. Installation procedures shall conform to AWWA C-605 Standards.

D. Couplings

1. Straight and transition couplings shall be as manufactured by Ford, Romac Industries, Inc., or approved equal and shall have ductile iron center rings and end rings meeting ASTM A536-80, Grade 65-45-12. Center rings shall be epoxy coated. Gaskets shall be SBR compounded for water service. Couplings for 12 inch and larger pipe shall be a minimum 12 inches in length.

E. Tapping Sleeves

1. Shall be ductile iron or stainless steel, flanged branch ends, with test plugs for pressure testing. The Sleeve shall be approved for use at pressures equaling or exceeding those of the pipe classification being installed. Ductile iron tapping sleeves shall be mechanical joint with totally confined end gaskets. Stainless steel tapping sleeves shall have a 304 stainless steel shell with SBR gaskets compounded for water service, a stainless steel flange, and shall have 304 stainless steel nuts, bolts, and washers.

2.3 Valve Boxes:

A. Gate Valves and Butterfly Valves:

1. Valve Boxes shall be Tyler Union 6850/60 series 2-piece screw-type construction, or East Jordan (EJIW) Series 8550 3-piece screw type or approved equal. Drop lids shall be marked "Water" and are to be of all-metal construction.

B. Valve Box Adaptor:

1. A valve box adaptor shall be installed on the valve bonnet prior to installing the valve box. The valve box adaptor eliminates shifting of the valve box, protects the coatings, centers the valve box, and seals the valve box with a resilient material. The adaptor shall be incidental to the valve box installation. The valve box adaptor shall be installed per the manufacturer's recommendations. The valve box adaptor shall be a "Valve Box Adaptor II" as manufactured by Adaptor Inc., a "Valve Box Self-Centering Alignment Ring" as manufactured by American Flow Control, or an approved equal.
2. Extension stems shall be included on any valve greater than 3' in depth.

2.4 Fire Hydrants:

- A. Fire hydrants shall meet AWWA Standard C-502 and shall be Mueller Centurian, Clow Medallion, East Jordan 5CD250, American AVK Series 2700, or Waterous Pacer.
- B. All hydrants shall be Traffic model with 6 ft. bury and 6-inches mechanical joint inlets. Hydrants shall have 5 ¼ inches minimum valve openings, having O-ring packings and oil chamber to hold soft oil for stem thread lubrication, and shall have all operating parts, including valve seat, removable through the barrel. Barrel and upper standpipe shall be ductile iron with breaker flange and operating stem at ground level. A steel breakaway coupling shall be installed on the operating stem so that in case of breakage, no damage will result to the fire hydrant other than safety breakers.
- C. All internal and external ferrous surfaces shall be coated with a minimum of 6 mils of epoxy coating and at a minimum shall meet the requirements of AWWA C550 and AWWA C116 as applicable.
- D. All external ferrous surfaces below the fire hydrant "bury line" including the fire hydrant riser (barrel) sections and adjoining 90 degree ells shall be coated with HB Fuller IF1947T Red Oxide Powder, Tnemec Series 140 Pox Epoxy, or equal meeting the requirements of AWWA C550 and AWWA C116 as applicable.

- E. Additionally an exterior coating of Polyurea/Polyurethan Hybrid Resin per American AVK Company, or equal may be added to the epoxy coatings required above.
- F. All exposed nuts and bolts below the breakaway (direct bury) shall be 304 stainless steel.
- G. Hydrants shall have a minimum extension adjustment capability of 10 inches, in 6 inch increments.
- H. Drain valves shall be bronze and shall be positively operated by the main operating rod. All threads shall be National Standard threads. Operating nuts shall be 1 ½ inches point-to-flat, pentagon (National Standard). Valve stem for hydrant outlets shall open in a counter-clockwise direction. Fire Hydrants shall have an internal travel stop nut.
- I. Hydrants are to have two (2), two and one-half (2 1/2) inches nozzles and one (1) four and one-half- (4 1/2) inches steamer nozzle, all with National Standard threads. The minimum distance from the hydrant breaker flange to the centerline of the lower nozzle shall be sixteen (16) inches. Caps shall be nut type and shall be provided with chains. Hydrants shall be enamel Caterpillar yellow.
- J. All Fire Hydrants are to be ordered with barrel lengths of five (5) to eight (8) feet to facilitate their installation per the grades and lines shown on the drawings. Adjustments greater than eight (8) feet shall be accomplished using vertical bends (45, 22½, or 11¼) along the hydrant lead. The use of a Fire Hydrant Extension will not be an acceptable method of adjustment for a new Fire Hydrant. If the hydrant requires adjustment for final grade, then the Contractor shall replace the Fire Hydrant with a new Fire Hydrant with the correct barrel length or install the appropriate vertical bends on the hydrant lead.
- K. In cases where a Fire Hydrant Extension will be installed, the Contractor shall furnish the appropriate extension.

2.5 Service Lines, Valves and Fittings:

A. General

1. All fittings used shall meet current safe drinking water guidelines for lead free fittings, solder and flux. All service lines, valves and fittings shall meet AWWA Standard C-800 (ASTM B62 and B-584, UNS No C83600-85-5-5 and NSF/ANSI 61 Annex F). Shall have a 300 psi min. working pressure. All fittings shall meet the specified manufacturer's minimum material specifications or approved equal.

B. 1-inch services

1. 1-inch services shall be assembled as shown on the 1-Inch Service Connection LHC Standard Detail.
2. Service connection: the connection to the main shall consist of using a service saddle, corporation stop and un-spliced copper tubing in order to provide water to the meter box per Lake Havasu City Standard Details.
3. Service Termination: the service termination consists of connections made to the copper tubing that is stubbed out at the property line at the proposed meter box location. At the end of the tubing a 1 inch ball valve shall be placed, a short piece of 1 inch tubing (10-12 inches in length) to a service tee (if dual meters are necessary), then a ball meter valve shall be placed at each end of the tee branch. If a single service is to be installed a 1 inch angle meter stop shall be installed after the short piece of tubing.
4. The one inch angle meter stop shall be a Ford BA43-342W or equal, the one inch service tee shall be a Ford T884-334-9 or equal, the ball meter valve shall be a B13-332W or equal and the 1 inch ball valve shall be a Ford B44-444 or equal.

C. 1-½ and 2 inch services

1. 1-½ and 2 inch services shall be assembled as shown on the detail named "Service Connection and Termination Details". All fittings shown shall meet the specified manufacturer's minimum material specifications or equal.
2. Service connection: the connection to the main shall consist

of using a brass saddle and corporation stop in order to provide water to the meter box. The brass saddle shall be a Ford 202B Double Band Brass Saddle or equal. The corporation stop shall be a (Ford FB-1100-6 for 1 ½ inch) (Ford FB 1100-7 for 2 inch) or equal. Polyethylene Tubing shall be used and is described in the previous section "Water Service Pipe".

3. Service Termination: the service termination consists of connections made to the polyethylene tubing that is stubbed out at the property line at the proposed meter box location. At the end of the tubing a Pack Joint Coupling (Ford C84-66 for 1 ½ inch) (Ford C84-77 for 2 inch) or equal shall be attached, a 1 ½ or 2 inch brass 90 degree street elbow shall then be attached, then a Ball Valve (Ford # B44-666W for 1 ½ inch) (Ford # B44-777W for 2 inch) or equal shall be attached.

D. Meter Boxes

1. For 1 inch service lines plastic meter boxes shall be Carson/ Brooks or equal. In Traffic areas meter boxes shall be Christy Fiberlite or equal.
2. For 1 ½ inch service lines the meter box shall be a Christy Fiberlite box # FL-36T Box 12 w/ lid # FL-36D01.
3. For 2 inch service lines (with no bypass) the meter box shall be a Christy Fiberlite box # FL 36T Box 18 w/ lid # FL36D01. For 2 inch service with a bypass the box shall be a NDS Pro Series Box # 126B with a Pro Series Lid with Reader Cover part # 126BCDMCIFB

E. Tapping Sleeves and Valves

1. Shall be used for service lines larger than 2 inches.

F. Concrete Thrust Blocks:

1. Thrust blocks shall be 4000 psi concrete as specified in Section 03300 of these specifications.

G. Joint Restraining Devices

1. **Joint Restraint Devices at Fittings shall meet the**

following requirements:

- a. In general, solid ring restraints shall be used whenever possible. Split restraints may be used when connecting to existing systems, for special cases, and when a solid ring restraint is not available for the application. All joint restraint devices shall be epoxy coated or poly-wrapped.

2. For DI pipe to DI push-on fittings:

- a. Fitting Joint Restraints shall be EBAA Series 1100HD, or equal.

3. For DI pipe to DI MJ fittings:

- a. Fitting Joint Restraints shall be EBAA MEGALUG Series 1100, Series 1100SD, or equal.

4. For PVC pipe to DI push-on fittings:

- a. Fitting Joint Restraints shall be EBAA Series 15PF00, or equal.

5. For PVC pipe to DI MJ fittings:

- a. Fitting Joint Restraints shall be EBAA Series 2000PV, Series 2000SV, Series 15PF00, or equal.

6. For PVC pipe to PVC push-on fittings:

- a. Fitting Joint Restraints shall be EBAA Series 2500, or equal.
- b. Joint Restraint Devices at pipe bells shall meet the following requirements:
- c. In general, solid ring restraints shall be used whenever possible. Split restraints may be used when connecting to existing systems, for special cases, and when a solid ring restraint is not available for the application. All joint restraint devices shall be epoxy coated or poly-wrapped.

7. For ductile iron pipe:

- a. The bell restraint shall be EBAA Series 1700, or equal.
- b. In lieu of bell restraint devices, push on joints with the American Fastite Joint system with Fast Grip Gasket, or equal may be used when approved by the Engineer.

8. For PVC C-900 pipe:

- a. The bell restraint shall be EBAA Series 1600, or equal.

9. For PVC C-905 pipe:

- a. The bell restraint shall be EBAA Series 2800, or equal.

H. Polyethylene Encasement:

1. Polyethylene Encasement (poly-wrap) shall meet AWWA C-105.
2. For ductile iron pipe, the encasement shall be 8-mil thickness, seamless tube, black ASTM D-1248, Type 1, Class C, Grade G-1. Joint tape for encasement shall be 3M Scotch-Wrap 50, or equal.

I. Combination Air Release Valves:

1. Air Release Valves shall be constructed in accordance with the LHC Standard Details. Air release valves shall be the size and style indicated on the drawings.

J. Tracer Wire System:

1. Tracer Wire shall be a direct bury wire that meets or exceeds the following requirements:
 - a. Conductor: 12 AWG 20 AMP solid strand soft drawn copper per ASTM B-3 soft annealed copper, or B-8 stranded/concentric lay 14 g (15 AMP). The breaking pounds of the wire shall be a minimum of 124 with an O.D. of 0.154". All wire shall be spark tested at 7500 VAC.
 - b. Insulation: Conductor shall be insulated with low density high molecular weight polyethylene insulation

suitable for direct bury applications per ASTM D-1248. The minimum insulation thickness shall be 0.045". The color of the insulation shall be blue with a print line saying "WATER".

- c. Splices and or Connectors: Splices and or Connectors should be capable of handling from 2 to 4 wires per connector and designated as "water- proof". PVC adhesives or sealing compounds are not acceptable.
- d. Tracer Wire Access Box: Tracer wires shall be terminated using a small terminal box suitable for flush burial with a 2½ inches lockable cast iron top, integral stainless terminals and a minimum 12 in. ABS bottom section or as indicated on the plans.

- e. Tracer Wire System Manufactures:

Tracing Wire – Kris Tech Wire Co. Inc., Paige Electric Corporation, or equal.

Splice Kit/Connectors -3M epoxy type compounds, fusible heat shrink tubing, 3M DBY connectors, or Snaploc LV 9000 direct bury wire connectors, or equals.

Tracer Wire Access Box – Valvco Pipe Tracer Wire Terminal Box or equal.

PART 3 EXECUTION

3.1 Materials Handling and Storage:

- A.** The Contractor shall be responsible for the safe handling and storage of all materials furnished by them and shall replace, at their expense, all such materials found defective in manufacture or damaged in transportation, handling, or storage.
- B.** Pipe, fittings, and accessories shall be loaded and unloaded by lifting with hoists or skidding to avoid shock or damage. Under no circumstances shall such materials be dropped. All material shall be stored in a neat and orderly manner. Pipe shall be stored, to the greatest extent possible, in unit packages or bundles and shall be handled to prevent stress to bell joints and prevent damage to

bevel ends. In addition, materials shall be handled and stored in accordance with manufactures' recommendations.

- C. If in the opinion of the Engineer damage or defects to the factory applied external coatings on steel or ductile iron pipe and fittings (including fire hydrants) can not be repaired, the Contractor shall replace the damaged items with new materials.
- D. If approved by the Engineer, the Contractor may make repairs when damage or defects occur in the factory applied external epoxy or "MEGABOND" coatings supplied on steel or ductile iron pipe and fittings (including fire hydrant risers and joint restraint devices). Coating repairs shall be made using a high build, low temperature applicable, fast cure, liquid epoxy coating. This epoxy coating material shall be DENSO Protal 7125 Repair Cartridge in packaged two component tubes with dispensing gun as manufactured by DENSO North America Inc.
- E. When high ambient temperatures (i.e., > 85 degrees F) occur or when metal surface skin temperatures are high (i.e., > 100 degrees F) such that use of the DENSO Protal 7125 Repair Cartridge may be difficult due to the very short handling time of the material, an alternate coating TC 7010 FS-Gray fast setting epoxy coating as manufactured by Tapecoat Co, shall be used.

3.2 Alignment and Grade:

- A. Pipe shall be laid true to the line and grade established on the Drawings. Where the Drawings indicate that the finished ground surface elevations are to be modified from the existing elevations by this or future construction, the Contractor shall exercise care to ensure that pipe, and appurtenances are placed to the elevations indicated on the drawings.

3.3 Underground Obstructions:

- A. The Contractor shall expose existing underground obstructions shown on the plans or located in the field and shall determine their elevations far enough in advance of pipe laying that the proposed water main can be installed without the use of fittings at or near the points of crossing. Wherever obstructions are encountered during the progress of the work and interfere with the proposed horizontal or vertical alignment of the pipeline, the contractor shall consult with the Engineer who may change the

plans and order a deviation in the line and/or grade, or may arrange for the removal or relocation of the obstructions. The Contractor shall not deviate from plan line or grade without the Engineer's approval.

3.4 Water Main and Sewer Main/Storm Sewer Separation:

A. Vertical Separation at Crossings:

1. Water mains may cross above sanitary and storm sewers with a minimum vertical distance of twenty four (24) inches between the invert of the water main and the top of the sewer. In these cases where the water main is above the sewer and there is at least 24 in. of separation, then at the crossing no extra protection is required.
2. At all other crossings the sewer shall be encased in concrete a minimum of 6 inches thick per LHC standard details.

B. Water Main and Sewer Main/Storm Sewer Horizontal Separation:

1. Water mains shall be constructed with a minimum of 6 feet of horizontal separation from any existing sanitary or storm sewer or proposed sanitary or storm sewer. The 6 feet horizontal separation shall be the clear distance (water pipe sidewall to sewer pipe sidewall) and not the centerline distance between the utilities.

C. Unusual Conditions:

1. Where conditions prevent a minimum horizontal and vertical separation as set forth above, both water and sewer shall be protected 10' in both directions. Where a water main must cross under a sewer, a vertical separation of at least 18 inches between the bottom of the sewer and the top of the water main shall be maintained, under all conditions, with adequate support provided for the sewer lines to prevent them from settling on and breaking the water main.

D. Sewer Manholes:

1. No water pipe shall pass through, or come in contact with any part of the sewer manhole.

3.5 Installation:

- A.** Trenching shall comply with the requirements of Section 02300 Trench Excavation and Backfill.
- B.** Minimum Cover depth from top of pipe to finished grade shall be 3 ft.
- C.** Cleaning shall be done as necessary so that the interior of all water pipe and fittings are free from all dirt, cement, or other foreign material before installation. Contact surfaces shall be wire brushed immediately prior to jointing.
- D.** Pipe Cutting shall be done without damage to the pipe with saw or abrasive wheel and shall be smooth, straight, and at right angles to the pipe axis. Ends of pipe shall be dressed and beveled to remove roughness and sharp corners.
- E.** Laying and Joining of PVC pipe shall be in accordance with AWWA C-900, AWWA C905, and AWWA C605, and with the pipe manufacturer's instructions. Laying and joining of ductile iron pipe shall be in accordance with AWWA C-600, Installation of Ductile-Iron Water Mains and their Appurtenances, and with the pipe manufacturer's instructions, unless specifically required otherwise by these Specifications. All Ductile Iron Water Mains shall be constructed with a Polyethylene Encasement tube as specified herein. The polyethylene encasement tube shall be secured circumferentially at 2 feet horizontal intervals with tape during installation.
- F.** Pipe shall be laid with bell ends facing in the direction of laying. Each pipe length shall be inspected for defects prior to being lowered into the trench. All pipe and fittings shall be carefully lowered into the trench piece by piece by means of pipe slings to prevent damage to the pipe and/or coating. Full lengths of pipe shall be installed except where connecting to appurtenances and fittings. The Contractor shall leave an appurtenance or fitting with a full length of pipe whenever possible.
- G.** During construction, prior to filling and testing, no water shall be allowed to run into or through the pipe.
- H.** During the course of construction, a suitable stopper shall be kept in the end of the pipe so as to prevent any dirt and or water from entering during the progress of the work at all times. Any

dirt, loose material or cement mortar, which may accumulate in the pipe, shall be removed prior to installation.

- I. Push-on Joints: The spigot end of field cut piping shall be cut square and then beveled. Joint surfaces shall be cleaned and lubricated immediately before completing the joint.
- J. Mechanical Joints: Joints shall not be over-tightened; if an effective seal is not obtained the joint shall be disassembled, cleaned thoroughly and reassembled. Where joint restraint devices are used with a mechanical joint, the holes shall be carefully aligned to permit installation of harness bolts. At mechanical joints, a beveled PVC spigot may not be used. Rather a non-beveled spigot shall be used for insertion into mechanical joint.
- K. Protection of the Work: Once in place, the pipe shall have its open end plugged to prevent soil, water, or other matter from entering the pipe.
- L. Pipe Deflection: Deflection or bending of the pipe or deflection of the pipe joint (bell and spigot) shall not be permitted except as approved by the Engineer.
- M. Fittings: Bends and tees shall be placed on a stable foundation, which may require the use of concrete pads of equal size or larger than specified for valves. Fittings may require thrust blocks and/or joint restraining devices. All fittings not epoxy-coated shall be poly-wrapped.
- N. Couplings: Couplings shall be placed on a stable foundation and shall be wrapped in polyethylene encasement as specified herein. Couplings shall be approved by the pipe manufacturer for the use with the pipe and shall be installed according to the coupling manufacturer's recommendations.
- O. Thrust Blocks: concrete thrust blocks may be required in lieu of restraints as approved by the Engineer at tees, crosses, horizontal bends, plugs, caps, fire hydrants, and similar locations as indicated. Refer to the subsection "Joint Restraining Device Installations" for situations and fittings that require the use of joint restraints in-lieu of concrete thrust blocks.
 - 1. Concrete thrust blocks shall have a thickness at the fitting equal to at least half the diameter of the pipe being installed but

shall not be less than six (6) inches thick under any circumstances. They shall extend from the fitting to the undisturbed wall of the excavation. The Contractor shall insure that the concrete does not cover or render inoperable nuts or bolts on the fittings. All metal fittings, valves, or appurtenances shall be wrapped in polyethylene prior to pouring thrust blocks.

2. Concrete Thrust blocks shall be allowed to cure for 48 hours prior to activating the water main. If the water main needs to be activated prior to the concrete curing (48 hours) then the water main shall be restrained using joint restraining devices. Prior to backfilling, thrust blocks shall cure for a minimum of four hours.
 3. Thrust Blocks shall be installed as shown on the drawings and shall meet or exceed the minimum volume or bearing area requirements as specified on the drawings or specifications for the water pressures and soil conditions.
- P.** In muck, peat, or similar weak soils, thrust loads shall be resisted by using joint restraining devices or by removal of the soil and replacement with a material of sufficient stability to resist thrust loads as determined by the Engineer.
- Q.** Where prior approval of the Engineer is obtained, the Contractor may be able to substitute acceptable joint restraining devices for concrete thrust blocking. A condition of approval will be to address the potential corrosion issues associated with the use of joint restraints. The approval to substitute joint restraints is the Engineer's decision and approval may or may not necessarily be granted even if the potential corrosion issues are addressed.
- R.** Joint Restraining Device Installations: Joint Restraining Devices are required for the following installations: Refer to the plans for the definition of "L" length for Joint restraining devices.
1. All Valves 12 inches and larger and pipe joints within their corresponding "L" lengths shall be restrained.
 2. All High Pressure Valves (working pressures greater than 110 psi) and pipe joints within their corresponding "L" lengths shall be restrained.

3. All Reducers/Increasesers and their corresponding "L" lengths shall be restrained.
4. All Vertical Bends and pipe joints within their corresponding "L" lengths shall be restrained.
5. All Water Main Lowering and pipe joints shall be restrained. Water Main Lowering restraint shall include restraining all joints within the fitting's corresponding "L" length plus restraining all pipe joints which lie between the start of the lowering and the end of the lowering, regardless whether or not the pipe joint is located within the fitting's "L" length.
6. All Joint Restraint Devices shall be double poly wrapped and taped per the specifications for polyethylene encasement. If cathodic protection anodes are used, double poly wrap shall not be required. The polyethylene encasement ends shall be taped around the entire pipe diameter.
7. Joint Restraining Devices shall be installed per the manufactures' recommendations and for the appropriate water pressures and soil conditions as shown on the drawings or specifications.

S. Tracer Wire: Tracer wire shall be installed along with all water pipes as described below:

1. The tracer wire shall be extended along with the water main. The wire shall be installed along the top of the pipe and shall be securely anchored to the pipe every 4 feet horizontally with an adhesive tape. The tracer wire shall be extended along all water main branches and hydrant leads as well. At fire hydrant leads two (2) tracer wires (the upstream tracer wire and the downstream tracer wire) shall be brought along the lead and brought to the surface at the fire hydrant. The upstream and downstream tracer wire at fire hydrants shall not be tied together as this is intended to allow independent tracing of the downstream and upstream main.
2. Tracer wire shall not be installed with copper water service lines.
3. Tracer wire shall be installed with PVC water services. Tracer wire installed with PVC service lines shall be installed in accordance with water main requirements except that the

tracer wire shall be brought to the surface at a service line valve location. Do not connect the water service tracer wire to the tracer wire on the main. Tracer wire installed along service lines shall be independent of the tracer wire installed along the main. This allows for only tracing the service line.

4. At locations where the PVC water service is not being replaced entirely, the contractor shall splice the new tracer wire to the existing tracer wire at the point of reconnection. In instances where a PVC water service is not being replaced entirely and an existing tracer wire is not encountered, the Contractor shall coil approximately five (5) feet of wire at the reconnection location(s) to facilitate a future splice.
5. All tracer wire connections shall be accomplished through the use of "pig- tails". All splices and "pig-tails" shall be accomplished by stripping the wires to be connected, twisting the wires together, securing the connection by using an appropriately sized wire nut, and then preserving the splice or "pig-tail by using a direct bury splice kit.
6. The main line tracer wire shall run continuous along the main(s) from fire hydrant to fire hydrant but shall not be continuous at fire hydrants. At fire hydrants two tracer wires shall be installed, one wire is the main line wire from downstream of the fire hydrant and the second wire is the main line wire going upstream of the fire hydrant. The main line tracer wire shall not be interconnected at the fire hydrant or at the main. This is intended to allow independent tracing of the downstream main from the upstream main and vice a versa. Service line tracer wire shall not be connected to the main line tracer wire.
7. As a condition of project acceptance, Water Division personnel shall be able to successfully electronically trace all newly installed tracer wire/water mains. Utility maintenance personnel should be able to connect to tracing wires at every Fire Hydrant location and energize all water mains between that fire hydrant and the surrounding fire hydrants. The contractor is responsible for coordinating conductivity testing with Water Division personnel prior to finish surfacing activities. If the tracer wire does not function as intended, the contractor shall repair the system to the satisfaction of the Engineer.

8. The Engineer shall inspect all underground splices and "pig tails" prior to backfilling.

T. Fire Hydrants and Auxiliary Valves:

1. Fire Hydrants shall stand plumb and shall have their nozzles parallel with or at right angles to the street, with the pumper nozzle facing the street. At intersections, the pumper nozzle shall face the higher classification street. Hydrants shall be set with the bottom of the breaker flange 2 inches above the finished ground elevation as shown on the Standard Details, resulting in the centerline of the lowest nozzle being at least 18 inches above finished grade. In no case shall hydrants be set closer than 4 feet from curb or edge of pavement; measured from outside of hydrant barrel to back of curb or edge of pavement.
2. The Contractor shall set each fire hydrant on a 8 inch x 12 inch precast concrete pad with a 4 inch thickness and shall place a minimum of 1/3 cubic yard of Aggregate Base around the lower part of the hydrant to at least six (6) in. above the drain port to provide a drainage area for the hydrant barrel. The Contractor shall insure that the drain port at the base of the hydrant is open to allow for the hydrant to drain properly when closed. Cast in place concrete may be used in lieu of the pre-cast pad if the hydrant lead is not charged for at least 48 hours and the drainage ports are maintained.
3. The hydrant barrel shall be poly wrapped to the ground surface and the poly wrap shall not cover up the weep holes.
4. A thrust block shall be installed between the hydrant valve chamber and the undisturbed trench wall. The thrust block shall meet the thrust block specifications herein.
5. An auxiliary valve matching the size of the fire hydrant lead and a valve box shall be installed on the fire hydrant lead. Auxiliary valves shall be installed as shown on the standard detail and shall be placed on a precast concrete block, or shall be fitted with a joint restraining device as approved by the Engineer. Cast in place concrete may be used in lieu of the pre-cast block if the hydrant and hydrant lead are not charged

for 48 hours, and 4 hours cure time is allowed before backfilling.

6. Tracer wire shall be attached to the fire hydrant barrel section prior to backfill per LHC Standard Details.

Q. Valves

1. Valve interiors and adjacent piping shall be cleaned of foreign material prior to making valve to pipe connection. Pipe/valve joints shall be straight and without deflection. All valves shall be encased in polyethylene per AWWA Standard C105 and as specified herein. Valves shall be placed and centered on a precast concrete anchor block. The trench surrounding valves shall be backfilled with Bedding Sand to one (1) foot above the valve. The Contractor shall check all operating mechanisms for proper functioning; valves which do not operate easily or are otherwise defective, shall be replaced by the Contractor at their expense.
2. Valves placed on dead-ends of mains with less than the required "L" length of pipe extending beyond the valve shall be restrained using the appropriate "joint restraining devices".

R. Valve Boxes

1. Valve boxes shall be installed straight and plumb directly over the valve stem and shall not be placed in direct contact with the valve. The top of the valve box shall be placed flush to ¼ inch below flush with the surfacing in paved or graveled areas and 1 inch - 2 inches above finished grade in non-paved surfaced areas. Where the Drawings indicate that the future grade at the valve location will be higher or lower than the existing grade at the time of valve installation, the Contractor shall provide the correct combination of extension pieces so that the valve box can be adjusted to the future finished grade without replacing the valve box.
2. A Valve Box Adaptor shall be installed on the valve bonnet prior to installing the valve box.
3. When shown on the drawings or specified, tracer wire shall be secured to the valve box section prior to backfill.

S. Tapping Tees for taps 4 inches and larger:

1. Where new 4 inch or larger service lines or mains are to be connected to an existing main, the Contractor shall furnish all material necessary for connection to the water main, as specified herein. The tapping tee shall be assembled in accordance with the manufacturer's instructions. Tapping sleeves shall be supported independently from the pipe prior to tapping and shall be provided with thrust restraint as specified for other fittings. All tapping tees shall be poly wrapped.

T. Polyethylene Encasement:

1. All buried metallic items including fittings, service lines, valves, valve boxes, fire hydrants, pipe, and accessories, shall be encased in 8-mil thickness sheet polyethylene per AWWA Standard C105. The polyethylene sheet shall be installed per AWWA C105 and taped using 3M Scotchwrap 50 or equal. The polyethylene shall fully encase the fitting and appurtenances. Excess material shall be neatly trimmed away and all seams shall be taped. The transition between Ductile Iron and PVC shall be accomplished by sealing the ends of the polyethylene sheet and taping the material fully around the circumference of the pipe twice.
2. Polyethylene encasement shall NOT be used when the metallic piping is cathodically protected by the use of an anode.

U. Dewatering

1. If necessary, dewatering shall be accomplished as identified in the special provisions.

3.6 Disinfection:

- A.** Disinfection shall comply with the requirements of AWWA Standard C651, C605, C600, and ADEQ Engineering Bulletin #8. All new water mains and appurtenances shall be disinfected before they are placed into service. All water mains taken out of service for inspecting, repairing, or other activity that might lead to contamination shall be disinfected before they are returned to service.

B. Preventative Methods

1. The Contractor shall take precautions to protect the interiors of pipes, fittings, and valves against contamination. Pipe delivered for construction shall be strung so as to minimize the entrance of foreign material.
2. If dirt enters the pipe, it shall be removed and the interior of the pipe surface swabbed with a 1%-5% hypochlorite disinfecting solution. If, in the opinion of the Engineer, the dirt remaining in the pipe will not be removed by flushing, the Contractor shall clean the interior of the pipe by mechanical means, such as a hydraulically propelled foam pig. Following mechanical cleaning the Contractor shall flush the line achieving minimum flushing velocities of at least 30 ft/s and shall then disinfect the pipe using either the continuous-feed or the slug method. Flushing a completed main will not be allowed as a method of cleaning sediment allowed to enter the pipe during construction.
3. All openings in the pipeline shall be closed with watertight plugs when pipe laying is stopped for any length of time. If water accumulates in the trench, the plugs shall remain in place until the trench is dry. If, for any reason, the water main is flooded during construction, it shall be cleared of the floodwater by draining and flushing with potable water until the main is clean. The section exposed to floodwater shall then be filled with chlorinated potable water that, at the end of a 24-hour holding period, will have a free chlorine residual of not less than 25 mg/l. The chlorinated water shall then be flushed from the main and after construction is completed, the main shall be disinfected using the continuous-feed or slug method.

C. Disinfectant

1. Unless specified otherwise in the Detailed Specifications or on the Drawings, or required by other provisions of this specification, disinfection shall be accomplished by the tablet method. The Contractor shall obtain the Engineer's approval prior to using a method other than the tablet method.
2. This method requires that the pipes and appurtenances be kept clean and dry. This method may not be used if the pipes and appurtenances are not kept clean and dry and in the event

this happens, the Engineer must be contacted.

3. Tablets shall be 5-gram calcium hypochlorite tablets conforming to AWWA Standard B300 and shall contain between 65 and 70 per cent available chlorine. Tablets shall be fresh and shall be stored in a cool, dry, and dark environment to prevent loss of strength, which occurs upon exposure to the atmosphere.
4. Do not use calcium hypochlorite intended for swimming pool disinfection, as this material has been sequestered and is extremely difficult to eliminate from the pipe after the desired contact time has been achieved.
5. **Dosage:**

Unless otherwise specified, the Contractor shall place hypochlorite tablets in each section of water pipe installed, including the hydrant branch, according to the Table 1 below.

Table 1

NUMBER OF 5-GRAM CALCIUM HYPOCHLORITE TABLETS REQUIRED

(25 mg/l Dose)

Length of Pipe Section (Ft.)	4	6	8	10	12	16
13 or less	1	1	1	2	3	4
13 - 18	1	1	2	3	4	6
18 - 20	1	1	2	3	4	7
20 - 30	1	2	3	4	6	10
30 - 40	1	2	4	5	7	13

For Pipes 18 inches and larger refer to drawings or detailed specifications for disinfection requirements. The Engineer of Record is responsible for establishing the disinfection requirements for pipes 18 inches and larger.

6. **Placing Tablets**

- a. Tablets shall be adhered to the inside top section of each pipe length using a food-grade adhesive, such as Permatex Form-A-Gasket No. 2 or Permatex Clear RTV Silicon Adhesive Sealant as manufactured by Loctite Corporation. Adhesives shall meet the requirements of a food-grade adhesive per either NSF/ANSI 51-2005: Food Equipment Materials or NSF/ANSI 61-2005: Drinking Water System Components – Health Effects. NSF/ANSI 61 lists several adhesives that are approved for drinking water contact. It is recommended to use an adhesive that sets quickly and isn't reactive with the water main's composition or with the disinfectant tablet. There shall be no adhesive on the tablet except on the broad side attached to the surface of the pipe. If the tablets are attached before the pipe section is placed in the trench, their position shall be marked on the pipe section to indicate the pipe has been installed with the tablets at the top.

7. Filling and Contact

- a. The water main shall be filled slowly so that the water velocity is no greater than **one foot per second**. Precautions shall be taken to assure that air pockets are eliminated. The water shall be allowed to stand in the pipe for at least 24 hours. Valves shall be positioned so that the strong chlorine solution in the treated main will not flow into water mains in active service. The chlorinated water shall remain in the pipe for at least 24 hours. The Contractor shall notify the Engineer at the end of the 24- hour retention period prior to flushing to allow the Engineer to check the chlorine residual in the pipe. If the chlorine residual is less than 25 mg/l, the Contractor shall, at his expense, disinfect the water main again by the continuous-feed method or the slug method, as approved by the Engineer.

8. Flushing

- a. Within 48 hours of the end of the 24-hour retention period, the Contractor shall flush the heavily-chlorinated water from the main until the chlorine concentration in the water leaving the main is no higher

than that prevailing in the system or is less than 1 ppm as determined by the Engineer. In addition to the above requirements, a **minimum flushing velocity of 3 feet per second** and flushing duration of one minute per 100 feet of pipe being flushed shall be achieved per Table 2.

- b. Flushing shall be done in accordance with AWWA C651. Flushing shall be accomplished through use of hydrants or temporary fittings installed for the purpose; flushing through corporation stops and/or water service lines is prohibited. The Contractor shall obtain the Engineer's approval prior to installing special fittings for flushing.
- c. Flushing shall be conducted in such a way as to prevent contamination of existing water mains and/or water service lines and to minimize traffic and pedestrian hazards and nuisance conditions. When possible, flushing shall be to the nearest storm sewer or drainage way. Flushing to the sanitary sewer is prohibited.
- d. The Contractor will be responsible for any damage to fish and/or aquatic life caused by the chlorine residual. If Chlorine reaches or is detected in a stream, river, or other waterway the Contractor will be in violation for that discharge. For more information, contact ADEQ (602) 771-2300. Refer to section below, "Disposal of Chlorinated Water" for additional information regarding neutralizing chlorine residual.

Table 2

REQUIRED FLOW AND MINIMUM FLOW DURATION TO FLUSH PIPELINES

Pipe Diameter (In.)	Flow required to Produce 2.5 fps Velocity in Main* (Gpm)	Fire Hydrants		Minimum Flushing Duration (minutes Per 100 Feet of Pipe)
		Number Of Fire Hydrants	Outlet Size (In.)	
4	100	1	2-1/2	1
6	200	1	2-1/2	1
8	400	1	2-1/2	1
10	600	1	2-1/2	1
12	900	2	2-1/2	1**
16	1600	2	2-1/2	1**

Table 2 shows the rates of flow required to produce a velocity of 3.0 fps in pipes of various sizes and the minimum flushing duration per 100 feet of pipe length

For pipes 18 inches and larger refer to drawings or detailed specifications for flushing requirements.

* Requires a minimum 40-psi pressure in the main and the hydrant flowing to atmosphere.

** Assumes that the corresponding flow rate is being met.

After the water lines have been flushed, the contractor shall sample the lines. Two consecutive samples of water from the end of the disinfected/flushed line must be collected at least 24 hours apart.

9. Bacteria Testing:

- a. Per AWWA C651, the Contractor shall coordinate with Engineering to schedule sampling for coliform bacteria contamination. The samples must show the absence of coliform bacteria contamination before any taps may be made to the main or the main is activated and placed into service. Copies of all sample results shall be submitted to the Engineer within 48 hours of receipt thereof.

10. Disposal of Chlorinated Water:

- a. When, in the opinion of the Engineer or Contractor, the potential exists for chlorinated water to reach a stream, river, or waterway, the Contractor shall apply a neutralizing chemical to the water to be wasted to neutralize thoroughly the chlorine residual remaining in the water as listed in Appendix B of AWWA Standard C651. The Contractor will be responsible for any damage to fish and/or aquatic life caused by the chlorine residual. If Chlorine reaches or is detected in a stream, river, or other waterway the Contractor will be in violation for that discharge. For more information, contact ADEQ (602) 771-2300

3.7 Pressure and Leakage Test for Mains and service lines 4 inches or larger:

A. General

1. Pressure and leakage tests shall be performed on all newly installed water mains. The "Simultaneous Pressure and Leakage Tests" will be used unless otherwise specified. The testing methods specified in this section are specific for water pressure testing only; air pressure testing is prohibited due to the catastrophic nature of potential failure.

B. Test Restrictions:

1. Per AWWA C605 the pressure shall be a minimum of 150% of the working pressure at the point of test, but not less than 125% (or 150 psi, whichever is greater) of normal working pressure at the highest elevation, whichever is greater. Test pressure shall not exceed pipe, valve, or thrust-restraint design pressures and shall not vary by more than 5 percent (plus or minus) for the duration of the test. The duration of the hydrostatic test shall be a minimum of two (2) hours.
2. The Contractor shall anticipate the need to conduct multiple tests in areas of varying topography and shall conduct testing in such a manner and sequence that the pressure requirements indicated above are achieved.

C. Pressurization

1. Before applying the specified test pressure, each valved section of pipe to be tested shall be slowly filled with potable water and all air expelled from the pipe, valves, fittings, and hydrants. Where City water is not available, the Contractor shall furnish sufficient potable water to fill and test the pipe. The specified test pressure, based on the elevation of the lowest point of the section under test and corrected to the elevation of the test gauge, shall then be applied by means of a suitable pump connected to the pipe in a manner satisfactory to the Engineer and shall be sustained for the specified time.
 2. The test pump shall be equipped **with two (2) accurate pressure gauges**, between the pump shut-off valve and water main being tested, both to show the line pressure reading during testing. Pressure gauges shall have graduation marks, at minimum, for every 2 psi, and be capable of interpreting pressure readings within 1 psi. The pressure reading deviation between the two pressure gauges shall not be greater than 2.0 psi. During the pressure test the pressure loss indicated between the two gauges shall not deviate more than 0.5 psi between the two gauges.
- D. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain pressure within five (5) psi of the specified test pressure after the pipe has been filled with water and the air has been expelled. Leakage shall not be measured by the drop in pressure for a test section over a period of time.

1. Allowable Leakage for PVC Pipe and Ductile Iron Pipe:

The PVC pipe shall be pressure and leakage tested in accordance with AWWA C605. The Ductile Iron pipe shall be pressure and leakage tested in accordance with AWWA C600.

No pipe installation, PVC pipe or ductile iron pipe will be accepted if the leakage is greater than that indicated in Table 3.

Table 3
ALLOWABLE LEAKAGE IN GALLONS
PER HOUR PER 1000 FT OF PIPE
(GPH)

Pipe. Dia. (in.)	Average Test Pressure (PSI)					
	50 psi (gph)	100 psi (gph)	150 psi (gph)	200 psi (gph)	250 psi (gph)	300 psi (gph)
4	0.19	0.27	0.33	0.38	0.43	0.47
6	0.29	0.41	0.50	0.57	0.64	0.70
8	0.38	0.54	0.66	0.76	0.85	0.94
10	0.48	0.68	0.83	0.96	1.07	1.17
12	0.57	0.81	0.99	1.15	1.28	1.40
14	0.67	0.95	1.16	1.34	1.50	1.64
16	0.76	1.08	1.32	1.53	1.71	1.87
18	0.86	1.22	1.49	1.72	1.92	2.11
20	0.96	1.35	1.66	1.91	2.14	2.34
24	1.15	1.62	1.99	2.29	2.56	2.81
30	1.43	2.03	2.48	2.87	3.21	3.51
36	1.72	2.43	2.98	3.44	3.85	4.21

The above table is based on the equation $L = SD(P)^{.5} / 148,000$ where

L= allowable make up water in gallons

D= nominal diameter of pipe in inches

P= average mainline test pressure (lb/ sq in) during mainline hydrostatic test

S= length of pipe tested

2. Acceptance shall be determined on the basis of allowable leakage. If any test of installed pipe discloses leakage greater than that specified in Table 3, the Contractor shall, at his own expense, locate and make approved repairs as necessary until the leakage is within the specified allowance. All visible leaks shall be repaired, regardless of the amount of leakage.

3. Any damaged or defective pipe, or appurtenances discovered following the pressure test shall be repaired or replaced with approved material at the Contractor's expense, and the test shall be repeated until it is within the specified allowance.

Example - A pipe segment is required to be tested at 140 psi. At the

start of the test, pressure gauge #1 indicates an initial pressure of 141 psi and pressure gauge #2 indicates an initial pressure of 143 psi. Both gauges are recording the test pressure within 2 psi and therefore the test may proceed. After completing the two-hour test duration, pressure gauge #1 indicates a pressure of 134 psi and pressure gauge #2 indicates a pressure of 136.5 psi. The pressure drop for pressure gauge #1 is 7 psi and the drop for pressure gauge #2 is 6.5 psi. The two gauges record a pressure drop within 0.5 psi of each other therefore the deviation of the pressure reading between the two gauges is acceptable.

If the pressure test had indicated a pressure loss of less than 5 psi then the "Pressure and Leakage Test" would have been considered as passing. Because in this example, the pressure loss is more than 5 psi, the Contractor may elect to re-pressurize the system and repeat the two-hour test or the Contractor may elect to measure the quantity of water required to pressurize the pipe segment so that the pressure loss is less than 5 psi. For this example if the quantity of water required to pressurize the pipe segment so that pressure gauge #1 indicates a pressure of 137 psi (loss of 4 psi) and pressure gauge #2 indicates a pressure of 137.5 psi (loss of 4.5 psi), is within the quantity of water allowed per Table 3 then the test would be considered as passing without having to repeat pressure test for two-hours.

3.8 Water Main Closures and Temporary Service

- A.** Water Main Closures shall be scheduled to minimize the inconvenience to the public. Consequently, water main closures shall be scheduled, between 9:00 A.M. and 4:00 P.M. Monday through Friday, when possible. Water main closures scheduled to begin prior to or continue beyond those times listed above, will require approval from the Engineer. In any case, water main closures will not be allowed until the Engineer gives his approval.

- B.** The Contractor shall provide notification of a proposed closure to the Water Division and any affected residents at least 48 hours prior to closure of any water main, unless a shorter time of notice is approved by the Engineer.

3.9 Operation of Valves

- A.** Only City personnel shall operate valves on existing water mains. The Contractor may operate valves on newly installed water mains

that are under his control or closed valves with permission from Water Division.

4.0 Temporary Water Service

- A.** Private residences affected shall be provided by the Contractor when the water main closure will exceed eight (8) hours. The Contractor shall provide temporary water service for businesses upon request, regardless of the length of closure. When temporary service is to be provided to businesses, the Contractor shall obtain the name and phone number of a responsible contact person at each affected business and submit the information to the Engineer at least 48 hours prior to closure.

4.1 Abandonment and/or Salvage of Water Main and Appurtenances:

A. Water Mains

The Contractor shall seal all open ends of water mains to be abandoned with a concrete plug having a length equal to the diameter of the pipe being plugged.

B. Fire Hydrants

Fire hydrants and auxiliary valves are to be removed and salvaged, unless indicated otherwise on the drawings or Detailed Specifications, and shall be delivered by the Contractor to the City Utility Maintenance Shop in good working condition. Any damage to the hydrant and/or appurtenances as a result of removing, salvaging, and delivering, shall be repaired by the Contractor at no cost to the City.

C. Valves

Unless indicated otherwise on the drawings or Detailed Specifications, valves are to be removed, salvaged, and delivered by the Contractor to the City Utility Maintenance Shop without further damage.

D. Valve Boxes

The Contractor shall close the valve, remove and salvage the top sections of those water main valve boxes marked on the plans to be abandoned and shall deliver them to the City Utility Maintenance

Shop. The resulting holes shall be backfilled and compacted to meet the requirements of these specifications and shall be resurfaced with the appropriate material; i.e. seed, gravel, asphalt, concrete, etc.

E. Others

When the drawings indicate items are to be removed or salvaged, the Contractor shall deliver the items to the City Utility Maintenance Shop in good working condition. Any damage to the items as a result of removing, salvaging, and delivering, shall be repaired by the Contractor at no cost to the City.

Unless an item is indicated as salvaged, the item will be considered a Contractor obligation to remove and dispose of.

4.2 Service Lines and Fittings:

- A.** Service pipe: Copper pipe shall be laid with sufficient waving as to prevent rupture in settlement. A "goose-neck" shape shall be constructed in the copper pipe leading from the corporation stop. Polyethylene, PVC and ductile iron service pipe shall be laid as specified herein for water mains. Minimum cover depth for water service lines shall be four (4) feet. A minimum six (6) foot horizontal separation (outside diameter to outside diameter) shall be maintained between water service and sewer service lines. Tracer Wire shall be installed along with all Polyethylene and PVC service lines, as described in the specification section relating to tracer wire. Tracer Wire shall not be installed with copper service lines.
- B.** Service saddles shall be installed for all connections to water mains 2 inch and smaller. Unless specified otherwise on the Drawings or Detailed Specifications, the Contractor shall furnish and install all service saddles.
- C.** Corporation stops shall be provided by the Contractor. Corporation stops that are used to connect metal water services to metallic water mains shall be the isolator style. If a Contractor is installing a copper water service on private property but is not replacing the service to the main and the copper water service connects to a metallic water main then an insulating union for copper water services shall be installed near the curb stop or at the location where the new copper connects to the existing copper. This is only required for copper water services

connecting to metallic mains.

- D. Service lines larger than 2 inches diameter shall be connected to the main with either an appropriately sized tapping sleeve and valve or a ductile iron tee as specified for water main fittings elsewhere in these specifications.
- E. Meter boxes shall be installed on all service lines and shall be located entirely within the public Right of Way. The top of the box shall be placed flush to ¼ inch below flush with the surfacing in paved or graveled areas and 1 - 2 inches above finished grade in non-traffic areas.
- F. Water Services: Where service lines are to be installed for undeveloped property or future buildings or additional services added to an existing building, the Contractor shall furnish all materials necessary for connection of new service lines to the water main. The termination point shall be at a meter box.
- G. Water Service Reconnections: The Contractor shall furnish all materials necessary for reconnecting service lines existing prior to construction of a water main. On City projects, all permits and tapping fees will be waived.
- H. Inspection: All water service installations shall be inspected by the City prior to the Contractor backfilling the trench. The Contractor shall notify the City a minimum of four (4) hours prior to the time he needs the inspection. Any trench backfilled without being inspected and approved by authorized City personnel shall be re-excavated by the Contractor to expose the work for the required inspection. Discrepancies shall be corrected by the Contractor and re-inspected by City personnel.

4.3 Acceptance of Meter Valves and Main Valves:

- A. As a condition for project acceptance, all meter valves and water main valves within the project boundaries shall be in proper operating condition. City personnel will inspect and operate each valve as part of the final inspection. The Contractor shall correct any deficiencies discovered during the inspection

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

- A. No measurement will be made for this item.

4.2 Payment

- A. Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

END OF SECTION

SECTION 02600

SUBGRADE PREPARATION

PART 1 - GENERAL

1.1 Description

A. Description of the Work

The work to be performed in accordance with this section includes the preparation of native or excavated soils prior to the placement of subbase, base course, pavement, curb, gutter, driveways, sidewalks or other structures.

The work shall include the furnishing of all labor, tools, equipment, materials and performing all required operations to provide a complete item in accordance with the project plans and these specifications.

B. Related Work Specified Elsewhere

Clearing and Grubbing	Section 2100
Earthwork	Section 2200
Trench Excavation and Backfill	Section 2300

1.2 Quality Assurance

A. Reference Test Standards and Specifications

ASTM D1556, Density of Soil in Place by the Sand-Cone Method.

ASTM 1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

ASTM D6938-08a, Density of Soil and Soil-Aggregate in Place by Nuclear Methods.

ASTM D6938-08a, Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods.

Rock Correction Procedure for Maximum Density Determination, ARIZ 227.

B. Frequency of Testing

- 1. Maximum Dry Density and Optimum Moisture Content, ASTM D1557.**
 - a. One test for each different class or type of material shall be provided by the prior to beginning construction.
 - b. **CONTRACTOR** shall provide additional test when previous test is suspect, due to subtle changes in the material, as determined by the **OWNER**.
- 2. Density of In-Place Soil by the Sand Cone or by Nuclear Methods, ASTM D1556 or D6938-08a**
 - a. **CONTRACTOR** will perform a minimum of one test per lift per 2,000 square yard per type of material.
 - b. **CONTRACTOR** will perform additional test as required to ensure proper compaction.

C. Testing Tolerances

1. Percent Relative Compaction

Not less than as specified on plans or in these specifications.

2. In-Place Moisture Content

As required to achieve minimum relative compaction.

3. Soft or Yielding Surfaces

Regardless of the percent compaction obtained by test, areas which are soft and yield under the load of construction equipment are to be removed and replaced at no additional cost.

1.3 Submittals

A. Materials Test Report

1. Report on maximum dry density and optimum moisture content prior to beginning of construction.

1.4 Job Conditions

A. Soils Report

This section does not apply to this project.

PART 2 - MATERIALS

2.1 General

A. Unsuitable materials not to be incorporated in the work.

1. Organic matter such as peat, mulch, organic silt or sod
2. Soil containing expansive clays
3. Material containing excessive moisture
4. Poorly graded coarse material
5. Material with particle sizes in excess of 6 inches
6. Material which will not achieve density and/or bearing requirements

2.2 Earthwork Balance

No attempt has been made to estimate cut and fill earthwork quantities. The **CONTRACTOR** is solely responsible for an estimation of quantities of earthwork materials to construct the project as shown.

PART 3 - EXECUTION

3.1 Preliminary Investigation of the Work

The **CONTRACTOR** is to satisfy himself that all preliminary work including clearing, grubbing and staking has been performed in accordance with these specifications prior to subgrade preparation.

3.2 Subgrade Preparation

A. Scarification

Scarify and loosen to a minimum depth of 6 inches. Remove any particles larger than 6 inches.

B. Moisture Conditioning

Condition the soil by aerating or wetting to the moisture content required to obtain the minimum compaction requirements. Mix the soil such that the moisture content is uniform throughout the lift. No payment will be made for conditioning of the soil, wetting, or drying.

C. Compaction

Construct subgrade cut and fill areas to achieve a uniform soil structure. Compact the subgrade to the percent relative compaction indicated on the plans. When not shown on the plan, compact as indicated herein.

Major streets, other streets and traffic ways	95%
Curbs, gutters and sidewalks	95%
Area to receive Engineered fill	95%

D. Subgrade Tolerances

Below pavement, sidewalk, curb and gutter	$\pm 1/4$ inch
Below base course	$\pm 3/4$ inch

Variations from the plan grade and cross section shall be compensating so that the average grade and cross section are obtained.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

- A. No measurement will be made for this item.

LHC 2600-4

4.2 Payment

- A.** Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

**** END OF SECTION 02600 ****

SECTION 02610

AGGREGATE BASE COURSE

PART 1 - GENERAL

1.1 Description

A. Description of Work

The work to be performed in accordance with this section includes furnishing and placing an aggregate base course to plan grades and cross sections.

This work shall include the furnishing of all labor, tools, equipment, materials and performing all operations required to provide a complete item in accordance with the project plans and specifications.

B. Related Work Specified Elsewhere

Earthwork	Section 2200
Subgrade Preparation	Section 2600

C. Definitions

1. Crushed Rock

Crushed rock shall consist of the product obtained by crushing rock, stone, or gravel so that at least 50 percent by weight of aggregate is retained on the No. 4 sieve for 3/4 inch or larger maximum sizes, and 50 percent is retained on the No. 8 for maximum sizes less than 3/4 inch. All crushed rock particles shall have at least one rough, angular surface produced by crushing.

2. Gravel

Material designated herein as gravel shall be composed entirely of particles that are either fully or partially rounded and water-worn. The quality and gradation requirements shall be as specified herein.

3. Sand

Sand shall consist of fine granular material produced by the crushing of rock or gravel or naturally produced by disintegration of rock and shall be sufficiently free of organic material, mica, loam, clay, and other deleterious substances to be thoroughly suitable for the purpose for which it is intended.

1.2 Quality Assurance

A. Reference Test Standards and Specifications

ASTM C117, Test Method for Material Finer Than 75-um (No. 200) Sieve in Mineral Aggregates by Washing.

ASTM C131, Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.

ASTM C136, Method for Sieve Analysis of Fine and Coarse Aggregates

ASTM D1556, Density of Soil in Place by the Sand-Cone Method.

ASTM D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort.

ASTM D6938-08a, Density of Soil and Soil-Aggregate in Place by Nuclear Methods.

ASTM D6938-08a, Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods.

ASTM D4318, Test Method for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

Rock Correction Procedure for Maximum Density Determination, ARIZ 227.

B. Frequency of Testing

1. Maximum Dry Density and Optimum Moisture Content, ASTM D1557.

- a. One test for each different class to type of material shall be provided by the **CONTRACTOR** prior to placing aggregate base.
 - b. **CONTRACTOR** shall provide additional test when previous test is suspect, due to subtle changes in the material, as determined by the **OWNER**.
2. **Density of Soil In-Place by the Sand Cone or by Nuclear Methods, ASTM D1556 or D6938-08a.**
- a. **CONTRACTOR** will perform a minimum of one test per lift per 2,000 square yards per type of material.
 - b. **CONTRACTOR** will perform additional test as required to ensure proper compaction.
3. **Method for Sieve Analysis of Fine and Coarse Aggregates, ASTM C136.**
- a. **OWNER** may perform sampling of Aggregate Base in place to check conformance with gradation requirements.

C. Testing Tolerances

1. Percent Relative Compaction

Not less than as specified on plans or in these specifications.

2. In-Place Moisture Content

As required to achieve minimum relative compaction.

3. Soft or Yielding Surfaces

Regardless of the percent compaction obtained by test, areas which are soft or yield under the load of construction equipment are to be removed and replaced at no additional cost.

1.3 Submittals

A. Materials Test Report

Report on maximum dry density and optimum moisture content, as well as gradation prior to beginning of construction.

1.4 Job Conditions

A. Soils Report

This section does not apply to this project.

PART 2 - MATERIALS

2.1 Aggregate Base

Crushed aggregate or processed natural mineral shall be clean, hard, sound and free of any detrimental quantity of soft, friable elongated or laminated pieces, organic matter or other deleterious substances. Aggregate base shall meet the following requirements:

A. Grading

ASTM C136 and ASTM C117

Sieve Size	Percent by Weight Passing
1-1/8"	100
No. 4	38-65
No. 8	25-60
No. 30	10-40
No. 200	3-12

B. Percentage of Wear

ASTM C131, maximum percentage of wear of 40 after 500

revolutions.

C. Plasticity Index and Liquid Limit

ASTM D4318, maximum plasticity index of 5, maximum liquid limit of 25 percent.

D. Fractured Faces

1. Maximum aggregate size of 3/4 inch or greater, at least 50 percent of aggregate retained on the No. 4 sieve, at least one fractured face.
2. Maximum aggregate size less than 3/4 inch, at least 50 percent of aggregate retained on the No.8 sieve, at least one fractured face.

PART 3 - EXECUTION

3.1 Preliminary Investigation of the Work

Verify that all of the preliminary work including clearing, grubbing, subgrade preparation and staking has been performed in accordance with the plans and specifications prior to placing aggregate base.

3.2 Base Course Placement and Compaction

A. Moisture Conditioning

Condition the base by aerating or wetting to the moisture content required to obtain the minimum percent compaction. Mix the soil such that the moisture content is uniform throughout the lift. Take care so as not to damage the subgrade below.

B. Lift Thickness

Place and compact base course lifts, 6 inches or less, in a single lift. For lifts in excess of 6 inches thick, place and compact in successive equal layers not to exceed a maximum of 6 inches.

C. Compaction

Construct base course to achieve a uniform soil structure. Compact the base course to a relative density of not less than 100 percent.

D. Base Course Tolerances

Place and compact the base course to the grade and cross sections indicated. The base course shall not vary from plan grade and cross sections by more than 1/4 inch.

E. Deficiencies

Remove and replace deficiencies prior to placement of the pavement. Deficiencies in the base course, covered by paving will be removed and replaced at no additional to the **OWNER**.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

A. No measurement will be made for this item.

4.2 Payment

A. Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

SECTION 02615

ASPHALT CONCRETE LEVELING COURSE

PART 1 - GENERAL

1.1 Description

A. Description of Work

Asphalt concrete leveling course consists of the placing and compaction of plant mix asphalt concrete over ruts, distortions, depressions and other irregularities to restore proper grade and cross section to the existing pavement.

B. Related Work Specified Elsewhere

Bituminous prime and tack coat.....Section 02620
Asphalt concrete pavement..... Section 02630
Asphalt concrete overlay.....Section 02635

1.2 Quality Assurance

Reference test standards and specifications, frequency of testing, acceptable tolerances and acceptance per specification Section 2620, bituminous prime and tack coat and Section 2635, asphalt concrete overlay.

1.3 Submittals

A. Submittals as specified in the following Sections:

1. Section 2620, bituminous prime and tack coat.
2. Section 2630, asphalt concrete pavement.

PART 2 - MATERIALS

2.1 Asphalt Concrete Leveling Course

The tack coat, asphalt concrete, transportation and placement of the mix shall be as specified in Section 2620 bituminous prime and tack coat, and Section 2630 asphalt concrete pavement.

2.2 Aggregate Gradation

The aggregate gradation for asphalt concrete leveling course shall be the same as the asphalt concrete overlay being used for each of the bid items in Section 2635.

PART 3 - EXECUTION

3.1 Asphalt Concrete Leveling Course

The tack coat, asphalt concrete and the placement and compaction of the mix shall be as specified in Section 2620 bituminous prime and tack coat and Section 2630 asphalt concrete pavement except as modified herein.

3.2 Preparation of Existing Surfaces

The entire surface shall be cleaned with a power broom. After the surfaces have been prepared to the satisfaction of the **ENGINEER**, they shall receive a tack coat as specified in Section 2620. Traffic will not be permitted over the surfaces which have received a tack coat.

3.3 Placement of Asphalt Concrete Leveling Course

Leveling courses shall not exceed three inches (3") per layer. Areas requiring multiple layers shall not exceed three inches (3") per layer and each layer will extend past the previous layer until the desired cross section is obtained. Each layer will be compacted in Section 2630 prior to other layers being placed.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement

The quality of asphalt concrete leveling course to be paid for will be determined by tons delivered and placed and accepted by the **ENGINEER** as complying with the Specifications.

Preparation of existing surfaces including sweeping, crack filling, tack coat, and any other necessary work required prior to placing the leveling course shall be considered as incidental to the bid item for asphalt concrete leveling course.

4.2 Payment

Payment for asphalt concrete leveling course will be made at the Contract unit price per ton in-place for each item. The price shall be full compensation for furnishing all materials, for all preparation, mixing, testing and placing of these materials, and for all labor, equipment, tools, and incidentals necessary to complete the item.

Payment will be made under Item No.

NOT USED - Asphalt Concrete Leveling Course, TONS

****END OF SECTION****

SECTION 02620

BITUMINOUS PRIME AND TACK COAT

PART 1 - GENERAL

1.1 Summary

A. Description of Work

The work to be performed in accordance with this Section includes furnishing and applying emulsified asphalt prime and tack coats prior to asphalt concrete paving.

This work shall include the furnishing of all labor, tools, equipment, materials and performing all required operations to provide a complete item in accordance with the project plans and specifications.

B. Related Work Specified Elsewhere

Aggregate Base CourseSection 02610
Asphalt Concrete PavementSection 02630

1.2 Quality Assurance

A. Reference Standards and Specifications

1. American Society for Testing and Materials (ASTM)

ASTM C117 - Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing.

ASTM C136 - Sieve or Screen Analysis of Fine and Coarse Aggregates.

ASTM D420 - Guide to Site Characterization for Engineering Design, and Construction Purposes.

ASTM D977 - Emulsified Asphalt.

ASTM D2397 - Cationic Emulsified Asphalt.

1.3 Submittals

A. Certificates of Compliance

1. Bituminous Prime Coat.
2. Bituminous Tack Coat.

B. Suppliers Recommendation

1. Type and Grade of Bituminous Prime Coat.
2. Type and Grade of Bituminous Tack Coat.
3. Application Temperature, Dilution Recommendations.

1.4 Product Delivery Storage and Handling

Take all precautions in handling, storing and applying emulsified asphalts so as not to damage the product or damage the environment.

PART 2 - MATERIALS

2.1 Bituminous Prime and Tack Coats

A. Alternatives

Select one of the emulsions listed below as recommended by the emulsion supplier.

B. Bituminous Prime Coat

ASTM D977, SS-1, SS-1h, or ASTM D2397, CSS-1 or CSS-1h.

C. Bituminous Tack Coat

ASTM D997, SS-1, SS-1h, or ASTM D2397, CSS-1 or CSS-1h. Diluted 1 to 1 with water.

D. Application Temperatures

Apply bituminous prime and tack coat at suppliers recommended temperature but in no case less than 75 degrees Fahrenheit.

PART 3 - EXECUTION

3.1 Preliminary Investigation of the Work

Verify all preliminary work has been performed in accordance with the plans and specifications prior to application of bituminous prime and tack coats.

3.2 Weather Limitations

Apply bituminous tack and prime coat only when the application surface is dry, when the atmospheric temperature is above 60 degrees Fahrenheit and when the weather is not foggy, rainy, or extremely windy.

3.3 Bituminous Prime Coat

A. Preparation of Surface

Construct base course according to Section 2610, Aggregate Base Course, to the grade and cross section indicated.

B. Application of Bituminous Material

1. Dilution

Not used.

2. Area Application

Immediately before applying the prime coat, sweep the base course surface with a power broom to remove all loose dirt and other objectionable material.

Apply bituminous prime coat only to surfaces that are slightly damp or dry with a self-powered, pressure operated distributor. The distribution truck shall be capable of applying the prime coat at the specified rate, with an allowable deviation of 5 percent.

3. Application Rate

Uniformly apply prime coat at a rate of 0.20 to 0.40 gals/square yard. The exact rate of application shall be as recommended by the supplier and approved by the Owner.

Apply the prime coat at the approved application rate in one application.

4. Drying Time

Maintain the integrity of the primed surface until the bituminous material has sufficiently dried (breaks) so it will not be picked up or otherwise damaged by the paving operation. If the bituminous material has not cured within 36 hours, a sand blotter material shall be spread over the required areas.

The sand blotter material shall conform to the following requirements:

Sieve Sizes	Percentage by Weight Passing Sieve
1/2-inch	100
No. 4	90-100
No. 16	30-75
No.200	0-12

Test	Method	Requirements
Sieve Analysis	ASTM C136 & C117	Above
Sampling Aggregate	ASTM D420	-----
Organic Impurities	ASTM C403	Maximum *

* Organic Plate Number

3.4 Bituminous Tack Coat

A. Preparation of Surface

Thoroughly clean surfaces to receive tack coat of all loose material including dirt and other objectionable material. Use equipment specifically suited for the work.

B. Application of Bituminous Material

1. Dilution

Dilute asphalt as recommended by the supplier and as approved by the Owner. Unless otherwise approved dilute 1 to 1 with water. Always add water to emulsion.

2. Area Application

Apply bituminous track coat with a pressure operated distributor truck designed, equipped, maintained and operated for such use. The distributor truck shall meet the requirements of that used for the application of the prime coat.

3. Vertical Edges and Miscellaneous Work

Apply bituminous tack coat to all edges except driveways with mechanical or hand held spray equipment. Brushed or poured application will not be accepted.

4. Application Rate

Apply bituminous tack coat at a rate of 0.05 to 0.10 gallons per square yard. The exact rate of application shall be as recommended by the supplier and approved by the Owner. Apply the tack coat at the approved application rate in one application.

5. Drying Time

Maintain the tacked surface until the bituminous material has sufficiently dried (breaks) so it will no longer be picked up or otherwise damaged by the paving operation.

PART 4 - MEASUREMENT AND PAYMENT – Not Applicable

**** END OF SECTION 02620 ****

SECTION 02630

ASPHALT CONCRETE PAVEMENT

PART 1 - GENERAL

1.1 Summary

A. Description of Work

The work to be performed in accordance with this section includes the furnishing of all materials and the placing of asphalt concrete for roadway pavements.

The work covered shall include furnishing of all labor, equipment, materials and performing all required operations to provide a complete item in accordance with the project plans and these specifications.

B. Related Work Specified Elsewhere

Aggregate Base CourseSection 02610
Bituminous Prime and Tack Coat.....Section 02620

C. Definitions

1. Relative Density

Relative density is determined by the bulk specific gravity of the compacted pavement divided by the 75 blow Marshall specific gravity of the corresponding lot.

2. Lot

For the purposes of compliance testing, a lot shall be 300 tons of asphalt concrete placed or one day's production, as determined by the Engineer.

3. Coarse Aggregate

Portion of the mineral aggregate retained on the No. 4 sieve.

4. Fine Aggregate

Portion of the mineral aggregate retained on the No. 200 sieve and passing the No. 4 sieve.

5. Mineral Filler

Portion of the mineral aggregate passing the No. 200 sieve.

1.2 Quality Assurance

The Contractor shall provide all preliminary materials and mix design testing and the mix design report in accordance with Section 1330, Submittals. Compliance sampling and testing during construction will be provided by the Owner.

A. Reference Test Standards and Specifications

1. American Society for Testing and Materials (ASTM)

ASTM C88, Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

ASTM C117, Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing

ASTM C131, Resistance to Abrasion of Small Size Coarse Aggregate by Use of the Los Angeles Machine

ASTM C136, Sieve or Screen Analysis of Fine and Coarse Aggregates

ASTM C150, Portland Cement

ASTM C183, Sampling Hydraulic Cement

ASTM C977, Specification for Quicklime and Hydrated Lime for Soil Stabilization

ASTM D75, Practice for Sampling Aggregates

ASTM D140, Practice for Sampling Bituminous Materials

ASTM D242, Mineral Filler for Bituminous Paving Mixtures

ASTM D692, Coarse Aggregate for Bituminous Paving Mixture

ASTM D946, Penetration-Graded Asphalt Cement for Use in Pavement Construction

ASTM D995, Requirements of Mixing Plants for Hot-Mixed Hot-Laid Bituminous Paving Mixtures

ASTM D1073, Fine Aggregate for Bituminous Paving Mixture

ASTM D1075, Effect of Water on Cohesion of Compacted Bituminous Mixtures

ASTM D1188, Bulk Specific Gravity of Compacted Bituminous Mixtures Using Paraffin-Coated Specimens

ASTM D1559, Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

ASTM D2041, Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures

ASTM D2172, Quantitative Extraction of Bitumen from Bituminous Paving Mixtures

ASTM D2419, and Equivalent Value of Soils and Fine Aggregate

ASTM D2489, Degree of Particle Coating of Bituminous-Aggregate Mixtures

ASTM D2726, Bulk Specific Gravity of Compacted Bituminous Mixtures Using Saturated Surface-Dry Specimens

ASTM D2950, Density of Bituminous Concrete In-Place by Nuclear Methods

ASTM D3381, Viscosity-Graded Asphalt Cement for Use in Pavement Mixtures

ASTM D3515, Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures

ASTM D3549, Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimen

ASTM D3665, Random Sampling of Paving Materials

ASTM D3666, Inspection and Testing Agencies for Bituminous paving Materials

ASTM D4318, Liquid Limit, Plastic Limit, and Plasticity Index of Soils

2. The Asphalt Institute

Mix Design Methods for Asphalt Concrete
Manual No. 2 (MS-2), 1992 or its latest revision.

3. Maricopa Association of Governments (MAG), Uniform Standard Specifications for Public Works Construction, 1998 Edition (Includes revisions through 2004)

4. Arizona Department of Transportation (ADOT), Standard Specifications, 2000 Edition

B. Frequency of Testing

The following table indicates the minimum number of tests to be performed for acceptance of each lot.

Test Description	Test Method	Test Frequency
Maximum Density of Laboratory Compacted Mixture	ASTM D1559 ASTM D2726	3 test per lot
Asphalt Cement Content of Uncompacted Mixture	ASTM D2726	3 test per lot
Aggregate Gradation of Uncompacted Mixture	ASTM C136 ASTM C117	3 test per lot
In-Place Density of Compacted Mixture	Core Samples ASTM D2726 or	3 to 5 randomly distributed core samples per lot
Thickness of Compacted Mixture	ASTM D3549	3 to 5 randomly distributed core samples per lot
Temperature of Mix at Time of Placement	Field Thermometer	1 test per hot mix sample
Straight Edge	10 foot straight edge	Continuously

Sampling and testing frequencies may be reduced at the discretion of the Engineer if test results are repeatedly compliant and consistent.

Locations for sampling and in-place tests shall be in accordance with ASTM D3665. The Contractor shall provide extra tests as required by the Owner to define deficient areas at no additional cost to the Owner.

Acceptance samples shall be taken from behind the paving machine with a sampling plate in accordance with Arizona Department of Transportation test method ARIZ 104b. The acceptance laboratory and quality control laboratory shall utilize the ignition method (ASTM D6307) with the appropriate calibration/corrections applied for both gradation and binder content testing.

Three (3) cores should be used for acceptance testing if the production of the lot is less than 1,000 tons. Four (4) cores should be used for lots containing 1,000 to 1,500 tons, and Five (5) cores for lots exceeding 1,500 tons.

The density of the compacted mixture shall be determined from core samples cut from the pavement. The relative density of the finished product shall be determined by dividing the specific gravity of the core by the average Marshall specific gravity obtained for the corresponding lot.

C. Allowable Tolerances

The following table provides the tolerance for individual test results that will be allowed without adjustment to payment.

Description	Allowable Tolerance
Relative Density	-1 percent
Asphalt Cement Content	± 0.3 percent

Aggregate Gradation, Job Mix Tolerances	
Aggregate Passing No. 4 Sieve or Larger	± 6 percent
Aggregate Passing Nos. 8 and 30 sieves	± 6 percent
Aggregate Passing 200 sieves	± 2 percent
Thickness of Compacted Mixture	-1/4 inch
Temperature of Mix at Time of Placement	± 25 degrees Fahrenheit
Straightedge, Finish Course	$\pm 1/4$ inch

D. Acceptance

In place materials with deviations in excess of the allowable tolerances will be either removed and replaced or paid for at a reduced unit price as dictated herein. The penalties shown in the tables following are not cumulative with-in the same table.

1. Relative Density

Deviations from specifications will be based on the average values of acceptance testing performed for each lot and will be based on 95% of the Marshall Specific Gravity. When the relative density is greater or less than that specified, payment will be reduced as follows:

Deviation From Density Specifications	Reduction in Payment
0 to -1% points	0%
Greater than -1% point	- 2%
Greater than -2% points	- 5%
Greater than -3% points	- 10%
Greater than -5% points	Rejected

When the relative density deviates from that specified by more than 5 percent, remove and replace that section of asphalt concrete pavement in accordance with specifications at no additional cost to the Owner.

2. Asphalt Cement Content

Deviations from specifications will be based on the average values of acceptance testing performed for each lot. When the asphalt cement content exceeds the allowable tolerance of ± 0.3 percent from the approved mix design target value, the payment will be reduced or the material rejected as follows:

Deviation From Asphalt Cement Content Target Value	Reduction in Payment
0 to $\pm 0.3\%$ points	0%
Greater than $\pm 0.3\%$ points	-2%
Greater than $\pm 0.4\%$ points	-5%
Greater than $\pm 0.5\%$ points	Rejected

3. Aggregate Gradation

When the aggregate gradation exceeds the allowable job mix tolerances, that asphalt concrete pavement will be removed and replaced in accordance with the specifications at no additional cost to the Owner.

4. Thickness

Deviations from specifications will be based on the average values of acceptance testing performed for each lot. Where the pavement is deficient in thickness by not more than **-1/4** inch, payment will be reduced by 25 percent. Where the pavement is deficient in thickness by more than **1/4** inch, pavement shall be rejected. In the event that an individual core is deficient in thickness by more than **3/8** inch, two additional cores will be taken, one approximately 100 feet ahead of the deficient core and one approximately 100 feet behind the deficient core. These three cores will be used to

evaluate the deficiency of that area and it will be treated as a new sub lot regarding thickness acceptance. If the new sub lot is deficient, additional cores may be needed to determine the extent of the deficiency.

Deviation From Minimum Thickness Specifications	Reduction in Payment
Spec. to - 1/8 inch	0%
Spec. minus 1/8 inch to spec minus 1/4 inch	-25%
Less than Spec. minus 1/4 inch	Rejected

5. **Effective % Air Voids**

When the percent laboratory air voids (75 blow Marshall method) exceed the allowable mix design tolerances, the following table shall be used to determine pay reduction or pavement remove and replace. Deviations from specifications will be based on the average values of acceptance testing performed for each lot.

Deviation From Target Percent Air Voids	Reduction in Payment
0 to \pm 2%	Full Payment
\pm 2.1% to \pm 2.9%	-5%
Greater than \pm 3%	Rejected

6. **Straightedge**

Where the finish surface deviates from a true plane as determined by using a 10-foot straightedge in excess of 1/4 inch, the surface shall be removed and replaced in accordance with these specifications with a method approved by the Owner and shall be provided at no additional cost to the Owner. The repair shall be accomplished by completely removing and replacing the section or grinding down and replacing with a minimum of 2 inch overlay. The 10-foot straightedge shall be furnished by the Contractor.

1.3 Submittals and Quality Control

A. Certificates of Compliances

1. Mineral Filler
2. Asphalt Cement
3. **ARPA plant certification**
4. **Plant scale and metering device calibration**

B. Materials Test Reports

1. Report on Coarse Aggregate
2. Report on Fine Aggregate
3. Asphalt Concrete Mix Design, include the following items in the report:
 - a. Name and address of laboratory and responsible party
 - b. Location of source of aggregate
 - c. Supplier, refinery and grade of asphalt cement
 - d. **Supplier and source of admixture**
 - e. Individual aggregate gradations
 - f. Combined aggregate gradations
 - g. Job mix formula
 - h. Aggregate and mix design test results and voids analysis
 - i. Recommended asphalt cement content
 - j. Recommended lay down temperature
 - k. Recommended mixing temperature
 - l. Complete set of calculations

B. Quality Control Testing

The Contractor is required to provide a reasonable level of quality control testing to ensure that materials incorporated into the work and plant operations achieve a product that complies with the specifications without significant numbers of failures and asphalt concrete penalties. Acceptance testing provided by the Owner is not sufficient for controlling the plant.

PART 2 - MATERIALS

The following materials shall be used in the asphalt concrete.

2.1 Aggregates

A. Coarse Aggregates

ASTM D692, except as modified herein. Hard, strong durable pieces free of coherent coatings.

1. Percentage of Wear

ASTM C131. maximum percentage of wear of 40% after 500 revolutions. ASTM C88, sodium sulfate soundness loss after 5 cycles, less than 12 percent.

2. Fractured Faces

Minimum 75 percent by weight of aggregate retained by weight on the No. 8 sieve, at least one rough angular surface produced by mechanical crushing.

B. Fine Aggregate

ASTM D1073 except as modified herein. Sand prepared from stone, crushed gravel or combinations thereof shall be used, except that natural sand not exceeding 20% of the total aggregate weight may be used. Material shall consist of hard, tough grains free of injurious amounts of clay, loam, or other deleterious substances.

1. Sand Equivalent

ASTM D2419, Greater than 50.

2. Plasticity

ASTM D4318, non-plastic.

3. Percentage of Wear

ASTM D88, sodium sulfate soundness loss after 5 cycles, less than 12 percent.

2.2 Asphalt Cement

Asphalt cement shall be performance grade asphalt conforming to the requirements of MAG Specifications, Section 711 for PG-70-10, unless otherwise specified in the plans or special provisions.

2.3 Asphalt Concrete Mixture Composition

A. Design

Design the bituminous mixture using the procedures outlined the Asphalt Institute's Manual Series No. 2 (MS-2), 1992 edition or its latest revision to the following requirements:

MARSHALL DESIGN CRITERIA (Latest Edition)	
Number of Blows	75
Stability, Pounds, Minimum	1800
Flow, 0.01 inch	8 to 16
Effective Percent Air Voids	4.0
Percent Voids in Mineral Aggregate	14 minimum
Percent Voids Filled With Asphalt	65 to 75
Asphalt Cement Content, Percent	5.2 (+/- 0.3)

B. Quality

The proposed mix shall contain a minimum of 1.0 % mineral admixture. The mineral admixture shall be hydrated lime conforming to the requirements of ASTM C-207 Type N or Portland Cement conforming to MAG section 725. , The proposed mix shall have a minimum dry strength of 250 psi and an index of retained strength of at least 60 percent, when tested in accordance with ASTM D1075.

C. Gradation

Gradation of the combined aggregates shall conform to the following table:

MINERAL AGGREGATE GRADATION (C-3/4) *	
SIEVE SIZE	PERCENTAGE BY WEIGHT PASSING
3/4"	100
1/2"	90 -100
3/8"	65-90
No. 4	45-70
No. 8	30-55
No. 30	15-35
No. 200	2-8

*** Percentages based on weight of dry aggregate and admixture.**

Provide the mineral aggregate or mineral aggregate and filler gradation specified in the previous table when tested in accordance with ASTM C136 and C117.

Provide a combined aggregate gradation within the bounds of the specified limits when plotted on an aggregate grading chart. The gradation shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be uniformly graded from coarse to fine.

The ratio of the percentage of aggregate by weight passing the No. 30 sieve to that passing the No. 8 sieve shall not exceed 65 percent.

Sand may be used to obtain the proper gradation of the aggregate blend or to improve the workability of the mix. The amount of sand to be added shall be adjusted to produce mixtures conforming to requirements of this specification.

2.4 Preservative Seal

None required.

2.5 Equipment

A. Bituminous Mixing Plant

ASTM D995, Central mixing plant, with the following changes and/or additions.

1. Inspection of Plant

Provide the Owner or his/her authorized representative access, at all times, to all parts of the plant for checking adequacy of equipment; inspecting the operation of the plant; verifying weights, proportions, and character of materials; and checking the temperatures maintained in the preparation of the mixture.

2. Calibration

The plant shall have a current certification of Hot Mix Asphalt Production Facilities by Arizona Rock Products Association. The accuracy of all scales shall be certified through a representative of the State Division of Weights and Measures at least annually. Calibrate the plant as often as required to produce the specified mixture. A copy of all certifications for weighing and metering devices shall be kept in the plant.

3. Air Quality

Provide evidence of applicable permits and/or approval from the Air Quality Section, State Division of Environmental Protection prior to beginning operations.

B. Hauling Equipment

Discharge the bituminous mixture from the surge bin directly into the hauling vehicle and transport directly to the jobsite. Stockpiling outside the surge bins and ultimately loading into the vehicle is strictly prohibited. Provide trucks for hauling bituminous mixtures with tight, clean, and smooth metal beds. To prevent the mixture from adhering, lightly coat the truck beds with a small amount of light film

of distillate or light oil. Provide a suitable cover to protect the mixture from adverse weather. When necessary to ensure that the mixture will be delivered to the site at the specified temperature, insulate truck beds and provide securely fastened covers. Trucks with belly dumps shall not be used.

When required, provide legible weigh masters certificates at the time of material delivery. The ticket shall include the following information;

Date, Supplier, Plant, Ticket Number, Truck Number, Contractor, Project, Product Code and Description, Temperature of batch, Time of batch, Material Weight.

C. Bituminous Paver

Provide self-propelled mechanical, spreading and finishing equipment with a screed or strike off assembly capable of distributing not less than twelve feet. The equipment shall produce a finished surface of the smoothness and texture required. The screed shall be adjustable to the required template and elevation. The forward speed of operation shall be regulated so that no irregularities will result, but in no case will the forward speed exceed 55 feet per minute.

Equip the paver with a control system capable of automatically maintaining the specified screed elevation. The control system shall be automatically actuated from either a reference line or surface through a system of mechanical sensors or sensor-directed mechanisms or devices which will maintain the paver screed at a predetermined transverse slope and at the proper elevation to obtain the required surface. The transverse slope controller shall be capable of maintaining the screed at the desired slope within plus or minus 0.1 percent.

Equip the controls so that they are capable of working in conjunction with any of the following attachments.

- 1.** Ski-type device of not less than 30 feet in length or as approved by the Owner.
- 2.** Taut stringline set to grade.
- 3.** Short ski.

D. Rollers

Provide the number and type of rollers necessary to compact the mixture to the required density while it is still in a workable condition.

In no case shall there be less than one steel wheel and one pneumatic roller for production of 150 tons per hour or less. Add additional rollers as required for production of more than 150 ton per hour. Provide self propelled, reversible rollers with a minimum weight of 8 tons. Equip rollers with a device to dispense an approved releasing agent on the wheels to prevent the wheels from picking up the asphalt. When required, equip pneumatic tired rollers with skirt devices to maintain temperature during the rolling process.

1. Pneumatic Rollers

Two axle tandem type with a rolling width of at least 5 feet. Tires shall be the same size with a tread satisfactory to the Owner. The operating weight per tire shall not be less than 2000 pounds and designed so that the entire gap between the adjacent tire is covered by the following tire. Inflate each tire to 90 psi \pm 5 psi.

PART 3 - EXECUTION

3.1 Preliminary Investigation of the Work

Verify that all work has been performed in accordance with these specifications prior to placing asphalt concrete pavement.

3.2 Weather Limitations

Do not place bituminous mixture upon a wet surface or when the surface temperature of the underlying course is less than 40 degrees Fahrenheit or when weather conditions otherwise prevent the proper handling and furnishing of the bituminous mixture.

3.3 Tack and Prime Coat

Apply tack and prime coat in accordance with Section 2620, Bituminous Tack and Prime Coat. Tack coat shall be required at all joints between existing and new pavement. Tack coat will not be required over native subgrade.

3.4 Mixing

According to ASTM D3515.

A. Preparation of Bituminous Material

Heat bituminous material in a manner that will avoid local overheating and provide a continuous supply of the bituminous material to the mixer at a uniform temperature. Deliver the bituminous material to the mixer at a temperature sufficient to provide a suitable viscosity for adequate coating of the aggregate particles. Do not exceed 340 degrees Fahrenheit.

B. Preparation of Mineral Aggregate

Dry and heat the aggregate for the mixture to the temperature designated by the job mix formula within the tolerance specified. The maximum temperature and rate of heating shall be such that no permanent damage occurs to the aggregates. The temperature shall not be lower than is required to obtain complete coating and uniform distribution of the bitumen on the aggregate particles and to provide a mixture of satisfactory workability. The aggregate moisture content shall be 1.0 percent or less at the time of mixing.

C. Preparation of Bituminous Mixture

The aggregates and the bituminous material shall be weighed or metered and introduced into the mixer in the amounts specified in the job mix formula.

Commercial mineral filler shall be added to the mixer separately and shall be thoroughly dry. If the materials are mixed in a batching plant, the filler material shall be fed directly into the mixer as near the center as possible.

The combined materials shall be mixed until the aggregate mixture is uniformly coated with bitumen. The mixing time shall be the shortest time that will produce a satisfactory mixture. It shall be established by the Supplier, based on the procedure for determining the percentage of coated particles described in ASTM D2489, and approved by the **OWNER** for each individual plant and for each type of aggregate used. The minimum mixing time shall be 25 seconds. The mixing time will be set to achieve 95 percent coated particles.

For continuous mix plants, the minimum mixing time shall be determined by dividing the weight of its contents at operating level by the weight of the mixture delivered per second by the mixer.

3.5 Transporting, Spreading, and Finishing

Transport the mixture from the mixing plant to the point of use in vehicles conforming to the specified requirements. Schedule deliveries so the spreading and rolling of all mixture prepared for one day's run can be completed during daylight, unless adequate artificial lighting is provided. Do not haul over freshly placed material until the material has been compacted, as specified, and allowed to cool sufficiently to handle traffic loads.

Place the mix at a temperature no higher than necessary for placing, finishing and compacting but not less than 260 degrees Fahrenheit.

Spread the mixture to the full width with an approved bituminous paver. The lay down machine shall be capable of placing a 12-foot wide mat without a screed. Strike off in a uniform layer of such depth that, when the work is completed, it shall have the required thickness and conform to the grade and contour indicated. Regulate the speed of the paver to eliminate pulling and tearing of the bituminous mat. Begin the placement of the mixture along the centerline of a crowned section or on the high side of area with a one-way slope. Place the mixture in consecutive adjacent strips having a minimum width as specified. Offset transverse joints in adjacent lanes a minimum of 10 feet. Belly dumps shall not be used on overlay projects.

On areas where irregularities or unavoidable obstacles make the use of mechanical spreading and finishing equipment impractical, the mixture may be spread, raked, and luted with hand tools.

Handle the mixture in such a way as to prevent segregation of the aggregate mix. Coarse float rock that develops in the process of raking shall be placed on a surface, which will receive pavement or shall be removed from the site.

Place layers of bituminous material such that the compacted thickness does not exceed 4 inches. Place layers in excess of 4 inches in successive layers of equal thickness not exceeding 4 inches. When required by the Owner, place tack coat between successive layers as specified in Section 2620, Bituminous Prime and Tack Coat.

3.6 Compaction of Mixture

The completed surfacing shall be thoroughly compacted, smooth and true to grade and cross section as indicated and be free from ruts, humps, depressions or irregularities. After spreading, thoroughly and uniformly compact the mixture by rolling. Roll the surface when the mixture has attained sufficient stability so that the rolling does not cause undue displacement, cracking or shoving. The sequence of rolling operations and the type of rollers used shall be at the discretion of the Contractor and as specified herein.

Compact the mixture to 96 percent of the maximum Marshall density determined in accordance with ASTM D1559 (75 blows).

Operate the roller at a sufficiently slow speed to avoid displacement of the hot mixture. Immediately correct any displacement that occurs as a result of reversing the direction of the hot roller, or from any other cause.

Furnish sufficient rollers to handle the output of the plant. Continue rolling until all rolling marks are eliminated, the surface is of uniform texture and true to grade and cross section, and the required density is obtained.

To prevent adhesion of the mixture to the roller, keep the wheel properly moistened, but excessive water will not be permitted.

In areas not accessible to the roller, thoroughly compact the mixture with hand tampers or mechanical compactors.

Remove and replace any mixture that becomes loose and broken, mixed with dirt, or is in any way defective, with fresh hot mixture and immediately compact to conform to the surrounding area. Skin patching will not be allowed.

3.7 Joints

Form all joints in such a manner as to ensure a continuous bond between old and new sections of the course. The Contractor shall make every attempt to provide joints with the same texture, density, and smoothness as adjacent sections of the course.

Longitudinal joints which are irregular, damaged, or defective shall be cut back to expose a clean, sound surface for the full depth of the course. All contact surfaces shall be given a tack coat of bituminous material prior to placing any fresh mixture against the joint.

Stagger longitudinal joints at least 6 inches in relation to the joints of the underlying course and provide a sloped joint for each course.

Do not pass over the unprotected end of the freshly laid mixture except when necessary to form a transverse joint. Construct transverse joints by placing a bulkhead or by tapering the course, in which case the edge shall be cut back to its full depth and width on a straight line to expose a vertical face. Tack coat all contact surfaces before placing any fresh mixture against the joint.

3.8 Preservative Seal

None required.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement & Payment

Measurement and payment will be made for asphalt concrete pavement as specified in Section 01210 Measurement and Payment for Asphalt Pavement Replacement.

**** END OF SECTION 2630 ****

SECTION 02650

TRAFFIC CONTROL

PART 1 - GENERAL

1.1 Description

A. Description of Work

The work to be performed in accordance with this section includes providing flagging services and pilot trucks, and furnishing, controlling, maintaining, moving and removing barricades, warning signs, lights, signals and pavement markings as required to provide a safe and efficient vehicular and pedestrian passage through the work zone.

The work shall include the furnishing of all labor, tools, equipment, materials and performing all required operations to provide a complete item in accordance with the project plans and specifications.

1.2 Quality Assurance

A. Reference Test Standards and Specifications

Manual on Uniform Traffic Control Devices, latest edition. (MUTCD)

Arizona Department of Transportation (ADOT) Standard Specifications for Road and Bridge Construction, 1990.

ADOT Signing and Marking Standard Drawings.

ADOT Construction Standard Drawings.

1.3 Submittals

A. Traffic Control Plan

The **CONTRACTOR** will provide the **OWNER** a traffic control plan for each portion of the work prior to that work beginning. Changes to traffic control plans shall be submitted at least 10 days prior to performing the work.

B. Schedule

Provide complete traffic control plan schedule showing dates and times for traffic control changes that will be performed in conjunction with the work schedule, ten (10) days prior to performing the work.

C. Responsible Employees

Provide name(s) of and after phone number(s) for the employee(s) responsible for implementation and maintenance of the traffic control plan to the **OWNER** and local law enforcement agency. The employee(s) shall be available at all times to make necessary changes or repairs to the traffic control facilities as required to maintain safe traffic control in and around the construction areas.

D. Emergency Service Notification

Provide a copy of Emergency Service Notification Form. Include date and person or persons to be notified.

PART 2 - MATERIALS

2.1 General

All products, procedures and facilities shall be per MUTCD latest edition. All traffic control devices shall be high intensity.

2.2 Advanced Warning Arrow Panel

MUTCD 6E-7, 8, 9. Type B min., independent power source, minimum 12 hours between intensity.

2.3 Temporary Concrete Barriers

MUTCD 6C-10, ADOT, construction detail, C-10.14 with barricade warning lights where required.

2.4 Sand Barrel Crash Cushions

ADOT, Signing and marking details 4-C-1.01, 02, 03. Filled with sand with a dry unit weight of 90 to 100 lbs. per cubic foot and a moisture content less than 2 percent by weight.

2.5 Temporary Pavement Markings

A. Raised Pavement Markings

MUTCD 3A-10, ADOT Specification Section 706, temporary reflective markers, color as indicated.

B. Marking Point

ADOT Specification Section 708, color as indicated.

C. Performed Marking Tape

ADOT Specification Section 705-202.2, removable.

2.6 Sign Posts

MUTCD 6B-4, wood, steel or aluminum.

2.7 Signs, Barricades, Channelizing Devices and Lighting Devices

MUTCD, Part VI. Lighted barricades shall be properly maintained.

2.8 Flagmen

Competent, trained and supplies with a combination STOP and SLOW sign, orange vest, orange hard hat or orange cap. Provide adjacent barricading devices where required. Flagmen shall be certified as required by State law and/or local codes and ordinances.

2.9 Pilot Vehicles

Equip vehicle with at least one roof mounted flashing yellow light and appropriate vehicle signage which will inform the traffic that they are required to follow that vehicle.

2.10 Detour

Provide surfacing on detour routes as indicated on the traffic plan. Surface shall be smooth and adequately maintained to keep dust to an absolute minimum.

PART 3 - EXECUTION

3.1 General

Provide adequate protection of all vehicular and pedestrian traffic, and workmen through any and all portions of the construction zone where the construction operations interfere with, obstruct or create a hazard to the normal movement of traffic.

- A.** Two (2) lanes of traffic shall remain open at all times unless otherwise approved by the **OWNER**.
- B.** During emergency situations, the **OWNER** may provide traffic control. The cost of any traffic control provided by the Owner shall be borne by the **CONTRACTOR**.
- C.** In the event that any employees of Lake Havasu City are required to correct, repair, or modify any in-place traffic control provided by the **CONTRACTOR**, it shall be the responsibility of the **CONTRACTOR** to reimburse Lake Havasu City for any incurred costs.
- D.** The **CONTRACTOR** will coordinate his work so as not to disrupt residential trash service.

3.2 Public Notification

A. Services

Notify all Emergency and Public Service which may operate in the affected traffic area, in writing when traffic patterns are to be alerted not less than 24 hours prior to street closure. Provide each service with the name of the employee(s) responsible for traffic control maintenance.

B. News Media

At least 7 days prior to closing any street, the **CONTRACTOR** shall notify at least 2 local radio and newspaper offices. The notification shall include the locations and time periods of closures. Periodically update news organizations as required.

3.3 Traffic Control Devices

Place all necessary traffic control devices before any work is started. Move devices as necessary to keep up with the advancing operation. Place devices at the locations indicated on the traffic plan and in accordance with plan details and the MUTCD and as specified herein.

Maintain devices, keep free from dirt, mud and roadway grime. Promptly replace all damaged devices.

3.4 Removal of Existing Markings

Remove existing pavement markings by any method that does not structurally damage the pavement. The method of removal shall meet all local codes and ordinances. Markings shall not be painted out.

3.5 Temporary Pavement Markings

Place pavement markings in accordance with the traffic control plan. Remove existing pavement marking and place temporary pavement marking immediately. Use temporary traffic control devices as required to safely channel traffic until markings are complete.

3.6 Temporary Concrete Barriers

Locate and install barriers as indicated on the plans. Fasten sections of the barrier to form a continuous chain. Flare ends of the barrier back as indicated to prevent exposing barrier end to oncoming traffic. Install flashing warning lights as required.

3.7 Sand Barrel Crash Cushions

Locate and install as indicated on the plans. Remove and replace damaged crash cushions immediately. Have available on the site a sufficient number of cushions to completely replace all of crash cushions at one site.

3.8 Flagmen

Locate flagmen as indicated on the traffic control plan. Provide flagmen where traffic is required to stop or slow. Provide additional for site specific traffic control conditions.

3.9 Stopping Traffic

Traffic shall not be stopped and held longer than absolutely necessary. Traffic shall not be stopped long enough to interrupt traffic at the nearest intersection or longer than 5 minutes unless otherwise approved by the Owner.

3.10 Adjustment to the Traffic Control Plan

At any time, the **OWNER** may request that adjustments be made to the traffic control plan layout or signage. The **CONTRACTOR** shall immediately make all adjustments and provide all signage required. No additional payment will be made for adjustments to the traffic control plan.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

- A.** No measurement will be made for this item.

4.2 Payment

- A.** Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

**** END OF SECTION 02610 ****

SECTION 02660

PERMANENT SIGNS

PART 1 - GENERAL

1.1 Description

A. Description of Work

The work to be performed in accordance with this section includes furnishing traffic signs and posts and delivering them to the **OWNER**.

1.2 Quality Assurance

A. Reference Test Standards and Specifications

Manual on Uniform Traffic Control Devices, latest edition (MUTCD).

Arizona Department of Transportation (ADOT) Standard Specifications for Road and Bridge Construction, 1990, or its latest Drawings.

ADOT Signing and Marking Standard Drawings.

1.3 Submittals

A. Certificates of Compliance

1. Traffic Signs
2. Traffic Sign Posts

PART 2 - MATERIALS

2.1 General

All products shall be in accordance with the MUTCD, latest edition.

2.2 Signs

MUTCD, Part II. All signs shall be high intensity type.

2.3 Sign Posts

MUTCD, Part II. Sign posts shall be manufactured by Unistrut or an approved equal. Sign posts shall be 2-inch square galvanized steel tubing (10 gauge) perforated with 7/16-inch diameter holes; including an 18-inch long 2-1/2 inch square, perforated galvanized steel anchor sleeve (10 gauge) and a 2-1/4 inch square galvanized steel, solid tubing sleeve (12 gauge). Also included shall be an 8-inch anchor pin and two 3/8-inch x 8-inch bolts with nuts and lockwashers.

PART 3 - EXECUTION

3.1 General

The materials for permanent signs shall be purchased by the **CONTRACTOR** and delivered to the **OWNER** at an approved location. Permanent signs will be installed by City forces.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

A. No measurement will be made for this item.

4.2 Payment

A. Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

** END OF SECTION **

SECTION 02810

TEMPORARY CONSTRUCTION FENCING

PART 1 - GENERAL

1.1 Summary

A. Description

This Section includes temporary construction fencing and related components.

1.2 Submittals

A. Submit as specified in Section 01330.

B. Includes, but not limited to, the following:

- 1.** Product data: Manufacturer's technical data, specifications, and installation instructions for fence material and accessories.
- 2.** Shop drawings showing layout and location of fence, posts, and including details illustrating fence height, sizes of posts, hardware list, and accessories.

PART 2 - MATERIALS

2.1 Acceptable Manufacturers

A. Subject to compliance with requirements, provide products of one of the following.

- 1.** Roxford Fordell, Greenville, SC
- 2.** BF Products, Inc., Harrisburg, PA
- 3.** Naltex Plastics, Inc, Austin, TX
- 4.** Seton Identification Products, Branford, CT

2.2 General

- A. Fence height shall be 4 feet located from top of ground to top of fence.
- B. Fence shall extend from the top of ground. No gaps between the fence and the top of ground shall be permitted.

2.3 Fabric

- A. Fence material shall be plastic.
- B. Fence material shall be orange in color.
- C. Fence material shall be resistant to temperature change and shall be UV protected.

2.4 Framing and Accessories

- A. Provide posts and accessories necessary to erect fence in location desired.
- B. Posts shall be either fiberglass or steel, specifically made for the installation of fencing.
- C. Fencing shall be secured to the posts through the use of nylon ties or nylon wire (minimum 12 gauge). Steel wire shall not be used.

PART 3 - EXECUTION

3.1 Installation

- A. Follow the existing general contour of ground and properly align.
- B. **Posts**
 - 1. Posts shall be installed plumb and in straight alignment.
 - 2. Posts shall be spaced every 6.5 feet maximum, unless otherwise approved by the Engineer.
- C. **Fabric**
 - 1. Fabric shall be stretched taut between fence posts. Equal tension shall be applied so that fence remains straight and taut between posts.

2. Install fabric on security side of fence and anchor to posts so that fabric remains in tension after pulling force is released.
3. Fasten fabric to posts with nylon ties or nylon wire spaced 12 inches maximum.

3.2 Maintenance

- A. Fence shall not be allowed to be in disrepair. All breaks or tears in the fence fabric will be repaired immediately.
- B. All posts shall remain plumb and in straight alignment. All fallen posts shall be reset immediately.
- C. Contractor shall maintain temporary construction fencing in such a manner as to protect Work from damage and to protect the safety of the general public.
- D. No Contractor personnel or equipment shall be allowed outside of the fenced construction easement area.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement

No measurement will be made for this item.

4.2 Payment

No payment will be made for temporary construction fencing. This item will be considered incidental to the other items of Work.

**** END OF SECTION 02810 ****

SECTION 03100

CONCRETE FORMWORK

PART 1 - GENERAL

1.1 Summary

A. This Section includes formwork for cast-in-place concrete.

B. Related Work Specified Elsewhere

Concrete ReinforcementSection 03200
Concrete.....Section 03300
Concrete Curb, Gutter, Sidewalk, and Driveways.....Section 03310

1.2 Quality Assurance

A. Reference Standards and Specifications

1. American Concrete Institute (ACI)

ACI 301 - Specifications for Structural Concrete for Buildings.

ACI 318 - Building Code Requirements for Reinforced Concrete.

ACI 347 - Recommended Practice for Concrete Formwork.

2. American Society for Testing and Materials (ASTM)

ASTM C31 - Making and Curing Concrete Test Specimens in the Field.

PART 2 - MATERIALS

2.1 Materials for Facing

A. Where concrete will be exposed to view after construction:

1. Smooth finish, Exterior grade plywood at least 5/8 inch thick.
2. Steel.

B. Where concrete will not be exposed to view after construction:

1. Exterior grade plywood at least 5/8 inch thick.
2. Steel.
3. Wood fiberboard.
4. Dressed lumber free of loose knots.

C. Treat forms with lacquer, form oil, or other acceptable material to prevent bonding to concrete. Material shall not stain, cause injury to exposed concrete surfaces, or affect bonding of specified surface finishes. Bond breaker shall be VOC compliant with maximum 600 g/L (5 lbs/gal) or less where area restrictions are more stringent.

D. Clean forms of sawdust, dust, dirt, and other foreign materials.

2.2 Form Ties

A. Break-back, coil, or screw-type, except where otherwise specified.

B. Water-seal coil type or break-back water-seal type in walls below grade and walls of water-bearing structures.

C. All types shall leave conical depression in concrete.

D. Removable tapered tie system shall not be used.

E. Space as required against pressure of fresh concrete.

2.3 Chamfer Strips

A. Chamfer: 3/4-inch except where otherwise indicated.

B. Place in all forms to provide chamfer where concrete will have exposed projecting corners.

PART 3 - EXECUTION

3.1 Form Construction

- A.** Conform to ACI 301, 318, and 347, except Shop Drawings for formwork, shoring, and reshoring shall not be submitted to the Engineer for approval.
- B.** Adequately brace, stiffen, and support forms to prevent perceptible deflection or settlement, and to hold plumb, level, and true to line.
- C.** Construct and maintain forms to the tolerances given in ACI 301, Section 4.
- D.** Construct sufficiently tight to prevent mortar leakage.
- E.** Avoid offsets between adjacent forms and construct so that shores, braces, and stiffening members are in line with those below.
- F.** Space studs and stringers as required to support facing against concrete pressure, but not more than 12 inches for 5/8-inch plywood or 16 inches for 3/4-inch plywood.
- G.** Use wales, strongbacks, shores, and bracing as required.
- H.** Form all necessary openings where indicated or as required for the Work.
- I.** Construct forms to be removable in sections without marring concrete surface.
- J.** Surface of forms shall provide smooth, dense, plane surface to finished concrete where exposed to view.
- K.** Contractor shall be responsible for structural adequacy, design, engineering, and construction of the formwork.

3.2 Time-in-Place for Forms

- A.** No shores, bracing, supports, or other formwork shall be loosened or removed until the concrete members supported thereby have acquired sufficient strength to support safely their own weight and any other possible loads.

- B. The minimum time between concrete placement and form removal shall be determined either by field-cured, test-cylinder specimens or in accordance with the time specified for the member involved.
- C. If **CONTRACTOR** elects to determine the required time by means of test specimens, all costs in connection therewith shall be his responsibility.
- D. Test specimens shall be made, field-cured, and tested as specified in ASTM C31. No forms or supports shall be loosened or removed until tests indicate strength of members as follows:

<u>Percent of Design</u>	<u>Compressive Strength</u>
<u>Structural Member</u>	
Unshored slab and beam forms or forms which can be removed without disturbing shores	70
Slab or beam shoring.....	85
Wall, column, and beam side forms	40

- E. If field-cured test cylinders are not used as the basis for determination of time-in-place for formwork, the following criteria shall apply:

<u>Structural Member</u>	<u>Time-in-Place for Forms*</u>
Slab or beam shoring	12 days
Slab forms or beam soffits	7 days
Wall, column, and beam side forms	18 hours

*These periods are a cumulative number of days or fractions thereof, not necessarily consecutive, during which the temperature of the concrete surface is above 50°F.

3.3 Removal of Forms: Remove forms in a manner to avoid damage to the structure, with particular care for corners and edges.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

- A. No measurement will be made for this item.

4.2 Payment

- A.** Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

****END OF SECTION****

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 Summary

A. This Section includes steel reinforcement bars, ties, welded wire fabric, bolsters, chair supports, and accessories.

B. Related Work Specified Elsewhere

Concrete FormworkSection 03100
Concrete.....Section 03300
Concrete Curb, Gutter, Sidewalk, and DrivewaysSection 03310

1.2 Quality Assurance

A. Reference Standards and Specifications

1. American Concrete Institute (ACI)

ACI 301 - Specifications for Structural Concrete for Buildings.

ACI SP-66 - Detailing Manual.

ACI 318 - Building Code Requirements for Reinforced Concrete.

2. American Society for Testing and Materials (ASTM)

ASTM A82 - Steel Wire, Plain, for Concrete Reinforcement.

ASTM A185 - Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.

ASTM A615 - Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

ASTM A706/A706M – Low-Alloy Steel. Deformed and Plain Bars for Concrete Reinforcement.

3. American Welding Society (AWS)

A5.5 – Low-Alloy Steel Covered Arc Welding Electrodes.

B2.2 – Standard for Welding Procedure and Performance Qualification.

D1.4 – Structural Welding Code – Reinforcing Steel.

4. Concrete Reinforcing Steel Institute (CRSI)

Manual of Standard Practice.

1.3 Submittals

A. Submit as specified in Section 01330.

B. Include, but not limited to, the following:

1. Complete bar schedule, bar details, and erection drawings to conform to ACI SP-66.
2. Drawing with each type of bent bar marked with identification mark. Straight bars shall have mark number or be identified by size and length.
3. Erection drawings shall be clear, easily legible, and to a minimum scale of:
 - a. 1/4 inch = 1 foot.
 - b. 1/8 inch = 1 foot if bars in each face are shown in separate views.
4. Size and location of all openings.
5. Concrete protective cover.
6. Grade of steel.
7. Lap splice lengths.
8. Mechanical splice product specification and data.

1.4 Delivery, Storage and Handling

- A. Store steel reinforcement blocked-up off the ground and in orderly stacks.
- B. Store only bars with the same identifying label in the same stack.

1.5 Testing

- A. Perform at the mill for each heat.
- B. Submit certified test results to Engineer upon request.

PART 2 - MATERIALS

2.1 Reinforcement Bars, Ties, and Stirrups

A. Materials

- 1. Conform to ASTM A615, Grade 60, except as otherwise specified.

B. Fabrication of Bars

- 1. Fabricate with cold bends conforming to the recommended dimensions shown in ACI 318.
- 2. Fabricate bars according to the tolerances given in ACI 301, Chapter 5.
- 3. Field fabrication will not be allowed.
- 4. Attach metal or plastic tags with identifying mark or length corresponding to mark number or length on Drawing. Straight bars shall have mark number or size and length. Bent bars shall have mark number.
- 5. **CONTRACTOR** may, at his option, continue steel reinforcement through openings in walls and slabs, then field-cut the opening so that there will be the required concrete cover between ends of bars and edge of opening.

2.2 Welded Wire Fabric

- A.** Conform to ASTM A185 using bright basic wire conforming to ASTM A82.
- B.** Wire sizes W 1.4 and smaller shall be galvanized.

2.3 Bolsters, Chairs, and Accessories

- A.** Conform to ACI SP-66 and the CRSI Manual of Standard Practice.
- B.** Provide all spacers, bolsters, chairs, ties, and other devices necessary to properly space, place, support, and fasten steel reinforcement in place during the concrete placement.
- C.** Metal accessories shall be plastic-coated where legs will be exposed in finished concrete surfaces.
- D.** Do not use rocks, broken bricks, wood blocks, or concrete fragments for support of steel reinforcement.

2.4 Precast Concrete Block Bar Supports

- A.** May be used only for bar supports in slabs on ground.
- B.** Blocks shall be made with a minimum of nine sacks of cement per cubic yard and have a minimum compressive strength of 6,000 psi in 28 days.
- C.** Each block shall have a minimum of 9 square inches of bearing area. Space as required by the particular condition of weight, bearing surface, and rigidity of the steel reinforcement.

PART 3 - EXECUTION

3.1 Placement of Steel Reinforcement

- A.** Place in accordance with Chapter 5 of ACI 301, Chapters 7 and 12 of ACI 318, and the CRSI Manual of Standard Practice.
- B.** Tie securely with 16-gauge or larger annealed iron wire.
- C.** Place to maintain concrete cover to conform to Chapter 5 of ACI 301 and Chapter 7 of ACI 318, unless otherwise indicated.

- D. Splice steel to conform to Chapter 12 of ACI 318.
 - 1. Unless otherwise indicated, lap splices shall be Class B as defined by ACI 318.
 - 2. **Mechanical Splices**
 - a. Lerten mechanical splices shall be used where indicated.
 - b. The Lerten mechanical splices shall develop in tension and compression at least 125% of the yield strength (F_y) of the bar spliced.
 - 3. Any additional Contractor-proposed splice shall be approved by the Engineer for location and splice length.
- E. Lap welded wire fabric in accordance with Section 12.19 of ACI 318, but not less than the length of one mesh plus 2 inches.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

- A. No measurement will be made for this item.

4.2 Payment

- A. Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

****END OF SECTION****

SECTION 03300

CONCRETE

PART 1 - GENERAL

1.1 Summary

A. This Section includes concrete and related items.

B. Related Work Specified Elsewhere

Concrete Formwork.....	Section 03100
Concrete Reinforcement.....	Section 03200
Concrete Curb, Gutter, Sidewalk, and Driveways.....	Section 03310

1.2 Quality Assurance

A. Reference Standards and Specifications

1. American Concrete Institute (ACI)

ACI 211.1 - Recommended Practice for Selecting Proportions for Normal and Heavyweight Concrete.

ACI 301 - Specifications for Structural Concrete for Buildings.

ACI 304 - Recommended Practice for Measuring, Mixing, Transporting, and Placing Concrete.

ACI 305 - Committee Report on Hot-Weather Concreting.

ACI 306 - Committee Report on Cold-Weather Concreting.

ACI 308 - Recommended Practice for Curing Concrete.

ACI 309 - Recommended Practice for Consolidation of Concrete.

ACI 318 - Building Code Requirements for Reinforced Concrete.

ACI 350 – Code Requirements for Environmental Engineering Concrete Structures and Commentary

2. American Society for Testing and Materials (ASTM)

ASTM C31 - Making and Curing Concrete Test Specimens in the Field.

ASTM C33 - Concrete Aggregates.

ASTM C39 - Compressive Strength of Cylindrical Concrete Specimens.

ASTM C40 - Organic Impurities in Fine Aggregates for Concrete.

ASTM C42 - Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

ASTM C88 - Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.

ASTM C94 - Ready-Mixed Concrete.

ASTM C114 - Methods for Chemical Analysis of Hydraulic Cement.

ASTM C117 - Materials Finer than No. 200 Sieve in Mineral Aggregates by Washing.

ASTM C136 - Method for Sieve Analysis of Fine and Coarse Aggregates.

ASTM C142 - Clay Lumps and Friable Particles in Aggregates.

ASTM C143 - Slump of Portland Cement Concrete.

ASTM C150 - Portland Cement.

ASTM C172 - Sampling Freshly Mixed Concrete.

ASTM C192 - Making and Curing Concrete Test Specimens in the Laboratory.

ASTM C231 - Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

ASTM C233 - Testing Air-Entraining Admixtures for Concrete.

ASTM C260 - Air-Entraining Admixtures for Concrete.

ASTM C289 - Potential Reactivity of Aggregates (Chemical Method).

ASTM C295 - Petrographic Examination of Aggregates for Concrete.

ASTM C309 - Liquid Membrane-Forming Compounds for Curing Concrete.

ASTM C430 - Fineness of Hydraulic Cement by the No. 325 (45-Dm) Sieve.

ASTM C494 - Chemical Admixtures for Concrete.

ASTM C566 - Total Moisture Content of Aggregate by Drying.

ASTM D1751 - Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction. (Nonextruding and Resilient Bituminous Types.)

ASTM D1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

2. Concrete Plant Mixer Standards of the Plant Mixer Manufacturers Division Concrete Plant Manufacturers Bureau.
3. Concrete Plant Standards of the Concrete Plant Manufacturers Bureau.
4. Corps of Engineers Specification for Nonshrink Grout, CRD-C621.
5. Federal Specification (FS)

TT-S-227E - Sealing Compound: Elastomeric Type, Multicomponent (for Caulking, Sealing, and Glazing in Buildings and Other Structures).
6. National Bureau of Standards (NBS) Specifications for Scales.
7. National Ready-Mix Concrete Association, "Truck Mixer, and

Agitator Standards of the Truck Mixer Manufacturers Bureau."

B. Acceptance Testing of Concrete During Construction

1. A testing laboratory will be selected and paid by the Owner to perform the required compressive strength tests and statistical evaluations of concrete being used in the Work.
2. The Laboratory will sample, cure and test concrete cylinders in accordance with ASTM C31, C192 and C39, testing two cylinders at 7 days of age and two at 28 days of age.
3. The Laboratory will sample a minimum of one set of concrete cylinders per day's placement or one for each 50 cubic yards for larger placements.

1.3 Submittals

A. Submit as specified in Section 1330.

B. Include, but not limited to, product data and Shop Drawings of the following:

1. Nonshrink grouts.
2. Admixtures.
3. Bonding agents.
4. Curing agents.
5. Concrete floor hardeners, sealers, and coloring compounds.
6. Expansion joint materials.
7. Expansion joint sealants.
8. Waterstops.

C. Mill Certificates

1. Submit to Engineer a minimum of one copy for each cement shipment.

D. Concrete Mix Design Proportions

1. Submit as specified in PART 2, paragraph 2.1.D - Mix Proportions, this Section.
 2. Submit for each mix design.
 3. Resubmit for any change in each mix design.
- E.** Production Test Reports: Submit as specified in DIVISION 1 and PART 2, paragraph 2.1.E - Measurement of Materials, this Section.
- F.** Concrete Plant Certificate: Submit current plant certification showing the concrete plant is certified by the National Ready Mixed Concrete Association (NRMCA).

PART 2 - MATERIALS

2.1 Concrete

A. Materials

1. Portland cement Type V. Conform to ASTM C150.
2. **Fine Aggregate**
 - a. Conform to ASTM C33.
 - b. Approved service record of 3 years with a history indicating that the fine aggregate is not chemically reactive.
 - c. For a new fine aggregate source, or when 3 years' approved service records are not available, or when the service records are unacceptable; the aggregate shall be evaluated for potential reactivity. Aggregate must be considered innocuous in accordance with petrographic examination by ASTM C295 and tests conforming to ASTM C289.
 - d. Fine aggregate considered deleterious or potentially deleterious shall not be used without approval.
 - e. Maintain fine aggregate free of ice and frozen lumps.
3. **Coarse Aggregate**

- a. Conform to ASTM C33
 - (1) Limits for deleterious substances and physical property requirements shall conform to Table 3 and applicable class designation 5S, 5M or 1N.
- b. Approved service record of 3 years with a history indicating that the coarse aggregate is not chemically reactive.
- c. For a new coarse-aggregate source, when 3 years' approved service records are not available, or when the service records are unacceptable; the aggregate shall be evaluated for potential reactivity. Aggregate must be considered innocuous in accordance with petrographic examination by ASTM C295 and tests conforming to ASTM C289.
- d. Coarse aggregate considered deleterious or potentially deleterious shall not be used without approval.
- e. Blast furnace slag will not be permitted.
- f. Maintain coarse aggregate free of ice and frozen lumps.
- g. Grading Requirements
 - (1) From 1 inch to No. 4 for all concrete unless otherwise specified.

4. Mixing Water

- a. Only potable water will be acceptable.

5. Admixtures

- a. Water-Reducing Type
 - (1) Conform to ASTM C494, Type A.
 - (2) Conform to manufacturer's recommendations for use.
 - (3) Technical assistance of the manufacturer's field representative shall be furnished upon request.

- b. Air-Entraining Type
 - (1) Conform to ASTM C260.
 - (2) Conform to manufacturer's recommendations for use.
 - (3) Technical assistance of the manufacturer's field representative shall be furnished upon request.
 - (4) Testing of air-entraining admixtures shall conform to ASTM C233.
- c. Other Admixtures: Used only with Engineer's written concurrence.
 - (1) Water-Reducing, Retarding Type: Conform to ASTM C494, Type D, and shall not contain any chloride ions added during manufacture.
- d. Storage
 - (1) Admixtures shall be stored in such a manner as to avoid contamination, evaporation, freezing, temperature changes, settling, or any damage, which would adversely affect their characteristics.

B. Laboratory Testing of Materials for Use in Concrete

- 1. An approved independent testing laboratory shall be selected and paid by Contractor to perform all required quality control tests of materials proposed for use in the production of concrete and to determine mix proportions when laboratory trial batches are required.
- 2. If requested by the Owner, Contractor shall deliver representative Samples of all proposed concrete materials to the laboratory for the following testing:
 - a. Fine Aggregate
 - (1) ASTM C33.
 - (2) ASTM C40.

- (3) ASTM C88.
 - b. Coarse Aggregate
 - (1) ASTM C33.
 - (2) ASTM C88.
 - c. Air-entraining admixture shall be tested conforming to ASTM C233.
3. The laboratory test results shall be part of the design mix as specified in this PART 2, paragraph 2.1.D. - Mix Proportions, this Section.

C. Concrete Qualities Required

1. Compressive Strength

- a. Minimum 28-day compressive strength = 4,000 psi for all construction.
 - b. Compressive-strength determinations shall be made from 4" diameter x 8" long concrete cylinders tested in accordance with ASTM C39.
2. Slump of concrete shall be 4 inches, ± 1 inch as tested in accordance with ASTM C143.
3. Air Content: 4% to 6% as tested in accordance with ASTM C231.
4. Minimum Cement Content: 600 pounds per cubic yard.
5. Water-Cement Ratio: 0.45.

D. Mix Proportions

- 1. Concrete shall be homogeneous, readily placeable, and uniformly workable; proportioned to conform to ACI 211.1.
- 2. Mix proportions for all concrete, unless otherwise specified, shall be selected on the basis of laboratory trial mix design, or historical records of compressive strength.

- a. Laboratory Trial Batch: All such Work shall be performed by the laboratory as specified in PART 2, paragraph 2.01.B. - Laboratory Testing of Materials for Use in Concrete, this Section.
- (1) Laboratory trial batches shall be used to establish a water-cement ratio, compression-strength curve with at least three points, each representing the strength of a separate trial batch. At least one point shall be above and one below the strength required. Each point on the curve shall represent the average of at least three cylinders tested at 28 days or an earlier age when approved by Engineer. The slump and air content shall be at the maximum limits specified in PART 2, paragraph 2.01.C. - Concrete Qualities Required, this Section.
 - (2) A point on the water-cement ratio, compressive-strength curve shall be selected that will provide an average strength at least 1,200 psi greater than the specified minimum strength.
 - (3) Submit the following test data to Engineer for approval prior to placing concrete.
 - (a) Fine Aggregate
 1. ASTM C33.
 2. ASTM C40.
 3. ASTM C88.
 4. ASTM C117.
 5. ASTM C136.
 6. ASTM C142.
 7. Fineness modulus.
 8. ASTM C295 and ASTM 289 or approved service records.

(b) Coarse Aggregate

1. ASTM C33.
2. ASTM C88.
3. ASTM C136.
4. ASTM C142.
5. ASTM C295 and ASTM C289 or approved service records.

(c) Cement

1. Mill certificate.

(d) Concrete

1. Fine and coarse aggregate, water and cement sources.
2. Laboratory mix proportions, slump and air content.
3. Water-cement ratio, compressive-strength curve.

b. Historical Records: In lieu of laboratory trial batches, the Contractor shall submit historical compressive strength data which demonstrates the mixture meets the strength criteria for proportioning presented in ACI 318-5.2.

3. Prior to placing any concrete, the laboratory selected by the Contractor shall report the results of the testing and mix designs to the following:

- a. Resident Project Representative, Field Office (one copy).
- b. Contractor (copies as required).
- c. Concrete Supplier (copies as required).

E. Measurement of Materials

1. General Requirements

- a. Conform to ACI 304.
- b. Beam or springless dial-type scale conforming with NBS - "Specifications for Scales."
- c. Volumetric measurement of water shall be performed with an approved automatic valve.

2. Concrete Plant Scale Accuracy and Calibration Frequency

- a. The concrete plant scales shall be accurate to +0.4% of the capacity of the scale.
- b. The scales shall be calibrated at intervals as specified in PART 3, paragraph 3.09 - Testing, this Section.

3. Individual Batch Accuracy

- a. Cement: $\pm 1.0\%$.
- b. Water: $\pm 1.0\%$ by volume or weight.
- c. Aggregates: $\pm 2.0\%$.
- d. Admixtures: $\pm 3.0\%$ by volume or weight.

F. Mixing and Delivery

1. Conform to ACI 304.
2. Cement temperature, when added to mix, shall not exceed 170°F.
3. Adjust the amount of mix water to compensate for the moisture content of the aggregates.
4. Concrete Plant
 - a. Conform to "Concrete Plant Mixer Standards of the Plant Mixer Manufacturers Division Concrete Plant Manufacturers Bureau" and "Concrete Plant Standards of the Concrete Plant Manufacturers Bureau."
 - b. Charge with 5% to 10% of the mixing water both in advance and after the addition of aggregates and cement.
 - c. Charge with remaining water uniformly with the other materials.
 - d. Avoid charging in excess of manufacturer's rating.
 - e. Discharge mixed concrete completely prior to recharging.

f. Mixing Time

- (1) Start immediately when all ingredients, except the last of the water, are in the mixer.
- (2) Minimum mixing time shall conform with mixer manufacturer's instructions, but not be less than the following:

Capacity of Mixer _ <u>Cubic Yards</u>	Minimum Time <u>of Mixing</u>
1 or less	1 minute
2	1 minute, 15 seconds
3	1 minute, 30 seconds
4	1 minute, 45 seconds
5	2 minutes
6	2 minutes, 15 seconds

Add 15 seconds' mixing time for each additional cubic yard of concrete.

5. Mixing of Concrete at Plant Off Jobsite

- a. Mix concrete in central mixer or truck mixer. Transport in truck mixer turning at agitation speeds only.
- b. Water added to concrete having a slump below the specified minimum shall be at Contractor's risk. If the water added produces a slump greater than the specified maximum, the concrete will be rejected. If water is added, the concrete shall be remixed for a minimum of 25 revolutions.
- c. Truck mixer shall conform to "Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers Bureau" of the National Ready-Mix Concrete Association.
- d. Ready-mixed concrete shall be produced and delivered conforming to ASTM C94 as applicable.
- e. Contractor shall furnish Owner with a concrete delivery ticket for each load of concrete. The ticket shall have the following information recorded:
 - (1) Ticket number.

- (2) Time batched.
- (3) Time arrived on jobsite.
- (4) Time discharge started.
- (5) Time completed delivery.
- (6) Mix number.
- (7) Amount of all water added at jobsite by Contractor.

6. Plant and truck mixer uniformity shall be tested according to ASTM C94. Frequency of tests shall be as specified in PART 3, this Section.

2.2 Grout

A. Grout for Dry Packing

1. Volume: 1 part portland cement to 2 parts sand.
2. Keep water to a minimum as required for placing by the dry packing method.
3. Place after the mixed grout has been allowed to stand for 2 hours.
4. The sand and cement shall be as specified for concrete.

B. Flowable Nonshrinking Grout

1. Required for setting handrail posts, for setting equipment recommended by the manufacturer to be set with nonshrinking grout, and in other places indicated.
2. Grout shall conform to Corps of Engineers specification for Nonshrink Grout, CRD-C621.
3. Grout shall be nonmetallic, as manufactured by one of the following:

- a. L and M Construction Chemicals, Inc. - Crystex.
 - b. U. S. Grout Corporation - Five Star Grout.
 - c. Master Builder's Company - Masterflow 713 Grout.
 - d. Sauereisen Cements Company - Sauereisen F-100.
 - e. Gifford-Hill & Company - Supreme Grout.
4. Prepare and place conforming to manufacturer's printed instructions.
 5. For equipment bases, the concrete surfaces shall be sandblasted or roughened with a chipping hammer prior to grouting. The foundation plates shall be cleaned of any grease, oil, paint, primers, or epoxy coatings.

C. Grout for Bonding

1. Proportion (by weight): 1 part cement to 1-1/2 parts sand.
2. Keep water to a minimum.

2.3 Bonding Agent

- A. Provide moisture-insensitive, epoxy-resin bonding agent as manufactured by one of the following:
 1. A. C. Horn, Inc. - Epoxitite.
 2. Euclid Chemical Company - Euco Epoxy.
 3. Sika Chemical Company - Sikastix 370.
 4. L&M Construction Chemicals, Inc. - Epobond.

2.4 Concrete Accessories

A. Water Stops

1. Serrated virgin polyvinyl chloride equal to one of the following:
 - a. Four Seasons, Inc. - Horn Durajoint Type 3.

- b. Vulcan Metal Products Company - Vulco 8013.
- c. Greenstreak – Model No. 732

B. Expansion Joints

1. Expansion Joint Filler: Premolded cork of thickness indicated and conforming to ASTM D1752, Type III, self- expanding cork. Unless indicated to be asphalt-impregnated fiber.
2. Expansion Joint Filler: Preformed asphalt-impregnated fiber of thickness indicated and conforming to ASTM D1751. Use where indicated.
3. Bond Breaker: Polyethylene strip.
4. **Joint Sealant:**
 - a. Use 2-component, self-leveling urethane conforming to FS TT-S-227E as manufactured by one of the following:
 - (1) A. C. Horn Inc. - Duraseal-U.
 - (2) Pecora Inc. - Urexpan NR-200.
 - (3) Sonneborn - SL-2 Sealant.
 - b. Prime joints with manufacturer's primer.

C. Dovetail Anchor Slots

1. 24-gage zinc alloy, 1" (25 mm) wide back x 1" deep x 5/8" throat as manufactured by one of the following:
 - a. Gateway Products.
 - b. Heckmann Building Products, Inc.
 - c. Hohmann & Barnard, Inc.

2.5 Curing Agent

- A.** Liquid membrane-forming compound conforming to ASTM C309, Type 1. Curing agent shall be VOC compliant with maximum 2.9 lbs/gal

(350 g/l), or less where area regulations are more stringent. ASTM C309, Type 2 shall be used as specified in PART 3, paragraph 3.05 - HOT WEATHER CONCRETING, this Section.

PART 3 - EXECUTION

3.1 Preparation for Concrete Placement

A. Openings Through Concrete: Provide openings through concrete as indicated and for the proper installation of all equipment, piping, wiring and similar items, installed under this Contract.

B. Installation of Embedded Items

1. Provide for accurate installation of embedded items installed under this Contract.
2. Embedded items shall be as indicated or specified, or as selected by Contractor and approved by Engineer.
3. During cold weather, protect pipe sleeves from moisture, which may freeze, expand, and crack the sleeve and concrete structure.
4. Grease or tape anchor bolt threads to protect from concrete splatter.

C. Installation of Joints

1. Construction Joints

a. Location

- (1) Locate joints, which are not indicated or specified, in conformance with ACI 318.
- (2) Obtain Engineer's approval of joints located by Contractor prior to preparation of reinforcing steel drawings.

b. Preparation and Installation

- (1) Clean and break laitance or other foreign material from bonding surface.

- (2) Tighten forms remaining in place (where applicable) to prevent seepage between forms and hardened concrete.
- (3) Provide water stops and shear keys as indicated or specified and as required in any new construction joint requested by Contractor.

c. **Waterstops**

- (1) Install in all construction joints where indicated.
- (2) Install conforming to manufacturer's printed instructions.
- (3) All joints and splices of PVC waterstop shall be 100% fused.

2. Expansion Joints

- a. Install as indicated.
- b. Reinforcement bars will not extend through expansion joints unless otherwise indicated.
- c. Where joint sealant is indicated, completely cover the top surface of the joint filler with a polyethylene strip bond breaker prior to sealing joint.
- d. Seal top of expansion joint with joint sealant applied conforming to manufacturer's instructions. Depth of sealant shall be one-half the joint width unless otherwise indicated. During cold weather, protect joint from moisture prior to installation of joint sealant.

3. Dovetail Anchor Slots: Install as indicated or specified.

D. Cutting and Bonding to Existing Concrete

1. Cutting Existing Concrete

- a. Use methods and equipment that will avoid damage to adjacent parts of the structure from heavy blows or vibration.
- b. Cut existing concrete with power concrete saw where

- possible to prevent spalling and chipping and to form neat, straight edge.
- c. Remove all loose or cracked pieces resulting from cutting existing concrete, leaving only sound, undamaged concrete adjacent to new Work.
 - d. Leave access opening edges with a neat, true grout surface to the opening size indicated.
 - e. Cut reinforcing steel with sufficient length remaining (approximately 30-bar diameters) for bending and lapping into new construction.

2. Bonding to Existing Concrete

- a. Roughen concrete by use of a pneumatic chipping hammer or other approved means.
- b. Thoroughly clean the concrete surface and apply the bonding agent. Place the fresh concrete after the bonding agent becomes tacky.

3.2 Placing of Concrete

A. Conventional Placing

1. General Requirements

- a. Conform to ACI 304.
- b. Bonding surfaces shall be clean, free of laitance and foreign materials.
- c. Face horizontal bonding surfaces with 1-inch-thick coat of fresh "grout for bonding." Wet all other surfaces.
- d. Place concrete on properly prepared and unfrozen subgrade and only in dewatered excavation and forms.
- e. Use forms for all concrete except where otherwise indicated or specified.
- f. Do not place concrete that has partially hardened or has been contaminated by foreign materials.
- g. Prevent mud or foreign materials from entering the

concrete or forms during placement operations.

2. Conveying

- a. Convey concrete from the mixer and deposit in place by methods, which will prevent the segregation or loss of materials.
- b. Equipment for chuting, pumping, and pneumatically conveying concrete shall be of such size and design as to provide a practically continuous flow of concrete at the delivery end.
- c. Aluminum conveying equipment shall not be used.

3. Depositing

- a. Place concrete in continuous horizontal lifts not to exceed 2 feet, and place concrete against bulkheads and keyways at vertical joints.
- b. Maximum free drop of concrete shall be 5 feet, in walls 10 inches or less in thickness, with 1-foot additional drop allowed for each inch of wall thickness over 10 inches, with a maximum drop of 10 feet.

4. Consolidation of Concrete

- a. Consolidate concrete in conformance with ACI 309. Characteristics and application of concrete vibrators shall be as set forth in Table 5.1.4.
- b. Provide an adequate number of vibrators of sufficient capacity to keep up with the maximum rate of concrete placement. Keep on hand adequate standby equipment in good operating condition.
- c. Vibrate concrete only until the concrete is thoroughly consolidated and the voids filled, as evidenced by the leveled appearance of the concrete at the exposed surface and the embedment of the surface aggregate.

- d. Insert internal vibrators vertically to the full depth of the layer being placed and into the previous layer. Do not drag vibrators through the concrete. Insert and withdraw vibrator slowly with the vibrator running continuously so that no hole will be left in the concrete. Do not flow concrete from one location to another by use of a vibrator.
- e. Consolidate concrete layer to full depth when using a surface vibrator. Use thinner layers or a more powerful vibrator if necessary to achieve complete consolidation.
- f. Use form vibrators only where sections are too thin or where sections are inaccessible for internal vibrators.

5. Time Requirements

- a. Place concrete at a sufficient rate to assure that lifts below have not taken initial set before fresh concrete is deposited.
- b. Place concrete within 45 minutes after mixing. This period may be extended to 1 hour and 30 minutes provided that the combined air temperature, relative humidity, and wind velocity are such that the plasticity of the fresh concrete is satisfactory for placement and consolidation, and that the specified mixing water is not exceeded. Concrete, which has partially set, shall not be retempered but shall be discarded.

6. Placing Concrete at Joints

- a. Bed horizontal joints with 1 inch of grout for bonding.
- b. Take precautions to ensure tight, well-bonded construction joints with no air pockets or voids.
- c. Take special precautions to avoid bending or displacing waterstop while placing concrete around it.
- d. Delay construction at a joint a minimum of 16 hours where placement is continued past joint, except where otherwise indicated.

3.3 Finishing

A. Unformed Surfaces

1. Screed Finish

- a. Use as first stage for all concrete finishes.
- b. Use as final finish on surfaces that will be covered by additional concrete, grout placement, or mortar setting bed except as otherwise specified.
- c. Immediately after screeding, use a wood float, darby, or bullfloat to eliminate high and low spots and to embed large aggregate. This shall be done in a manner to produce even, uniform surfaces so that surface irregularities do not exceed 3/8 inch in 10 feet when used as final finish.

2. Floated Finish

- a. Use as second stage of broomed or troweled finish.
- b. Float with mechanical float. Hand floating will be permitted only in areas inaccessible to mechanical float.
- c. On surfaces not to receive troweled finish, finish with wood or cork float after mechanical floating to a true uniform surface so that surface irregularities do not exceed 1/8 inch in 10 feet, except at floor drains.

3. Broomed Finish

- a. Use as final finish on all outdoor concrete surfaces subject to pedestrian and/or vehicle traffic.
- b. After floated finish, draw a stiff bristle broom across the surface making uniform corrugations, perpendicular to the direction of traffic, not more than 1/16 inch deep.

4. Troweled Finish

- a. Use as final finish on all other unformed surfaces not otherwise indicated or specified.
- b. Trowel with steel trowel, mechanical or hand, to obtain a smooth, dense finish. The final troweling shall be done after the concrete has become hard enough so

that no mortar adheres to the edge of trowel and a ringing sound is produced as the trowel passes over the surface.

- c. Do not trowel before surface water has evaporated or has been removed with a squeegee.
- d. Finish to a true uniform surface so that surface irregularities do not exceed 1/8 inch in 10 feet, except at floor drains.
- e. Do not add sand or cement to the floor surface.

B. Formed Surfaces

- 1. Repair surface defects as specified in PART 3, paragraph 3.03.C. - Repair of Defective Surfaces, this Section.

C. Repair of Defective Surfaces

- 1. Defined as any concrete surface showing misalignment, rock pockets, poor joints, holes from ties, voids, honeycomb, or any other defective area.

2. Repairing

- a. Repair as soon as forms have been removed.
- b. Chip surface back to minimum depth of 1/2 inch, chip edges perpendicular to surface, prewet depression and brush with neat cement immediately before patching.
- c. Patch surfaces using stiff mortar with same sand-cement ratio as original concrete and with minimum water for placing. Blend with white cement to match concrete color.
- d. Compact mortar into depressions so that after curing, hole is filled and mortar is flush with surface. Use hammer and ramming rod for compacting the holes.
- e. Moist-cure for 3 days or use curing compound.
- f. Engineer shall be notified of areas containing defects or where reinforcing steel is exposed, prior to determination of repair method.

3.4 Curing

- A.** Cure all concrete by one of the following methods in accordance with ACI 308:
- 1.** Leaving in forms for a minimum of 7 days. Keep formwork wet to prevent drying of concrete surfaces.
 - 2.** Use of saturated bats, soaker hoses, or sprinkler for a minimum of 7 days. Keep concrete continuously wet.
 - 3.** Using one coat of a liquid membrane forming compound conforming to ASTM C309, Type 1. Apply immediately after removal of forms (which have been continuously wet); or in case of a slab, after the concrete has been finished and is hardened sufficiently to walk on.
 - 4.** Using polyethylene sheets applied in full contact with surfaces.
 - 5.** Curing of concrete during hot or cold weather shall conform to PART 3 - HOT WEATHER CONCRETING and COLD WEATHER CONCRETING, this Section.

3.5 Hot Weather Concreting

- A.** Follow the recommendations of ACI 305 if any of the following conditions occur:
- 1.** When the temperature is 90°F or above.
 - 2.** When the temperature is likely to rise above 90°F within the 24-hour period after concrete placement.
 - 3.** When there is any combination of high air temperature, low relative humidity, and wind velocity which would impair either concrete strength or quality.
- B.** Concrete shall have a maximum temperature of 100°F during placement.
- C.** Dampen subgrade and forms with cool water immediately prior to placement of concrete.
- D.** Protect freshly placed concrete immediately after placement so that the rate of evaporation as determined by ACI 305 (Figure 2.1.5) does

not exceed 0.2 pound per square foot per hour.

- E.** Protect concrete with suitable insulation if rapidly decreasing nighttime temperatures occur, which would cause thermal shock to concrete placed during warm daytime temperatures.
- F.** Protect the concrete with temporary wet covering during any appreciable delay between placement and finishing.
- G.** Begin curing unformed surfaces immediately after finishing and continue for 24 hours. Curing shall consist of application and maintenance of water-saturated material to all exposed surfaces; horizontal, vertical, and otherwise. After the 24-hour interval, continue curing using one of the following methods:
 - 1.** Moist curing for 6 days.
 - 2.** Application of one coat of curing compound conforming to ASTM C309, Type 2.
 - 3.** Application and maintenance of curing paper or heat-reflecting plastic sheets for 6 more days.
- H.** Begin curing formed concrete immediately after placing. Curing shall consist of keeping forms continuously wet for 24 hours. Thereafter, continue curing using one of the following methods:
 - 1.** Loosen forms and position soaker hose so that water runs down along concrete surfaces. Continue for 6 days.
 - 2.** Strip forms and apply curing compound conforming to ASTM C309, Type 2. Do not allow concrete surfaces to dry prior to application of curing compound.

3.6 Cold Weather Concreting

- A.** When the temperature is 40°F or is likely to fall below 40°F during the 24-hour period after concrete placement, follow the recommendations of ACI 306 to prevent loss of concrete strength or quality.
- B.** Minimum temperature for concrete as mixed shall be as indicated on lines 2, 3, and 4 of Table 1.4.1 of ACI 306. Maximum temperature for concrete as mixed shall be 10°F greater than the corresponding minimum temperature.
- C.** Place and maintain concrete so that its temperature is never less than

the temperature indicated on line 1 of Table 1.4.1 of ACI 306. Maintain the required temperature for the time duration indicated on Table 1.4.2 of ACI 306.

- D.** Monitor temperature of concrete in place at corners or edges of formwork as applicable.
- E.** Air Heaters
 - 1.** Do not expose concrete to carbon monoxide or carbon dioxide fumes from heaters or engines.
 - 2.** Oil- or coke-burning salamanders will not be permitted.
 - 3.** Heaters shall be ultramatic portable heaters made by the Union Chill Mat Company or approved equal.
 - 4.** Personnel shall be present at all times to maintain safe, continuous operation of heating system.
- F.** Control temperature and humidity of protected concrete so that excessive drying of concrete surfaces does not occur.
- G.** Calcium chloride will not be permitted as a concrete accelerator or to thaw frozen subgrade prior to concrete placement.
- H.** The maximum allowable temperature drop during the first 24-hour period after protection is discontinued shall be as indicated on line 5 of Table 1.4.1 of ACI 306.
- I.** Cure the concrete in accordance with Chapter 5 of ACI 306.

3.7 Low-Strength Concrete

- A.** Low-Strength Concrete
 - 1.** Defined as either
 - a.** Concrete whose average, of any sets of three consecutive 28-day strength tests, is below the required 28-day strength.
 - b.** Concrete whose individual 28-day strength test (average of two cylinders) is more than 500 psi below the required 28-day strength.

2. Should concrete meet either definition of low-strength concrete as a minimum, the Contractor shall take the following steps:
 - a. Increase the cement content. The increase shall be based on a statistical evaluation of the strength data, the design water-cement ratio, compressive-strength curve, and acceptable mix-design literature as follows:
 - (1) If sufficient concrete has been furnished to accumulate 30 tests, these should be used to establish a new target average strength in accordance with ACI 318, Section 4.3.1.
 - (2) If less than 30 tests have been made, the new target average strength should be at least as great as the average strength used in the initial selection of the mix proportions. Increase the target average strength based on a statistical evaluation of the available strength data, the design water-cement ratio, compressive-strength curve, and acceptable mix-design literature. If the statistical average equals or exceeds the initial mix-design level, a further increase in the average level is required.
 - b. Remove and replace with acceptable concrete when the quality and location of the low-strength concrete is such that Engineer considers the strength or durability of the structure is impaired and so orders.
3. Low-strength concrete shall be considered defective Work as defined in DOCUMENT 00700 - GENERAL CONDITIONS.

- B. Potentially Low-Strength Concrete: Defined as concrete whose 7-day test (average of two cylinders) is less than 70% of the specified minimum 28-day compressive strength.
- C. Construction delays caused by low-strength or potentially low-strength concrete shall not relieve Contractor from responsibility for late completion even though extensions of time may be granted.

3.8 Miscellaneous Concrete Items

A. Concrete Seal Coat

1. Apply to the ground surface immediately beneath all "on-

grade" slabs and footings where indicated or specified.

2. Seal coat shall consist of a concrete slab of the thickness indicated.
3. Accurately screed so that the top of the seal coat will not be higher than the bottom elevation of structural slabs or footings to be placed thereon.
4. Do not place seal coat until after all excavating in the area has been completed and all drain lines, conduits, and other items under the area are completed and properly backfilled and compacted.

B. Equipment Bases

1. Construct equipment bases, pads, and foundations as indicated or, when not indicated, conforming to equipment manufacturer's requirements.
2. Reinforce conforming to typical detail unless otherwise indicated.
3. Equipment bases shall include concrete, reinforcing steel, form work as required, and anchor bolts. Place grout for equipment installed under this Contract.
4. Finish top area of bases between anchor bolts and forms with a troweled finish.

3.9 Testing

A. Field Testing of Concrete Plant and Mixing Trucks

1. The concrete plant shall be inspected and tested to ensure conformance with ACI 304 and the "Concrete Plant Standards of the Concrete Plant Manufacturers Bureau." The scales shall be calibrated at the initial setup and at 3-month intervals thereafter.
2. Mixing trucks shall be inspected and tested to ensure conformance with ACI 304 and "Truck Mixer and Agitator Standards of the Truck Mixer Manufacturers Bureau" of the National Ready-Mix Concrete Association. Tests shall be done at initial setup and every 3 months thereafter.

3. Submit test reports when requested.

B. Field Testing of Concrete and Making of Concrete Test Cylinders

1. Contractor shall furnish test equipment, test cylinder molds, and trained personnel to perform all required field tests, make the required concrete test cylinders, and deliver test cylinders to the testing laboratory. The prescribed tests shall be made in the presence of or with the concurrence of the Owner.
2. Concrete sampling for tests and cylinder making shall be done conforming to ASTM C172. Samples shall be taken at random and at the point of truck discharge.
3. **Perform the following tests**
 - a. Moisture content, ASTM C566. Perform this test a minimum of twice a day and adjust the amount of mix water to compensate for the moisture content of the aggregates.
 - b. Prepare test cylinders conforming to ASTM C31, with not less than one set of cylinders (four cylinders) from each day's placement for each 50 cubic yards or fraction thereof. Test cylinders for compressive strength in accordance with ASTM C39.
 - c. Slump test conforming to ASTM C143. Perform tests on the first batch produced each day, for every 50 cubic yards or fraction thereafter, and with every set of test cylinders. Additional tests shall be run when directed by the Engineer.
 - d. Air content test conforming to ASTM C231. Perform for first batch of day and with each set of test cylinders.
 - e. The batch of concrete being tested for slump or air content shall not be placed until acceptable results are obtained.
 - f. Discard concrete used for slump and air tests.
 - g. Perform concrete and air temperature tests for first batch of day and with each set of test cylinders.

Additional readings shall be taken when directed by the Engineer.

- h. Any batch of concrete with slump or air content not in conformance with Specifications shall be rejected.
- i. Furnish slump, air content, and temperature test results to the testing laboratory for inclusion in the cylinder test reports.

C. Laboratory Testing of Aggregates and Concrete During Construction

- 1. An independent testing laboratory will be selected and paid by the Owner to perform the required laboratory tests and statistical evaluations of concrete being used in the Work.
- 2. Laboratory will sample, cure and test concrete cylinders in accordance with ASTM C31, C192 and C39, testing two cylinders at 7 days of age and two at 28 days of age.
- 3. Contractor shall have the right to observe all phases of concrete cylinder curing and testing. Should Contractor observe any deviations from the prescribed testing procedures that he considers detrimental to concrete strength test results, he shall immediately notify Owner in writing.
- 4. Contractor shall assist laboratory in obtaining Samples of fine and coarse aggregate for periodic testing.
- 5. The Contractor shall make arrangements with the testing laboratory to receive copies of test reports. The cost of providing a maximum of two copies of each report to the Contractor will be paid by the Owner.
- 6. Should the test results indicate low strength concrete as defined in PART 3, paragraph 3.07 - LOW-STRENGTH CONCRETE, this Section, Contractor shall take immediate corrective action.
- 7. Should the statistical data indicate an excessive margin of safety, the concrete mix may be modified subject to Engineer's approval.
- 8. Should the material tests taken during construction indicate nonconformance with the Specifications, the Contractor shall

take immediate corrective action.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

- A. No measurement will be made for this item.

4.2 Payment

- A. Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

** END OF SECTION 03300 **

SECTION 03310

CONCRETE CURB, GUTTER, SIDEWALK AND DRIVEWAYS

PART 1 - GENERAL

1.1 Summary

A. Description of Work

The work to be performed in accordance with this section includes the furnishing and placement of Portland cement concrete curb, gutter, sidewalk and driveways.

The work shall include the furnishing of all labor, tools, equipment, materials and performing all required operations to provide a complete item in accordance with the project plans and specifications.

B. Related Work Specified Elsewhere

Aggregate Base Course	Section 02610
Concrete Formwork.....	Section 03100
Concrete Reinforcement	Section 03200
Concrete	Section 03300

1.2 Quality Assurance

Provide all laboratory and field testing of material and workmanship in accordance with Specification Section 3300, Concrete.

A. Applicable Test Standards and Specifications

1. American Society for Testing and Materials (ASTM)

ASTM D-1751, Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction.

B. Tolerances

1. Sidewalk

Test the surface of concrete sidewalk with a 5-foot straightedge. Correct any deviation in excess of 1/8-inch at no additional cost to the Owner.

2. Water Test

Water test gutters having a slope of 0.8 foot per hundred feet or less, or where unusual or special conditions cast doubt on the capability of the gutters to drain. Establish flow in the length of gutter to be tested by supplying water from a hydrant, tank truck or other source. One hour after the supply of water is shut off, inspect the gutter for evidence of ponding or improper shape. In event water is found ponded in the gutter to a depth greater than 1/2-inch, or on the adjacent asphalt pavement, the defect or defects shall be corrected in a manner acceptable to the Owner at no additional cost.

PART 2 - MATERIALS

2.1 Portland Cement Concrete

Provide concrete conforming to Specification Section 3300, Concrete Structures unless indicated otherwise.

2.2 Preformed Joint Filler

According to ASTM D 1751.

PART 3 - EXECUTION

3.1 Matching Existing Concrete

Sawcut and remove existing concrete to the lines indicated on the plan in accordance with Specification Section 2110, Removal of Existing Improvements. Sawcut, remove and replace sections damaged by construction in accordance with these specifications.

3.2 Base Preparation

According to Section 2610, Aggregate Base Course.

3.3 Form Work

Unless otherwise approved, use conventional forms to construct concrete curb, gutter, sidewalk and drives. Secure formwork to line and grade. Thoroughly clean forms before each use and apply a light coat of release agent, which will not discolor the concrete.

Do not remove front face form before the concrete has taken the initial set and has sufficient strength to carry its own weight. Do not remove gutter forms or rear forms until concrete has reached sufficient strength to prevent damage. Sawcut, remove and replace damaged sections.

3.4 Machine Formed

Machines shall be designed specifically for such work and approved by the Owner. Machines shall be capable of producing results equal to or better than that produced with forms. If the results are not satisfactory to the Owner, discontinue the use of the machine and make necessary repairs no additional cost to the Owner. All applicable requirements of construction with forms shall apply to the use of machines.

3.5 Densification

Thoroughly spade concrete away from the forms so there will be no rock pockets next to the forms. The concrete may be compacted by mechanical vibrators approved by the Owner. Tamp or vibrate the concrete until the mortar rises to the surface and the coarse aggregate is not exposed.

3.6 Finish

Finish all concrete surfaces smooth, straight and defect free. Provide a light broom finish as approved by Owner on all surfaces.

3.7 Concrete Curing

Concrete curing shall be required according to the MAG Standard Specifications, Section 726. No diesel fuel is to be used.

3.8 Joints

A. Expansion Joints

Construct expansion joints in a straight line and vertical plane perpendicular to the longitudinal of the sidewalk or curb and gutter, except in cases of curved alignment, when joints will be constructed along the radial lines of the curve. Construct to the full depth and width of the concrete. Match the joints in the adjacent pavement sidewalk or curb and gutter. Joints shall be constructed at all radius points, driveways, alley entrances, adjoining structures, and at a maximum interval of 100 feet between joints.

B. Contraction Joints

Construct in a straight line and vertical plane perpendicular to the longitudinal line of the sidewalk or curb and gutter, except in cases of curved alignment when joints will be constructed along the radical lines of the curb. Construct to a depth of 1-inch and at 10-foot intervals on sidewalk widths of 5 feet and 12-foot intervals on sidewalks of 4-foot and 6-foot widths.

C. Edges

Shape with a suitable tool so formed as to round the edges to the radius indicated.

3.9 Sidewalks

Sidewalks shall have a cross-slope of 1/4-inch per foot or as indicated on the Plans.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement

A. Curb With And Without Gutter

Curb and gutter will be measured in linear feet, to the nearest one linear foot, along the gutter flow line horizontally from end of curb to end of curb, including the street frontage of driveways, sidewalk ramps, and all curb returns. The measurement shall be per plan dimensions.

B. Sidewalk

Sidewalk will be measured in square feet, to the nearest one square foot, along the sidewalk centerline horizontally, from end of sidewalk to end of sidewalk. Sidewalk ramps will be included in the sidewalk quantity. Driveways will not be included in the sidewalk quantity. The measurement shall be per plan dimensions.

C. Residential and Commercial Driveways

Residential and commercial driveways will be measured in square feet, to the nearest one square foot, horizontally from edge of driveway to edge of driveway and back of curb to the end of the driveway. The measurement shall be per plan dimensions.

D. Valley Gutter

Valley gutter will be measured in linear feet, to the nearest one linear foot, horizontally along the longest flow line of valley gutter, parallel to the street, from end of curb return to end of curb return. The curb and gutter around the curb returns shall not be considered as a portion of the valley gutter. The measurement shall be per plan dimension.

4.2 Payment

If no item is listed in the bid tab or the measurement and payment section, this item is to be considered incidental.

Payment for concrete curb with and without gutter, valley gutter, sidewalk, residential driveways and commercial driveways will be made at the full contract price per linear foot, square foot or per each. Payment shall include, but not be limited to subgrade preparation, base preparation, base course, form materials and placement of steel and concrete materials.

See Section 00310 Bid Schedule for Bid Items.

**** END OF SECTION 03310 ****

SECTION 03320

PORTLAND CEMENT CONCRETE STREET PAVEMENT

PART 1 - GENERAL

1.1 Description

A. Description of Work

The work to be performed in accordance with this section includes furnishing and installing Portland cement concrete street pavement on a prepared subgrade.

The work shall include the furnishing of all labor, tools, equipment, materials and performing all required operations to provide a complete item in accordance with the project plans and these specifications.

B. Related Work Specified Elsewhere

Subgrade preparation.....Section 02600
Concrete structures.....Section 03300

1.2 Quality Assurance

A. Reference test standards and specifications

ASTM C42, Obtaining And Testing Drilled Cores And Sawed Beams of Concrete.

ASTM D3406, Specification For Joint Sealant, Hot-Poured, Elastomeric - Type, For Portland Cement Concrete Pavement.

ASTM D1751, Specification For Performed Expansion Joint Fillers For Concrete Paving And Structural Construction.

B. Frequency of Testing

1. Consistency

Air content and compressive strength to be tested per the test methods and at the frequencies as specified in Section 3300,

Concrete Structures.

2. Thickness

ASTM C42. Determine the thickness of the hardened concrete pavement by drilled cores. Obtain one core per 1000 linear feet of pavement or one days production, whichever is less. Additional cores may be required to define deficient area.

C. Tolerances

1. Consistency

The measured slump shall not exceed the design slump by more or less than one inch. In no case shall the slump exceed 4-inches.

2. Air Content

The measured air content shall not be less than 4 nor more than 6 percent when tested in accordance with ASTM C231.

3. Compressive Strength

Concrete represented by a strength test of at least 95% of the required 28-day compressive strength will be acceptable. All concrete failing to meet this requirement as evidenced by test of either standard cylinder or drilled core specimens shall be rejected, removed and replaced at the **CONTRACTOR'S** expense. Concrete Strength tests between 95 percent and 100 percent of the 28-day requirement will be paid at a reduced cost.

4. Tolerances for Formed Surfaces

ACI 301, Table 4.3.1.

5. Tolerance for Slab on Grade

a. Surface Smoothness

Slabs shall be true planes within 1/4 inch in 10 feet as determined by a 10 foot straight-edge placed anywhere

on the slab in any direction.

- i. Grind down areas higher than 1/4 inch but not more than 1/2 inch above the correct surface.
- ii. Correct areas lower than 1/4 inch but not lower than 1/2 inch below the correct surface by grinding down the adjacent areas.
- iii. Break out and replace pavement when the deviation exceeds 1/2 inch from the correct surface. The area replace shall be of a length, width and depth as required to allow formation or a new slab of the required quality.

b. Thickness

If the slab thickness is not deficient by more than 1/4 inch the pavement shall be accepted and paid for in full.

If the slab thickness is deficient by more than 1/4 inch and less than or equal to 1/2 inch it shall be accepted and paid for at a reduced rate. Slabs deficient by more than 1/2 inch shall be rejected and removed and replaced at no additional cost to the **OWNER**.

1.3 Submittals

A. Certificates of Compliance

1. Admixtures
2. Cement
3. Fly Ash
4. Pozzolan
5. Water Stop
6. Reinforcing Steel
7. Fiber Reinforcement

B. Materials Test Reports

1. Coarse Aggregates
2. Fine Aggregates

C. Mix Designs

1. ACI 211 normal weight concrete, including for variations for admixtures. Include compressive strength test data and modulus of rupture test data obtained at the same concrete age which establishes a correlation between the flexural and compressive strength properties of concrete. Establish correlation with statistical procedures outlined by ACI.

PART 2 - MATERIALS

2.1 Portland Cement Concrete

A. Strength

Provide concrete that will develop a modulus of rupture of not less than 250 psi within 14 days and 650 psi at 28 days age as determined by ASTM C78.

B. Slump

Provide concrete with the minimum required slump to adequately place, densify and finish. Do not exceed the mix design water cement ratio (W/C) or design slump.

2.2 Cement

ASTM C150, Type V.

2.3 Water

Use clear water free from objectionable quantities of organic matter, alkali, acids, oil, silt and other deleterious substances. Water for prestressed concrete shall not contain chlorides calculated as sodium chloride in excess of 1,000 parts per million nor any sulphates calculated as sulphate in excess of 1,000 parts per million. Water shall not contain an amount of impurities that will cause a change in the time of setting of Portland cement of more

than 25 percent nor a reduction in the compressive strength of Portland cement mortar or more than 5 percent when compared to results obtained with distilled water.

2.4 Aggregate

A. Coarse Aggregate

ASTM C33, Class Designation M, grading size number 57, non-alkali reactive.

B. Fine Aggregate

ASTM C33, non-alkali reactive.

1. Sand equivalent

ASTM D2419, not less than 75.

2.5 Admixtures

A. Air Entraining Agent

ASTM C260.

B. Accelerating Agents

ASTM D98.

C. Water Reducing Agents

ASTM C494, Type A, D, or E.

D. Fly Ash and Pozzolan

ASTM C6618, Class N or F. Pozzolan may be used to replace up to 15 percent of the weight of the required Portland cement. The replacement ratio shall be 1.2 pounds of Pozzolan per pound of Portland cement.

2.6 Concrete Curing

Liquid membrane curing, ACI 308, ASTM C309. Liquid membrane curing compound for concrete exposed to vehicular traffic, Type 2.

2.7 Steel Reinforcement

ASTM A615, Grade 60, unless otherwise specified, and deformations to ASTM A615, A616 or A617 as applicable. All bars shall be round and deformed. Welded wire fabric or mesh shall conform to the requirements of ASTM A185.

2.8 Chairs and Spacers

Provide chairs and spacers manufactured specifically for use with concrete pavements.

2.9 Stationary Side Forms

Provide side form sections straight, free from warps, bends, indentations or other defects. Side forms shall be of metal, have a base width of at least four inches and a minimum depth equal to the thickness of the pavement. No section shall show a variation from a true plane greater than 1/8 inch in ten feet on the top of the form or more than 1/4 inch in ten feet on the inside face. Flexible or curved forms of proper radius shall be used for curves of 100 feet radius or less. Suitable materials other than metal may be used to form end closures or at other locations where use of metal forms is not practical when approved by the **OWNER**. Forms shall be thoroughly cleaned and oiled each time they are used.

2.10 Joint Sealant

ASTM D3406.

2.11 Backer Rod

Specifically made for use in joints to control the depth or sealant, achieve the desired shape factor, support sealant against indentation and sag and to prevent bond of the sealant to the bottom concrete surface.

2.12 Joint Filler

ASTM D1751.

PART 3 - EXECUTION

3.1 Inspection of the Work

Verify that all preliminary work has been performed in accordance with these specifications.

3.2 General

Construct Portland cement concrete pavement with mechanical equipment utilizing stationary side forms or by the use of slipform paving equipment without stationary side forms. Manual methods of placing and finishing concrete with stationary side forms may be permitted by the **OWNER**.

3.3 Equipment

Equipment used to place concrete may consist of one or more machines, shall be capable of uniformly distributing and consolidating the concrete as it is placed without segregation and shall be capable of producing concrete pavement which will conform to the required cross-section with a minimum of hand work. Furnish adequate number and capacity of machines to perform the work required at a rate equal to the concrete delivery rate.

Use vibrators to consolidate concrete. The rate of vibration shall not be less than 3,500 cycles per minute for surface vibrators and not less than 8,000 cycles per minute for internal vibrators. Connect power to vibrators mounted on mechanical equipment so that vibration ceases when forward or backward motion of the machine is stopped. Furnish a tachometer or other suitable device for measuring and indicating the frequency of vibration.

Equip slipform pavers with high frequency internal vibrators mounted with axes either parallel or normal to pavement alignment for the full paving width. Space vibrators mounted with axes parallel with pavement alignment at intervals not to exceed 24 inches, measured center-to-center. Vibrators mounted with axes normal to pavement alignment shall be spaced so that lateral clearance between individual vibrating units does not exceed 6 inches.

Equip slipform paving equipment which will be wholly or partially supported on subgrade with traveling side forms of sufficient dimensions, shape and strength to support the concrete at free edges laterally for a sufficient length of time during placement to produce pavement of the required cross-section.

Equip and operate equipment with automatic sensing and control devices such that the machine automatically senses deviations from the established

guideline and performs the necessary corrective maneuvers to overcome variations from correct grade and alignment.

3.4 Subgrade Preparation and Base Course

Specification Section 2600 and 2610. Uniformly moisten surface to receive concrete.

3.5 Placing, Spreading and Compacting

Deposit concrete on the subgrade and spread full width using mechanical methods that result in a minimum of handling and segregation. Necessary hand spreading shall be done with shovels, not rakes. Placement shall be continuous between transverse joints between transverse joints without the use of intermediate bulkheads.

Make adequate advance arrangements for preventing delay in delivery and placing of concrete. An interval of more than 15 minutes between placing of any two consecutive batches shall constitute cause for stopping operations, and the **CONTRACTOR** shall install a construction joint in the concrete already placed at the location and of the type directed by the **OWNER**.

Deposit concrete as near to expansion and construction joints as possible without disturbing them. Thoroughly consolidate concrete against and along the faces of all forms, adjacent pavement or curb and gutter, and on both side of all joint assemblies. Vibrators shall not be permitted to come in contact with joint assemblies, the grade, or side forms, and shall not be operated longer than 15 seconds in any one location.

Manual methods of placing, spreading, and impacting may be used in the construction of pavement lanes of irregular width or widths less than 10 feet, and sections of intersections or other locations with complex variable surface configurations when permitted by the **OWNER**. Workmen shall not be allowed to walk in the freshly placed concrete with boots or shoes coated with earth or other foreign substances.

3.6 Shaping and Initial Finishing

Strike off, consolidate, and float-finished concrete with a slipform paver, mechanical finishing machine, vibrating screed, or by hand finishing methods when approved by the **OWNER** so that the completed pavement will conform to the thickness and cross-section requirements of the plans and specifications. When the pavement being constructed is contiguous to

existing parallel concrete pavement or curb and gutter, the elevation of the new pavement surface shall conform as closely as possible to the elevation of the existing pavement or gutter surface and in a manner which will prevent ponding.

Do not apply water to the pavement surface during screeding and finishing operations in excess of the amount lost by evaporation. Adding water to the surface of the concrete to assist in furnishing operations shall not be permitted. When applications of water to the surface are required to prevent rapid evaporation of water from the surface during finishing operations, it shall be applied as a fog spray and with approved spray equipment.

A. Slipform Supported on Subgrade Method

The equipment shall spread, consolidate, screed and float-finish the concrete in one complete pass of the machine. The machine shall be operated with as nearly a continuous forward movement as possible and all paving operations shall be so coordinated as to provide uniform progress with stopping and starting of the paver held to a minimum. Sliding side forms shall be rigidly held together to prevent spreading. Any edge slump of the pavement, exclusive of edge rounding in excess of 1/4 inch shall be corrected.

No abrupt changes in longitudinal alignment of the pavement will be permitted. The horizontal deviation shall not exceed 1 inch from the alignment established by the **OWNER**.

While concrete is being spaced, compacted and shaped, vibrating units shall be operated within fresh concrete so that the longitudinal axis, at the center of each unit, is not more than 6 inches above the top of the subgrade. Amplitude of vibration shall be sufficient to be perceptible on the surface of concrete along the entire length of vibrating units and for a distance of at least one foot therefrom.

B. Mechanical Equipment Supported on Fixed Form Method

When concrete is spread without the use of internal vibration, the finishing machine shall be equipped with vibrating equipment that will internally vibrate the concrete for the full paving width and with not less than two oscillating or reciprocating screeds. Concrete shall be struck off and consolidated so that the surface will conform to the finished grade and cross-section shown on the project plans and with sufficient material on the surface for floating operations.

After the concrete has been struck off and consolidated, it shall be floated with a longitudinal float of a type approved by the **OWNER**.

A slipform paver or a single machine which will effectively spread, consolidate, screed, and float in one operation may be used in lieu of separate finishing and floating equipment.

C. Manual Methods with Fixed Forms

Concrete shall be deposited, spread and struck off to such an elevation that, when properly consolidated, the surface will conform to the required lines and grades. Concrete shall be consolidated by internal vibration as it is struck off with a screed. A slight excess of concrete shall be kept in front of the screed at all times during the strike-off operation.

Pavement shall be finished smooth and true to grade with suitable manually operated floats or powered finishing equipment.

3.7 Final Finishing

After the pavement has been float finished, it shall be scraped with a 10-foot long straightedge equipped with a handle to permit operation from the edge of the pavement, and excess water and laitance shall be removed from the surface. The straightedge shall be operated parallel to the centerline of the pavement and shall be moved forward one-half length after each pass. Irregularities shall be corrected by adding or removing concrete, and disturbed places shall be again straight-edged. Long-handled wood floats shall be used only in areas not accessible to finishing equipment and in emergencies, and use of such floats shall be confined to a minimum.

The addition of water to the surface of the concrete to assist in finishing operations shall not be permitted unless approved by the **OWNER**. When addition of the water to the surface is permitted to prevent rapid evaporation of water from the surface during finish, it shall be applied as a fog spray with approved spray equipment.

Pavement edges and joints shall be edged in accordance with the details shown on the project plans or as directed by the **OWNER**.

In advance of curing operations, pavement shall be given a texturing.

Texturing shall be performed with an artificial turf drag with a board added to assure the weight needed to obtain an approved surface. Artificial turf shall be a molded composite structure with polyethylene face, nylon and polyester backing, a pile height of 0.85 inches, and total weight of 75 oz./sq. yd. The approved surface will be made by the **OWNER** on the initial construction and shall not be changed without approval. Each time the construction is stopped or causes the texturing to stop, the artificial turf must be shaken clean before continuing.

3.8 Curing

Curing shall begin immediately following surface texturing and edging. **CONTRACTOR** shall have at hand and ready to install before concrete placement begins the materials and equipment needed for adequate curing.

After finishing operations have been completed, the newly placed concrete shall be cured by moist curing methods, by application of a white liquid membrane compound, or by a combination of these methods. All surfaces not covered by reasonably waterproof forms shall be kept damp by applying water with a nozzle that so atomizes the flow of water that a fog mist and not a spray is formed until the surface is covered with liquid membrane compound, the surface has hardened sufficiently to permit sprinkling of the surface, or moist curing by covering with wet burlap or other approved materials can be initiated. Moisture from the nozzle shall not be applied under pressure directly upon the concrete and shall not be allowed to accumulate on the concrete in a quantity sufficient to cause a flow and erode the surface. Moist curing shall be continued until liquid membrane curing compound or other type of curing membrane is applied.

Membrane curing compound shall be applied to all pavement by automatic mechanical method from a construction bridge.

The edges of concrete slabs exposed by the removal of forms shall be protected immediately to provide these exposed surfaces with continuous curing treatment equal to the method selected for curing the pavement surface.

The membrane method of curing may be applied behind the final finishing operation after all free water has disappeared from the surface. Complete and uniform coverage at the rate of one gallon per 100 square feet, or as otherwise recommended by the manufacturer, shall be required. Compound shall be kept agitated to prevent pigment from settling.

3.9 Joints

A. General

Provide joints in the pavement of the type, dimensions and at the locations as indicated in the plans or as specified herein.

The faces of all joints shall be perpendicular to the pavement surface. Joints shall be constructed in accordance with the details shown in the plans and in accordance with the following provisions.

At all times prior to acceptance of the construction, joints shall be maintained clean and free of all soil, gravel, and other foreign material except approved typed of joint filler materials.

B. Longitudinal Joints

Longitudinal joints shall be weakened plane or construction joints. Longitudinal weakened plane joints shall be constructed with keyways as indicated in the plans.

C. Transverse Joints

Transverse joints shall be weakened plane, construction or expansion joints. All transverse weakened plane joints will be constructed by sawing and in accordance with the details shown in the project plans.

Transverse construction joints shall be constructed with keyways and in accordance with the details shown in the project plans. Transverse expansion joints shall be constructed as butt joints with vertical expansion joint filler and with or without dowel bars in accordance with the details shown in the project plans. Dowel bars shall be supported on a basket-type system with a base plate on a subgrade and up the side form to prevent material from entering dowel openings.

D. Joint Location

Longitudinal joints shall be constructed between traffic lanes and at other locations as indicated in the project plans.

Transverse construction joints shall be constructed at the end of a day's production or when placing of concrete is discontinued for more than 45 minutes.

Transverse weakened plane joints in concrete placed in lanes adjacent to previously placed concrete shall be located to align with weakened plane joints in the adjacent lanes. No transverse weakened plane joint shall be constructed within 6 feet of another transverse joint. When the planned spacing of transverse weakened plane joints results in location of a weakened plane joint within 6 feet of another transverse joint, the transverse weakened plane joint shall be relocated so it is not within 6 feet of said transverse joint.

Provide isolation joints around manholes, catch basins, or other elements which extend into or project through the pavement and act as points of restraint to horizontal or vertical movement of the pavement.

3.10 Construction of Joints

A. Sawed Joints

Sawed joints shall be constructed by cutting a groove in the pavement using a single or multiple-blade power saw. The groove shall be cut to the dimensions shown on the project plans. Suitable guidelines or devices shall be used to assure joints are cut true to the lines as shown on the project plans.

If joints are sawed in stages, the initial saw cut shall be of the minimum width specified and sawed to the required depth shown on the project plans. The depth of the initial saw cut in the construction of weakened plane joints shall be a minimum of 1/4 of the slab thickness.

Sawing of weakened plane joints shall be done before uncontrolled cracking takes place, and after the concrete has hardened to the extent that tearing or raveling of the edges of the saw cut is not excessive. The exact time for all sawing shall be determined by the **CONTRACTOR**.

Any procedure for sawing joints that results in premature, uncontrolled cracking shall be revised immediately. The **CONTRACTOR** shall be responsible for replacing or repairing areas containing uncontrolled cracking and for repairing spilled or chipped concrete along the edges of sawed joints as directed and to the satisfaction of the **OWNER**.

After sawcutting of the joint and just prior to sealing the joint, the internal joint surfaces shall be cleaned of all dirt, curing compound residue, laitance and other foreign materials. The internal joint surface shall be defined as the sawed portion of the joint and resultant crack for the full depth of the pavement.

B. Sealing of Joints

Complete sealing prior to the opening of the pavement to traffic unless otherwise approved by the **OWNER**. When delayed sealing of sawed joints is permitted, saw cuts and formed recess to be filled with sealant shall be protected to ensure thorough curing of the concrete along the edges of the joint recesses and to prevent entry of foreign materials into the joint. At the **CONTRACTOR'S** option, inert compressible joint filler material such as plastic backer rod may be inserted into joints immediately after sawing or forming of the joint recess to provide curing protection and prevent entry of foreign material.

Apply sealant in accordance with the sealant manufacturer's recommendations. Furnish and apply a primer after the joint has been cleaned and prepared to receive sealant if so indicated in the manufacturer's recommendations.

Prior to the application of the sealant, an approved type of inert, compressible joint filler material such as plastic rod or an approved type of bond breaker, shall be inserted along the joint in accordance with the details shown on the project plans. Fill the joint with sealant to a level not less than 1/8 inch or more than 1/4 inch below the elevation of the pavement surface adjacent to the joint edge.

Apply sealant with the equipment as recommended by the sealant manufacturer. Sealant shall not be spilled on the surface of the concrete pavement. Remove any sealant inadvertently spilled on the pavement surface.

3.11 Repair of Cracks, Spills, Raveling and Tearing

CONTRACTOR shall be responsible for replacing or repairing all areas of pavement containing uncontrolled cracking, surface spills, or other types of surface defects as directed by the **OWNER**. Repairs shall be made by methods acceptable to the **OWNER** and the repair shall be completed to the satisfaction of the **OWNER**.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement

Measurement for Portland cement concrete pavement will be the number of square yards in-place and accepted by the **OWNER**. The quantity shall be based on plan dimensions.

4.2 Payment

Payment for Portland cement concrete pavement will be made at the contract unit price per bid per square yard. The unit price shall be full compensation for furnishing all materials, for all preparation, mixing, testing and placing of these materials, and for all labor, equipment, tools and incidentals necessary to complete this item.

- A.** When concrete is accepted on the basis of strength of less than 100% of the required minimum 28-day compressive strength, an adjustment in the contract unit price will be made for the quantity of concrete represented by such strength test in accordance with the following schedule:

Adjustment in Contract Unit Price for Strength Deficiency

Percent of Specified Minimum 28-day Compressive Strength tained (Nearest 1%)	Percent of Concrete Unit Price Allowed
100% or greater	100
98-99	90
96-97	85
95	80

See Section 00310 Bid Schedule for Bid Items.

****END OF SECTION****

SECTION 04200

MASONRY

PART 1 – GENERAL

1.1 Summary

A. This Section includes the following:

1. Concrete unit masonry.
2. Reinforced unit masonry.

1.2 Quality Assurance

A. Reference Standards and Specifications

1. American Concrete Institute (ACI)

ACI 315 – Details and Detailing of Concrete Reinforcement.

ACI 530.1-05 – Specification for Masonry Structures.

2. American Society for Testing and Materials (ASTM)

ASTM A153 – Zinc Coating (Hot-Dip) on Iron and Steel Hardware.

ASTM A185 – Steel Welded Wire, Fabric, Plain, for Concrete Reinforcement.

ASTM A496 – Steel Wire, Deformed, for Concrete Reinforcement.

ASTM A615/A615M – Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.

ASTM C90 – Load-Bearing Concrete Masonry Units.

ASTM C91 – Masonry Cement.

ASTM C140 – Method of Sampling and Testing Concrete Masonry Units.

ASTM C144 – Aggregate for Masonry Mortar.

ASTM C150 – Portland Cement.

ASTM C207 – Hydrated Lime for Masonry Purposes.

ASTM C270 – Mortar for Unit Masonry.

ASTM C404 – Aggregates for Masonry Grout.

ASTM C476 – Grout for Masonry.

ASTM C494 – Chemical Admixtures for Concrete.

ASTM C780 – Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry.

ASTM C1019 – Method of Sampling and Testing Grout.

ASTM C1093 – Practice for the Accreditation of Testing Agencies for Unit Masonry.

3. Brick Institute of America (BIA)

M1 – Specifications for Portland Cement-Lime Mortar for Brick Masonry.

Technical Note No. 1 – Cold Weather Masonry Construction – Introduction.

4. International Conference of Building Officials

U.B.C. Standard No. 21-15 – Mortar for Unit Masonry and Reinforced masonry other than Gypsum.

5. National Concrete Masonry Association (NCMA)

TEK 8-2 – Removal of Stains from Concrete Masonry Walls.

B. Testing Agency Qualifications: To qualify for acceptance, an independent testing agency must demonstrate to Engineer/Architect's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM C1093, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.

C. Preconstruction Testing: Employ and pay a qualified independent testing agency to perform the following preconstruction testing to establish compliance of proposed materials and construction with specified requirements:

1. **Concrete Masonry Unit Test:** For each different concrete masonry unit indicated, test units for strength, absorption, and moisture content per ASTM C140.
 2. **Prism Test:** For each type of wall construction indicated, test masonry prisms per ASTM E447, Method B.
 3. Test mortar properties per test methods of ASTM C270.
 4. Evaluate mortar composition and properties per ASTM C780.
 5. Test grout compressive strength per ASTM C1019.
- D. Single-Source Responsibility for Masonry Units:** Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from one source and by a single manufacturer for each different product required.
- E. Single-Source Responsibility for Mortar Materials:** Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from one manufacturer for each cementitious component and from one source or producer for each aggregate.
- F. Mockup:** Prior to installing unit masonry, construct a sample wall panel to verify selections made under sample submittals and to demonstrate aesthetic effects of materials and execution. Build mockup to comply with the following requirements, using materials indicated for final unit of Work.
1. Locate mockup on site as directed by Engineer/Architect.
 2. Build mockup for the following type of masonry in sizes approximately 48 inches long by 48 inches high by full thickness, including face and backup wythes as well as accessories. Include a sealant-filled joint at least 16 inches long in each mockup.
 - a. Typical exterior CMU wall through-wall flashing installed for a 24 inch length in corner of mockup approximately 16 inches with an 8 inch length of flashing left exposed to view (omit masonry above half of flashing).
 3. Clean exposed faces of mockup with masonry cleaner indicated.
 4. Notify Engineer/Architect on week in advance of the date and time when mockup will be constructed.

5. Protect accepted mockup from the elements with weather-resistant membrane.
 6. Retain and maintain mockup during construction in an undisturbed condition as a standard for judging the completed Work.
 - a. Acceptance of mockup is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints, aesthetic qualities of workmanship; and other material and construction qualities specifically approved by Engineer/Architect in writing.
 - b. Acceptance of mockup does not constitute approval of deviations from the contract Documents contained in mockup unless such deviations are specifically approved by Engineer/Architect in writing.
 - c. When directed, demolish and remove mockup from Project site.
- G. Preinstall Conference:** Conduct conference at Project site to comply with requirements of Section 01320.

1.3 Submittals

- A. Submit as specified in Section 01330.
- B. Product data for each different masonry unit, accessory, and other manufactured product specified.
- C. Shop drawings for reinforcing detailing fabrication, bending, and placement of unit Masonry reinforcing bars. Comply with ACI 315 showing bar schedules, stirrup spacing, Diagrams of bent bars, and arrangement of masonry reinforcement.
- D. **Samples for initial selection of the following:**
 1. Unit masonry samples of split-faced CMU in full or small-scale form showing the full range of colors and textures available.
- E. Material certificates for the following, signed by manufacturer and Contractor, certifying that each material complies with requirements.
 1. Each different cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of delivery.

2. Each material and grade indicated for reinforcing bars.
 3. Each type and size of joint reinforcement.
 4. Each type and size of anchors, ties, and metal accessories.
- F. Material test reports from a qualified independent testing agency, employed and paid by Contractor or manufacturer, indicating and interpreting test results relative to compliance of the following proposed masonry materials with requirements indicated:
1. Mortar complying with property requirements of ASTM C270.
 2. Grout mixes. Include description of type and proportions of grout ingredients.
 3. Masonry units.
- G. Qualification data for firms and persons specified in the "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed project names and addresses, names and addresses of architects/engineers and owners, and other information specified.

1.4 Performance Requirements

- A. Provide unit masonry that develops the following installed compressive strengths (*f_m*) at 28 days.
1. **For Concrete Unit Masonry:** As follows, based on net area:
 - a. $f_m = 1800$ psi.

1.5 Delivery, Storage, and Handling

- A. Deliver all materials to site in a dry condition.
- B. Store masonry units on elevated platforms, under cover, and in a dry location to prevent their deterioration or damage due to moisture, temperature changes, contaminants, corrosion, and other causes. If units become wet, do not install until they are in an air-dried condition.
- C. Store cementitious materials on elevated platforms, under cover, and in a dry location.
- D. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.6 Project Conditions

- A. **Protection of Masonry:** During erection, cover tops of walls, projections, and sills with waterproof, non-staining sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 - 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
 - 2. Protect completed works from mortar drippings using non-staining coverings.
- B. Do not apply loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or pilasters.
- C. **Stain Prevention:** Prevent grout, mortar, and soil from staining the face of masonry to be left exposed. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and mortar droppings.
 - 2. Protect flat areas under voids in wall from mortar droppings.
 - 3. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt on completed masonry.
- D. **Cold-Weather Requirements:** Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen subgrade or setting beds. Remove and replace unit masonry damaged by frost or freezing conditions. Comply with the following requirements:
 - 1. **Cold-Weather Construction:** When the ambient temperature is within the limits indicated, use the following procedures:
 - a. **40°F to 32°F:** Heat mixing water or sand to produce mortar temperatures 40 and 120°F.
 - b. **32°F to 25°F:** Heat mixing water and sand to produce mortar temperatures between 40 and 120°F. Heat grout

materials to produce grout temperatures between 40 and 120°F. Maintain mortar and grout above freezing until used in masonry.

- c. **25°F to 20°F:** Heat mixing water and sand to produce mortar temperatures between 40 and 120°F. Heat grout materials to produce grout temperatures between 40 and 120°F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40°F if grouting. Use heat on both sides of walls.
- d. **20°F and Below:** Heat mixing water and sand to produce mortar temperatures between 40 and 120°F. Heat grout materials to produce grout temperatures between 40 and 120°F. Maintain mortar and grout above freezing until used in masonry. Heat masonry units to 40°F. Provide enclosures and use heat on both sides of walls to maintain temperatures above 32°F within the enclosures.

2. **Cold-Weather Protection:** When the mean daily temperature is within the limits indicated, provide the following protection:

- a. **40°F to 25°F:** Cover masonry with a weather-resistant membrane for 48 hours after construction.
- b. **25°F to 20°F:** Cover masonry with insulating blankets or provide enclosure and heat for 48 hours after construction to prevent freezing. Install wind breakers when wind velocity exceeds 15 mi./h.
- c. **20°F and Below:** Provide enclosure and heat to maintain temperatures above 32°F within the enclosure for 48 hours after construction.

3. **Cold-Weather Cleaning:** Use liquid cleaning methods only when air temperature is 40°F and above and will remain so until masonry has dried out, but not less than 7 days after completion of cleaning.

E. **Hot-Weather Requirements:** Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Provide artificial shade and wind breaks and use cooled materials as required. Use waterproof, non-staining coverings. Do not apply mortar to substrates with temperatures of 100°F and above.

PART 2 – MATERIALS

2.1 Manufacturers

- A. Manufacturers:** Subject to compliance with requirements, provide Products by one of the following:
- 1. Concrete Masonry Units**
 - a. A Block Co., Inc.
 - b. Manufacturers within project area.
 - 2. Portland Cement, Mortar Cement, Masonry Cement, and Lime**
 - a. Glen-Gery Corporation.
 - b. Lafarge Corporation.
 - c. Lehigh Portland Cement Co.
 - d. Riverton Corporation (The).
 - 3. Mortar Pigments:**
 - a. Davis Colors – True Tone Mortar Colors.
 - b. Lafarge Corporation – Centurion Pigments.
 - c. Solomon Grind-Chem Services, Inc. – SGS Mortar Colors.
 - 4. Joint Reinforcement, Ties, and Anchors**
 - a. Dur-O-Wal, Inc.
 - b. Heckman Building Products, Inc.
 - c. Hohmann & Barnard, Inc.
 - d. Masonry Reinforcing Corp. of America.
 - e. National Wire Products Industries.
 - f. Southern Construction Products.

2.2 Concrete Masonry Units

- A. General:** Provide shapes indicated and as follows for each form of concrete masonry unit required.
1. Provide special shapes for lintels, corners, headers, bonding, and other special conditions.
 2. Provide square-edged units for outside corners.
- B. Concrete Masonry Units:** ASTM C90 and as follows:
1. **Unit Compressive Strength:** Provide units with minimum average net-area compressive strength indicated below:
 - a. 1800 psi.
 - b. Not less than the unit compressive strengths required to produce concrete unit masonry construction of compressive strength indicated.
 2. **Weight Classification:** Normal weight.
 3. **Cement:** Low alkali content and of one brand. Units shall be rated "not effloresced."
 4. **Aggregates:** Do not use aggregates made from pumice, scoria, or tuff.
 5. **Type:** Type I, moisture-controlled units.
 6. **Size:** Manufactured to the actual dimensions listed below (within tolerances specified in the applicable referenced ASTM specification) for the corresponding nominal sized indicated on Drawings:
 - a. **4-inch nominal:** 3-5/8-inch actual.
 - b. **8-inch nominal:** 7-5/8-inch actual.
 - c. **12-inch nominal:** 11-5/8-inch actual.
- C. Decorative Concrete Masonry Units:** ASTM C90 and as follows:
1. **Unit Compressive Strength:** Provide units with minimum

average net-area compressive strength indicated below:

- a. 1800 psi.
 - b. Not less than the unit compressive strengths required to produce concrete unit masonry construction of compressive strength indicated.
2. **Weight Classification:** Normal weight.
 3. **Type:** Type I, moisture-controlled units.
 4. **Size:** Manufactured to dimensions indicated for nondecorative units. Nominal dimensions; 8" x 16" thickness indicated on the drawings.
 5. **Finish:** Exposed faces of the following general description matching color, pattern, and texture of Engineer/Architect's sample.
 - a. Normal-weight aggregate, tinted split-face finish. Two colors have been selected; reference drawings. Colors indicated on drawings are names used by A Block Co., Inc.
 6. Use in the following location: Solids Process Building.

2.3 Mortar and Grout Materials

- A. **Portland Cement:** ASTM C150, Type I or II with low alkali content, except Type III may be used for cold-weather construction.
- B. **Masonry Cement:** ASTM C91.
 1. For pigmented mortars, use premixed, colored masonry cements of formulation required to produce color to match CMU or Building Brick wall colors. Pigments shall not exceed 5% of masonry Cement by weight for mineral oxides nor 1% for carbon black.
- C. **Hydrated Lime:** ASTM C207, Type S.
- D. **Aggregate for Mortar:** ASTM C144; except for joints less than ¼-inch, use aggregate graded with 100% passing the No. 16 sieve.
- E. **Aggregate for Grout:** ASTM C404.
- F. **Mortar Pigments:** Natural and synthetic oxides and chromium oxides,

compound for use in mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C494, Type C, and recommended by the manufacturer for use in masonry mortar of composition indicated.

H. Water: Potable.

2.4 Reinforcing Steel

A. Steel Reinforcing Bars: Material and grade as follows:

1. Billet steel complying with ASTM A615 (ASTM A615M).

B. Deformed Reinforcing Wire: ASTM A496, with ASTM A153 Class B-2 zinc coating.

C. Welded-Wire Fabric: ASTM A185.

2.5 Joint Reinforcement

A. General: Provide joint reinforcement formed from the following:

1. Galvanized carbon-steel wire, coating class as follows:

a. ASTM A153, Class B-2, for exterior walls.

B. Description: Welded-wire units prefabricated with deformed continuous side rods and plain cross rods into straight lengths of not less than 10 feet, with prefabricated corner units, and complying with requirements indicated below:

1. **Wire Diameter for Side Rods:** 0.1875 inch.

2. **Wire Diameter for Cross Rods:** 0.1875 inch.

C. For multi-wythe masonry, provide type as follows:

1. Ladder-eye design with perpendicular cross rods spaced not more than 16 inches o.c.

2.6 Miscellaneous Masonry Accessories

A. Weep Holes:

1. **Round Plastic Tubing:** Medium density polyethylene, 3/8-inch outside diameter by 4-inches long, to be used in the cavity wall.
- B. Cavity Drainage Material:** 1-inch (25-mm) thick, reticulated, nonabsorbent mesh, made from polyethylene strands and shaped to maintain drainage at weep holes without being clogged by mortar droppings.
1. **Product:** Subject to compliance with requirements, provide “Mortar Net” by AA Wire Products Co.

2.7 Embedded Flashing Materials

- A. Reinforced Plasting Flashing:** Composite plastic flashing as described below:
1. Polyester film bonded to fiberglass scrim reinforcement and 1.25-mil (0.03-mm) black-vinyl ethylene film, with a total thickness of 8 mils (0.2-mm).
 2. **Joint Tape:** Reinforced plastic flashing manufacturer’s standard polyester tape, 2 inches (50 mm) wide by 2.0 mils (0.05-mm) thick.
 3. **Application:** Use where flashing is fully concealed in masonry.
- B. Products:** Subject to compliance with requirements, provide one of the following:
1. Reinforced plastic flashing equal to Fiberweb International Corp.-Fiberweb 300.

2.8 Masonry Cleaners

- A. Job-Mixed Detergent Solution:** Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.
- B. Proprietary Acidic Cleaner:** General-purpose cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry surfaces of type indicated below without discoloring or damaging masonry surfaces; expressly approved for intended use by manufacturer of masonry unit being cleaned.
1. For masonry not subject to metallic oxidation stains, use formulation consisting of a concentrated blend of surface-acting acids, chelating, and wetting agents.

2. For dark-colored masonry not subject to metallic oxidation stains, use formulation consisting of a liquid blend of surface-acting acids and special inhibitors.
3. For masonry subject to metallic oxidation stains, use formulation consisting of a liquid blend of organic and inorganic acids and special inhibitors.
4. **Products:** Subject to compliance with requirements, provide one of the following:
 - a. Diedrich Technologies, Inc. – 202 New Masonry Detergent.
 - b. Diedrich Technologies, Inc. – 200 Lime Solvent.
 - c. Diedrich Technologies, Inc. – 202V Vana-Stop.
 - d. ProSoCo, Inc. – Sure Klean No. 600 Detergent.
 - e. ProSoCo, Inc. – Sure Klean No. 101 Lime Solvent.
 - f. ProSoCo, Inc. – Sure Klean Vana Trol.

2.9 Mortar and Grout Mixes

- A. **General:** Do not use admixtures, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.
 1. Do not use calcium chloride in mortar or grout.
 2. Add cold-weather admixture (if used) at the same rate for all mortar, regardless of weather conditions, in order to ensure that mortar color is consistent.
- B. **Mortar for Unit Masonry**
 1. Comply with ASTM C270, Proportion Specification, for types of mortar indicated below.
 - a. Limit cementitious materials in mortar to Portland Cement and Lime.
 - b. For exterior, above-grade, nonload-bearing walls and pilasters use type indicated below:

(1) **Type: S.**

2. **Pigmented Mortar:** Select and proportion pigments with other ingredients to produce color required.
- C. **Grout for Unit Masonry:** Comply with ASTM C476. Use grout of consistency at time of placement that will completely fill spaces intended to receive grout.
1. Use fine grout in grout spaces less than 2 inches in horizontal dimension, unless otherwise indicated.
 2. Use coarse grout in grout spaces 2 inches or more in least horizontal dimensions, unless otherwise indicated.

PART 3 – EXECUTION

3.1 Experience

- A. Mason contractor must have proven experience on a similar job.

3.2 Examination

- A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of unit masonry. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.3 Installation, General

- A. **Thickness:** Build cavity walls to full thickness shown.
- B. Cut masonry units with motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide continuous pattern and to fit adjoining construction. Use full-size units without cutting, where possible. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.
- C. Mix units for exposed unit masonry from several pallets or cubes as they are placed to produce uniform blend of colors and textures.

3.4 Construction Tolerances

- A. **Variation from Plumb:** For vertical lines and surfaces of pilasters and

walls, do not exceed ¼-inch in 10 feet. For external corners and other conspicuous lines, do not exceed ¼-inch in 10 feet. For vertical alignment of head joints, do not exceed plus or minus ¼-inch in 10 feet, nor ½-inch maximum.

- B. Variation from Level:** For bed joints and lines of exposed lintels, and other conspicuous lines, do not exceed ¼-inch in 20 feet, nor ½-inch in 40 feet or more.
- C. Variation of Linear Building Line:** For position shown in plan and related portion of walls and pilasters, do not exceed ½-inch in 20 feet, nor ¾-inch in 40 feet or more.
- D. Variation in Cross-Sectional Dimensions:** For pilasters and thickness of walls, from dimensions shown, do not exceed minus ¼-inch nor plus ½-inch.
- E. Variation in Mortar-Joint Thickness:** Do not vary from bed-joint thickness indicated by more than plus or minus 1/8-inch, with a maximum thickness limited to ½-inch. Do not vary bed-joint thickness from bed-joint thickness of adjacent course by more than 1/8-inch. Do not vary from head-joint thickness from adjacent head-joint thickness by more than 1/8-inch. Do not vary from collar-joint thickness indicated by more than minus ¼-inch or plus 3/8-inch.

3.5 Laying Masonry Walls

- A.** Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint widths and for accurate locating of openings. Avoid the use of less-than-half-size units at corners and where possible at other locations.
- B.** Lay walls to comply with specified construction tolerances, with courses accurately spaced and coordinated with other construction.
- C.** Lay exposed masonry in the following bond pattern; do not use units with less than nominal one-half horizontal face dimensions at corners.
 - 1.** All CMU to be running bond with vertical joint in each course centered on units in courses above and below.
- D. Stopping and Resuming Work:** In each course, rack back ½-unit length for one-half running bond; do not tooth. Clean exposed surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar prior to laying fresh masonry.

- E. Fill cores in hollow concrete masonry units with grout 24 inches under Lintels, unless otherwise indicated.

3.6 Mortar Bedding and Jointing

- A. Lay hollow concrete masonry units as follows:
 - 1. With full mortar coverage on horizontal and vertical face shells.
 - 2. Bed webs in mortar in starting course on footings and in all courses, and where adjacent to cells or cavities to be filled with grout.
 - 3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells.
 - 4. Maintain joint widths indicated, except for minor variations required to maintain bond alignment. If not indicated, lay walls with 3/8-inch joints.
- B. Tool exposed joints slightly concave when thumbprint hard, using a Jointer larger than joint thickness, unless otherwise indicated.

3.7 Horizontal-Joint Reinforcement

- A. **General:** Provide continuous horizontal-joint reinforcement as indicated. Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8-inch on exterior side walls, 1/2-inch elsewhere. Lap reinforcing a minimum of 6 inches.
 - 1. Space reinforcement not more than 16 inches o.c.
 - 2. Provide continuity with horizontal-joint reinforcement at corners by using prefabricated "L" units in addition to masonry bonding.
 - a. Reinforcement above is in addition to continuous reinforcement.

3.8 Cavities

- A. Keep cavities clean of mortar drippings and other materials during construction. Strike joints facing cavities flush.
 - 1. Place temporary wood strips in cavity to collect mortar droppings. As work progresses, remove strips, clean off mortar droppings, and replace in cavity.

3.9 Installation of Reinforced Unit Masonry

A. Temporary Formwork and Shores: Construct formwork and shores to support reinforced masonry elements during construction.

1. Construct formwork to conform to shape, line, and dimensions shown. Make sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.
2. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other temporary loads that may be placed on them during construction.

B. Grouting: Do not place grout until entire length of masonry to be grouted has attained sufficient strength to resist grout pressure.

1. Do not exceed the following pour heights for fine grout:
 - a. For minimum widths of grout spaces of $\frac{3}{4}$ -inch or for Minimum grout space of hollow unit cells of 1-1/2 by 2 Inches, pour height of 12 inches.
 - b. For minimum widths of grout spaces of 2 inches or for Minimum grout space of hollow unit cells of 2 by 3 inches, Pour height of 60 inches.
 - c. For minimum widths of grout spaces of 2-1/2 inches or for Minimum grout space of hollow unit cells of 2-1/2 by 3 inches, pour height of 12 feet.
 - d. For minimum widths of grout spaces of 3 inches or for Minimum grout space of hollow unit cells of 3 by 3 inches, pour height of 24 feet.
2. Do not exceed the following pour heights for coarse grout:
 - a. For minimum widths of grout spaces of 1-1/2 inches or for minimum grout space of hollow unit cells of 1-1/2 by 3 inches, pour height of 12 inches.
 - b. For minimum widths of grout spaces of 2 inches or for minimum grout space of hollow unit cells of 2-1/2 by 3 inches, pour height of 60 inches.

- c. For minimum widths of grout spaces of 2-1/2 inches or for minimum grout space of hollow unit cells of 3 by 3 inches, pour height of 12 feet.
 - d. For minimum widths of grout spaces of 3 inches or for minimum grout space of hollow unit cells of 3 by 4 inches, pour height of 24 feet.
- 3. Provide cleanout holes at least 3 inches in least dimensions for grout pours over 60 inches in height.
 - a. Provide cleanout holes at each vertical reinforcing bar.
 - b. At solid grouted masonry, provide cleanout holes at not more than 32 inches o.c.

3.10 Flashing and Weep Holes

- A. **General:** Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to the downward flow of water in the wall.
- B. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Place through-wall flashing on sloping bed of mortar and cover with mortar. Seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer before covering with mortar.
- C. Install flashing as follows:
 - 1. As composite masonry walls, including cavity walls, extend flashing from exterior face of outer wythe of masonry, through the outer wythe, turned up a minimum of 4 inches, and through the inner wythe to within 1/2-inch of the interior face of the wall in exposed masonry.
 - 2. At lintels and shelf angles, extend flashing a minimum of 4 inches into masonry at each end. At heads and sills, extend flashing 4 inches at ends and turn up not less than 2 inches to form a pan.
 - 3. Cut off flashing flush with face of wall after masonry wall is completed.
- D. Install weep holes in the head joints in exterior wythes of the first course of masonry immediately above embedded flashing and follows:

1. Form weep holes with product specified in Part 2 of this Section.
2. Form weep holes by keeping head joints free and clear of mortar.
3. Space weep holes 24 inches o.c.

3.11 Field Quality Control

- A. The Owner will employ and pay a qualified independent testing agency to perform the following testing for field quality control. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
 1. **Testing Frequency:** Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. of wall area or portion thereof.
 2. Mortar composition and properties will be evaluated per ASTM C780.
 3. Grout will be sampled and tested for compressive strength per ASTM C1019.
- B. **Evaluation of Quality-Control Tests:** In the absence of other indications of noncompliance with requirements, masonry will be considered satisfactory if results from construction quality-control tests comply with minimum requirements indicated.

3.12 Repairing, Pointing, and Cleaning

- A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or if units do not match adjoining units. Install new units to match adjoining units; install in fresh mortar or grout, pointed to eliminate evidence of replacement.
- B. **Pointing:** During the tooling of joints, enlarge voids and holes, and Completely fill with mortar. Point-up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance.
- C. **In-Progress Cleaning:** Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears prior to tooling joints.
- D. **Final Cleaning:** After mortar is thoroughly set and cured, clean exposed masonry as follows:

1. Remove large mortar particles with wooden paddles and nonmetallic scrape hoes or chisels.
 2. Test cleaning methods on sample wall panel; leave on half of panel uncleaned for comparison purposes. Obtain Engineer/ Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 3. Wet wall surfaces with water prior to application of cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
 4. Clean concrete masonry by cleaning method indicated in NCMA TEK 8-2 applicable to type of stain present on exposed surfaces.
- E. Protection:** Provide final protection and maintain conditions that ensure unit masonry is without damage and deterioration at time of Substantial Completion.

3.13 Masonry Waste Disposal

- A.** Undamaged, excess masonry materials are Contractor's property and shall be removed from the Project site.
- B.** Remove all other masonry waste and legally dispose of off Owner's property.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

- A.** No measurement will be made for this item.

4.2 Payment

- A.** Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

**** END OF SECTION 4200 ****

SECTION 09900

PROTECTIVE COATINGS

PART 1 - GENERAL

1.1 Summary

- A. This Section includes coating of exterior and interior surfaces throughout the Project and which are listed in PART 2 with systems specified in PART 2.
- B. Coating systems include surface preparation, prime coat (first coat), finish coats (second and third coats), inspection, cleaning, and touch-up of surfaces and equipment. Shop preparation, prime coat, and finish coats to be shop-applied, may be specified elsewhere or referenced to this Section so that a complete system is specified and coordinated.
 - 1. Where surface preparation and first (prime) coat are specified in other Sections to be shop-applied, such as for structural steel, or equipment, only the touch-up and finish coats are a part of field painting. Surface preparation is the required degree of preparation prior to application of first (prime) coat regardless if done in shop or field.
 - 2. If materials are provided without shop primer then surface preparation, first, second, and third coats are a part of field painting.
 - 3. Concealed surfaces are generally not required to have finish-coats unless otherwise specified, but prime coat should be applied and touched up prior to concealment.
 - 4. Where Equipment and Materials are provided with shop-applied finished coating system, only touch-up is a part of field painting.
 - 5. Refer to applicable Sections to determine whether surface preparation and first coat, or complete coating system, is to be shop-applied.

C. Related Work Specified Elsewhere

1. **Shop Painting and Coatings:** All applicable Divisions.
2. **Factory Prefinished Items:** All applicable Divisions.

D. Colors

1. Color of finish coatings shall match accepted color Samples.
2. When second and finish coats of a system are of same type, tint or use an alternate color on second coat to enable visual coverage inspection of the third coat. When first and second coats only are specified and are of same or different types, tint or use an alternate color on first coat to enable visual coverage inspection of the second coat.
3. Contract Price shall include the following approximate number of finish coat colors to form a basis for bidding:
 - a. **Epoxy:** Eight colors, with 50% deep tone colors.
 - b. **Ceramic:** Two colors, with 50% deep tone colors.

1.2 Quality Assurance

A. Reference Standards and Specifications

1. American National Standards Institute (ANSI)

ANSI A 13.1 - Scheme for the Identification of Piping Systems.

ANSI Z 53.1 - Safety Color Code for Marking Physical Hazards.

2. American Society for Testing and Materials (ASTM)

ASTM D4258 - Surface Cleaning Concrete for Coating.

ASTM D4261 - Surface Cleaning Concrete Unit Masonry for Coating.

3. Society for Protective Coatings (SSPC) Surface Preparation Specifications

SP1 - Solvent Cleaning: Removes oil, grease, soil, drawing and cutting compounds, and other soluble contaminants.

SP2 - Hand Tool Cleaning: Remove loose material. Not intended to remove adherent mill scale, rust, and paint.

SP3 - Power Tool Cleaning: Removes loose material. Not intended to remove all scale or rust.

SP5 - White Metal Blast Cleaning: Removes all scale, rust, foreign matter. Leaves surface gray-white uniform metallic color.

SP6 - Commercial Blast Cleaning: Two-thirds of each square inch free of all visible residues; remainder only light discoloration.

SP10 - Near-White Metal Blast Cleaning.

SP11 - Power Tool Cleaning to Bare Metal.

4. American Waterworks Association (AWWA)

Standard for Painting and Repainting Steel Tanks, Stand-Pipes, Reservoirs, and Elevated Tanks for Water Storage, D-102.

5. American Concrete Institute (ACI)

ACI 515.1R Guide to the Use of Waterproofing, Damp-proofing, Protective and Decorative Barrier Systems for Concrete

B. Include on label of container:

1. Manufacturer's name, product name, and number.
2. Type of paint and generic name.
3. Color name and number.

4. Storage and temperature limits.
5. Mixing and application instructions, including requirements for precautions which must be taken.
6. Drying, recoat, or curing time.

C. Prepainting Conference

1. Before Project field painting starts, representatives for the Owner, Contractor, coating applicator, and coating manufacturer's technical representative shall meet with Engineer.
2. Agenda for the meeting will include details of surface preparations and coating systems to ensure understanding and agreement by all parties for compliance.

D. Warranty

1. The coating manufacturers and applicators shall warrant their products and applications respectively against defects for a period of five (5) years under normal use. The warranty shall be in printed form.

E. In the event a problem occurs with coating system, surface preparation, or application, coating applicator and coating manufacturer's technical representative shall promptly investigate the problem and submit results to Engineer.

F. Stated VOC shall be unthinned maximum VOC certified by manufacturer.

G. A coating report shall be completed daily by Contractor at each phase of the coating system starting with surface preparation. These shall be submitted on the form attached at the end of this Section.

1.3 Submittals

- A.** Submit as specified in Section 1330.
- B.** Includes, but not limited to, the following:

1. Schedule of products and paint systems to be used. Schedule shall include the following information:
 - a. Surfaces for system to be applied.
 - b. Surface preparation method and degree of cleanliness.
 - c. Product manufacturer, name, and number.
 - d. Method of application.
 - e. Dry-film mil thickness per coat of coating to be applied.
2. Color charts for selection and acceptance.
3. Technical and material safety data sheets.
4. Certification by coating manufacturer(s) that all coatings are suitable for service intended as stated on each coating system sheet. If manufacturer has an equivalent product as that specified, but it is not suitable for the intended purpose, he shall submit the recommended product for approval at no increase in cost, and state reasons for substitution.
5. Contractor shall certify in writing to the Engineer that applicators have previously applied all the systems in this Specification and have the ability and equipment to prepare the surfaces and apply the coatings correctly.

1.4 Delivery, Storage, and Handling

A. Delivery of Materials

1. Deliver in original unbroken sealed containers with labels and information legible and intact. Containers shall also have correct labels with required information.
2. Allow sufficient time for testing if required.
3. Open and mix on the premises and in the presence of the Engineer. Any rejected material shall be at once removed from the premises. Colors shall be as selected by Engineer.

B. Storage of Materials

1. Store only acceptable materials on Project site in enclosed structures to protect them from weather and excessive heat and cold. Store in accordance with County and State Safety Codes.
2. Provide separate area and suitable containers for storage of coatings and related coating equipment.
3. Dispose of used or leftover containers, thinners, rags, brushes, and rollers in accordance with applicable regulations.

1.5 Regulatory Requirements

- A. In addition to requirements specified elsewhere for environmental protection, provide coating materials that conform to the restrictions of the local and regional jurisdiction. Notify Engineer of any coating specified herein that fails to conform to the requirements for the location of the project or location of application.
- B. **Lead Content:** Use only coatings that are totally lead free except for zinc-rich primers which shall not have a lead content over 0.06% by weight of nonvolatile content.
- C. **Chromate Content:** Do not use coatings containing zinc-chromate or strontium chromate.
- D. **Asbestos Content:** Materials shall not contain asbestos.
- E. **Mercury Content:** Materials shall not contain mercury or mercury compounds.

1.6 Project Conditions

- A. This Project is in a location in which drifting coatings, if spray-applied, could contaminate adjacent surfaces or vehicles nearby. All containment precautions and application methods shall be taken into consideration and implemented to prevent the above from occurring.

1.7 Inspection Service

- A. Owner will engage in the services of an independent NACE certified coating inspection service, Level III certification.
- B. Inspection service will provide full-time inspection of all field surface preparation and coating applications to ensure full compliance with the requirements of this Specification. The presence of the inspection service shall not relieve Contractor for compliance with Specifications or authorized changes.
- C. Inspection service will document all work, including nonconformance, using forms acceptable to Owner and Engineer. All documentation and reports will be prepared and signed by the Inspection service representative, and submitted to Engineer on a daily basis. At the completion of all coating applications, Inspection service representative will also submit a conformance report certifying that all Work relative to coatings complies with the Specifications or authorized change.
- D. Inspection service will be responsible for field verification and recommendations of the following field coating operations:
 - 1. Surface preparation methods, equipment.
 - 2. Substrate conditions, moisture content of concrete, substrate profiles, and surface temperatures.
 - 3. Temperature, humidity, and wind conditions at times of coating applications.
 - 4. Specified or approved coating verification.
 - 5. Application equipment.
 - 6. Coating wet and dry film thickness.
 - 7. Proper coating curing.
 - 8. Coating system failure, causes, and remedy.

- E. Inspection service representative will discuss with Engineer, Owner, and Contractor all recommended Specification deviations, changes in products, or application methods.

PART 2 - MATERIALS

2.1 Acceptable Manufacturers

- A. Acceptable manufacturers are as follows:
 - 1. Sauereisen
 - 2. Carboline
 - 3. Raven Lining Systems
 - 4. Ameron Protective Coatings Systems Group, Ameron Corp.
 - 5. Devoe Coating Company, Division of ICI.
 - 6. Futura Coatings, Inc.
 - 7. The Glidden Company.
 - 8. International Protective Coatings.
 - 9. Keeler & Long, Inc.
 - 10. Kop-Coat, Inc., Division of Carboline.
 - 11. Pittsburgh Paints, PPG Industries Inc.
 - 12. Santile, Division of Carboline Company, Inc.
 - 13. Tnemec Company, Inc.
 - 14. Polyken

2.2 General

- A. Materials furnished for each coating system must be compatible to the substrate.

- B.** When unprimed surfaces are to be coated, entire coating system shall be by the same coating manufacturer to assure compatibility of coatings.
- C.** When shop-painted surfaces are to be coated, ascertain whether finish materials will be compatible with shop coating. Inform Engineer/ Architect of any unsuitable substrate or coating conditions.
- D.** Coating system shall be as specified below or to the manufacturer's standard, whichever is more stringent.

2.3 Areas of Application

- A.** Submerged Concrete Surfaces, exposed to H₂S vapor:
 - 1.** Surface Preparation and coating system: In accordance with manufacturer's recommendations.
 - 2.** Applied to all concrete surfaces including floors, walls, baffles and ceilings.
 - 3.** Product and Manufacturer:
 - a.** Sauereisen 210
 - b.** Raven 405
 - c.** Plasite 5371
 - d.** Or approved equal.
- B.** Ferrous Metals including all Structural Steel, Miscellaneous Ferrous Metals, and all Ferrous Piping; Interior Non-submerged:
 - 1.** Surface Preparation: SSPC-SP6 Commercial Blast Cleaning as specified in Paragraph 3.1.
 - 2.** Interior non-submerged applies to areas that are housed within a building and/or within a non-process, enclosed structure.
 - 3.** Product and Manufacturer: Provide one of the following:
 - a.** Tnemec:
 - 1)** Shop Primer: 66 H.B. Epoxoline – two coats, 2-3 dry mils per coat
 - 2)** Field Primer or Field Touchup: 66 H.B. Epoxoline – one coat, 2-3 dry mils per coat.
 - 3)** Finish: 69 H.B. Epoxoline II – two coats, 4-5 dry mils per coat.
 - b.** Or approved equal

- C. Ferrous Metals, Including all Ferrous Piping; Exterior Non-submerged:
 - 1. Surface Preparation: SSPC-SP6 Commercial Blast Cleaning as specified in Paragraph 3.1.
 - 2. Exterior non-submerged applies to areas that are not housed within a building or structure, and that are not located within process and / or water carrying structures or tanks.
 - 3. Product and Manufacturer: Provided one of the following:
 - a. Tnemec:
 - 1) Primer: 66 H.B. Epoxoline – tow coats, 2-3 dry mils per coat.
 - 2) Intermediate: 69 H.B. Epoxoline II – one coat, 4-5 dry mils.
 - 3) Finish: 75 Endura-Shield – tow coats, 1.5-2 dry mils per coat
 - b. Or approved equal.

- D. Galvanized Metal and Non-Ferrous Metal; Interior Non-Submerged:
 - 1. Surface Preparation: SSPC-SP1 Solvent Cleaning, as specified in Paragraph 3.1.
 - 2. Interior non-submerged applies to areas that are housed within a building and/or within a non-process, enclosed structure.
 - 3. Product and Manufacturer: Provide one of the following:
 - a. Tnemec:
 - 1) Primer: 66 H.B. Epoxoline – one coat, 3-4 dry mils
 - 2) Finish: 69 H.B. Epoxoline II – one coat, 4-5 dry mils.
 - b. Or approved equal.

- E. All Aluminum in Contact with Dissimilar Materials:
 - 1. Surface Preparation: Remove all foreign matter.
 - 2. Product and Manufacturer: Provide one of the following:
 - a. Tnemec:
 - 1) 66 H.B. Epoxoline – two coats, 2.0 – 3.0 dry mils per coat
 - b. Or approved equal.

- F. PVC Piping, CPVC Piping, Fiberglass, Fiberglass Insulation Covering; Exterior:
 - 1. Surface Preparation: Sand as specified by the coating manufacturer.

2. Exterior applies to areas that are not housed within a building and/or within an enclosed structure.
 3. Product and Manufacturer: provide one of the following
 - a. Tnemec:
 - 1) Primer/Intermediate: 66 H.B. Epoxoline – one coat each, 2.0 – 3.0
 - 2) Finish: 75 Endura-Shield – one coat, 3.0 dry mils
 - b. Or approved equal.
- G.** PVC Piping, CPVC Piping, Fiberglass, Fiberglass Insulation Covering; Interior Non-Submerged:
1. Surface Preparation: Sand as specified by the coating manufacturer.
 2. Product and Manufacturer: Provide one of the following:
 - a. Tnemec:
 - 1) Primer/Intermediate/Finish: 66 H.B. Epoxoline – one coat each, 2.0 – 3.0 dry mils per coat.
 - b. Or approved equal.
- H.** Steel and Galvanized Steel Pipe; Buried Exterior:
1. Surface Preparation: SSPC-SP10, Near-White Blast, as specified in Paragraph 3.1.
 2. Product and Manufacturer: Provide one of the following:
 - a. Tnemec:
 - 1) Primer: 66-1211 Epoxoline – two coats, 3-4 dry mils per coat.
 - 2) Field Primer or Field Touchup: Surface preparation as specified.
 - 3) Finish: 46-413 Tneme-Tar – two coats, 10.0 dry mils per coat.
 - b. Or approved equal.
- I.** Submerged or Intermittently Submerged Ferrous Metals; Interior and Exterior:
1. Definition: Submerged shall apply to all metals below the maximum water surface elevation in open top structure unless otherwise noted or otherwise shown; and to all metals within liquid or residual solids carrying structures that are covered, including all metals on the underside of the covers unless otherwise noted or otherwise shown; and to all metals within an enclosed process structure. This shall apply to all metals whether intermittently or

continuously submerged.

2. Surface Preparation: SSPC-SP 10 Near-White Blast Cleaning as specified in Paragraph 3.1.
 - a. Tnemec:
 - 1) Primer: 69-1211 Epoxoline II – tow coats, 3-4 dry mils per coat.
 - 2) Intermediate: 69 H.B. Epoxoline II – tow coats, 5 dry mils per coat.
 - 3) Finish: 69 H.B. Epoxoline II – two coats, 5 dry mils per coat.
 - b. Or approved equal.

J. Special Requirements for Aluminum:

1. Aluminum surfaces bearing in or embedded in concrete and fayin surfaces of bolted aluminum joints ,except anchor bolts, shall be given two coats of 66 H.B. Epoxoline Primer, or approved equal. The primer shall be allowed to dry between coats and before concrete is poured against it.
2. Where aluminum metals are placed in contact with or fastened to ferrous or stainless steel metals, the contact surfaces of each shall receive the protective coating specified for that metal and a gasket shall be placed between the two contact surfaces. The gasket material shall be non-conductive commercial grade neoprene, 60 durometer, 0.03-inch in thickness unless otherwise specified. Bolts shall be isolated using one piece non-conductive sleeves and washers as manufactured by PSI Products, Inc., Burbank, California: Parker Seal Col, Culvert City, California, or approved equal.

K. Galvanizing: All galvanizing, where called for in the Contract Documents, shall be hot-dip process conforming to ASTM A-123:

1. Surface Preparation: All surfaces to be clean and free of contaminants prior to application of the coating system.
2. Prime Coat: Series 104 H.S. Epoxy; one coat 4-5 mils DFT.
3. Finish Coat: Series 104 H.S. Epoxy; one coat 4-54 mils DFT.

L. Concrete Semi-Gloss Latex:

1. Surface Preparation: All surfaces to be clean and free of contaminants prior to application of the coating system.

2. Prime Coat: Series 7 Tneme-Cryl; one coat 2-3 mils DFT.
3. Finish Coat: Series 7 Tneme-Cryl; one coat 2-3 mils DFT.

M. Ductile and Cast Iron (Exterior Exposure):

1. Surface Preparation: Solvent scrub with stiff bristle brush followed by brush-off abrasive blast cleaning to a minimum surfaces profile depth of 1.5 mils.
2. Prime Coat: Series 69-1255 (beige) H.B. Epoxoline II; one coat 3-5 mils DFT.
3. Finish Coat: Series 73 Endura-Shield; one coat 3-4 mils DFT.

N. Ductile and Cast Iron (Interior Exposure):

1. Surface Preparation: Clean, dry, and free of contaminants
2. Prime Coat: Series 135 Chembuild; one coat 4-6 mils DFT.
3. Finish Coat: Series 69 H.B. Epoxoline II; one coat 4-6 mils DFT.

O. Ductile and Cast Iron (Buried):

1. Surface Preparation: Solvent scrub with stiff bristle brush followed by brush-off abrasive blast cleaning to a minimum surface profile depth of 1.5 mils.
2. Prime Coat: Series 69-1255 (beige) H.B. Epoxoline II; one coat 3-5 mils DFT.
3. Finish Coat: Series 69 H.B. Epoxoline II; one coat 4-6 mils DFT.

P. Ductile and Cast Iron (Immersion):

1. Surface Preparation: Solvent scrub with stiff bristle brush followed by brush-off abrasive blast cleaning to a minimum surface profile depth of 1.5 mils.
2. Prime Coat: Series 66 H.B. Epoxoline; one coat 4-6 mils DFT.
3. Finish Coat: Series 69 H.B./ Epoxoline II; one coat 4-6 mils thick.

Q. Stainless Steel Duct (Buried):

1. Surface Preparation: SSPC-SP6 Commercial Blast Cleaning or manufacturer's recommendations, whichever is more stringent.
2. Prime Coat: Polyken 1019 or 1027, or approved equal.
3. Finish Coat: Polyken 905 tape, or approved equal.

2.4 Surfaces Not to be Coated

- A. Do not field paint any of the following items unless specifically noted otherwise.
1. Factory finished equipment, except for touch-up.
 2. Metal surfaces of aluminum, stainless steel, copper, bronze and similar finished materials.
 3. Equipment nameplates, valve stems, moving shafts and linkages.

2.5 Color Coding of Piping

- A. **Color Coding of Piping:** Exterior and interior by color coding entire pipe.
1. **General**
 - a. Coat piping with solid colors as specified below for entire length of pipe in exposed finished and unfinished areas. Exclude areas in pipe chases and furred areas.
 - b. Coat all other piping in colors matching adjacent surfaces. If adjacent area is unfinished, paint in color determined by Engineer/Architect.
 - c. Identify piping with letters, arrows and bands as specified below. Apply after completion of finish coating.

2. Color Scheme

Description	Pipe and Band Color	Letter and Arrow Color
Potable Water (hot or cold)	Light blue	Black
Nonpotable or Raw Water	Light blue with red bands	Black
Seal Water	Dark blue with red bands	White
Low Pressure (Air) Aeration supply	Light green	Black
Sewage	Light gray	Black
Sludge	Light brown	White
Scum	Dark brown	White
Drain	Dark gray	White
Sample	Light gray with green bands	Black
Sprinkler Piping	Red	White

In addition, special painting of the following items will be required.

Item	Color
Valve handwheels and levers	Red

Number at least 2 inches high shall be painted on or adjacent to all accessible valves, pumps, flowmeters, and other items of equipment which are identified on the drawings or in the specifications by number.

3. Location of Letters, Arrows and Bands

- a. Place letters, arrows and bands on piping near connections to equipment, adjacent to valves or fittings, on both sides of walls penetrated, and at intervals not to exceed 25 feet.
- b. Place arrows adjacent to or below letters depending upon visibility. Place arrows in direction of flow. For dual-flow piping, indicate both directions.

- c. Locate letters to be visible from normal line of vision above floor level. Letter locations subject to approval of Engineer/Architect.
- d. Band to be full circumference of pipe.

4. Letter, Arrow and Band Size

- a. Block-style letters, all capitals, conforming to ANSI A13.1 and as follows:

Outside Diameter of Letters Pipe or Covering	Size of Letters and Arrows	Width of Banding
Less than 3/4"	Approved metal tag or band	6"
3/4" to 1-1/4"	1/2"	8"
1-1/2" to 2"	3/4"	8"
2-1/2" to 6"	1-1/4"	12"
8" to 10"	2-1/2"	24"
Over 10"	3-1/2"	32"

- 5. Vent lines, electrical conduit and related electrical accessories shall be painted to match adjacent wall surfaces as directed by ceiling space shall be painted same as surfaces adjacent to the wall surfaces.

PART 3 - EXECUTION

3.1 Surface Preparation

- A. Prepare surfaces for each coating system conforming to SSPC or ASTM surface preparation specifications listed.
 - 1. If grease or oils are present, SSPC-SP1 must precede any other method specified.
 - 2. Remove surface irregularities such as weld spatter, burrs, or sharp edges prior to specified surface preparation.
 - 3. Undertake specified surface preparation in accordance with the coating manufacturer's recommendations.

- B.** Depth of profile will be as specified or as recommended by the manufacturer for each system, but in no instance shall it exceed one-third of the total dry film thickness of complete system.
- C.** Prepare only those areas which will receive the first coat of the system on the same day.
 - 1.** On steel substrates, apply coating before rust bloom forms.
- D.** Concrete surfaces shall be adequately cured in accordance with SECTION 3300 and a minimum of 28 days old prior to coating application.
- E.** Abrasives for blasting shall be free of oil, washed and dry, unused silica sand, coal, copper or nickel slag that have sharp and hard cutting surfaces. Abrasives approved by Powertech Laboratories are strongly recommended.
- F.** Sharp projections and weld splatter shall be ground smooth. All areas ground smooth shall be reblasted prior to the coating application.
- G.** Sharp edges shall be ground round and smooth to radius = 1/8 prior to the coating applications for structural steel in Highly Corrosive Areas and for Immersion Services.
- H.** After abrasive blasting, steel surfaces must be completely dust free (cleaned by vacuum and/or blown off with oil/water-free compressed air), oil and grease free, and have a chloride concentration of less than 3 µg/cm².
- I.** Unless otherwise specified, the steel profile must be 1.5 - 2.5 mils in depth and jagged as opposed to a peen pattern.
- J.** All welds shall be stripe coated by brush with the primer, prior to the application of the full primer coat. Note that inorganic zinc coatings shall not be applied by brush except to very small areas. Stripe coating shall be by spray.
- K.** Unless approved by the Paint Manufacturer to the contrary, the blast surface shall be primed prior to the development of rust bloom or other contaminants and not later than 8 hours after surface preparation.

- L. Oxidation of the steel due to deleterious conditions may necessitate reblasting or sweepblasting the surface to restore the specified cleanliness standard.

3.2 Application

- A. Apply coatings in accordance with coating manufacturer's recommendations.
- B. All work shall be undertaken by skilled applicators who are qualified to perform the required work and have a minimum of 5 years experience in similar applications. The work shall be done in a manner comparable to the best standards of practice found in that trade. All materials shall be evenly applied so as to be free from sags, runs, crawls, wrinkles, holidays, or any other defects. All coats shall be of the minimum of brush marks. When finished and dried, brush strokes shall appear in one direction only, and there shall be no curved brush marks showing. All coats shall be thoroughly dry before the succeeding coat is applied. All coats that are intended to hide shall be given another coat if the coating does not properly hide the undercoat.
- C. Use properly designed brushes, rollers, and spray equipment for all applications.
- D. Spraying shall be done in the cross lap method of spraying, streaking first in one direction and shortly later spraying across this section at right angles to the first set of passes.
- E. On unprimed surfaces apply first coat of the system the same day as surface preparation.
- F. Dry film thickness of each system shall meet the minimum specified. Maximum dry film thickness shall not exceed the minimum more than 20% or coating manufacturer's requirements if less. Where a dry film thickness range is specified, the range shall not be less than or exceeded.
- G. Shop and field painting shall remain 3 inches away from unprepared surface of any substrate such as areas to be welded or bolted.

H. Environmental Conditions:

- 1.** Do not apply coatings when inclement weather or freezing temperature may occur within coating curing time requirements. Atmospheric temperature must be maintained between 60°F and 85°F for at least 48 hours prior to and during application, unless otherwise approved by coating manufacturer.
- 2.** Wind velocities for exterior applications shall be at a minimum to prevent overspray or fallout and not greater than coating manufacturer's limits.
- 3.** Relative humidity must be less than 85% and the temperature of the surface to be painted must be at least 5°F above the dew point.
- 4.** Provide adequate ventilation in all areas of application to ensure that at no time does the content of air exceed the Threshold Limit Value given on the manufacturer's Material Safety Data Sheets for the specific coatings being applied.

- I. Recoat Time:** In the event a coating, such as an epoxy, has exceeded its recoat time limit, prepare the applied coating in accordance with manufacturer's recommendations.

J. Protection

- 1.** Cover or otherwise protect surfaces not to be painted. Remove protective materials when appropriate.
- 2.** Provide signs to indicate fresh paint areas.
- 3.** Provide daily cleanup of both storage and working areas and removal of all paint refuse, trash, rags, and thinners. Dispose of leftover containers, thinners, rags, brushes, and rollers which cannot be reused in accordance with applicable regulations.
- 4.** Do not remove or paint over Equipment data plates or code stamps on piping.

5. Mask, remove, or otherwise protect finish hardware, machined surfaces, grilles, lighting fixtures, and prefinished units as necessary.
6. Provide cover to prevent paints from entering orifices in electrical or mechanical equipment.

3.3 Inspection

- A. Contractor shall provide and use a wet film gauges to check each application approximately every 15 minutes in order to immediately correct film thickness under or over that specified.
- B. Contractor shall provide and use a dry film gauge to check each coat mm (mil) thickness when dry, and the total system mm (mil) thickness when completed.
- C. Use holiday or pinhole detector on systems over metal substrates to detect and correct voids when indicated on system sheet.
- D. Furnish a sling psychrometer and perform periodic checks on both relative humidity and temperature limits.
- E. Check temperature of the substrate at regular intervals to be certain surface is 5°F or more above the dew point.

3.4 Cleaning and Repairs

- A. Remove spilled, dripped, or splattered paint from surfaces.
- B. Touch up and restore damaged finishes to original condition. This includes surface preparation and application of coatings specified.

PART 4 - MEASUREMENT AND PAYMENT

- 4.1 **Measurement:** No measurement will be made for this item, Protective Coatings.
- 4.2 **Payment:** Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

COATING REPORT

Contract Name: _____ Contract No.: _____
Coating Contractor: _____ Foreman: _____
Unit or Surface Identification: _____
Unit or Surface Location: Exterior: _____, Interior: _____

Surface Preparation:

Date _____; Air Temp _____°F; Relative Humidity _____%
Method of Surface Preparation: _____
Profile achieved _____ mils (if applicable).

Touch-Up:

Date _____; Time _____; Air Temp _____°F; Surface Temp _____°F
Relative Humidity _____%; Dew Point _____°F
Coating Used _____; Dry Film Obtained _____ mils.

First Coat:

Date _____; Time _____; Air Temp _____°F; Surface Temp _____°F
Relative Humidity _____%; Dew Point _____°F
Coating Used _____; Dry Time Before Recoat _____ hrs.
Dry Film Obtained _____ mils.

Second Coat:

Date _____; Time _____; Air Temp _____°F; Surface Temp _____°F
Relative Humidity _____%; Dew Point _____°F
Coating Used _____; Dry Time Before Recoat _____ hrs.
Dry Film Obtained _____ mils.

Third Coat:

Date _____; Time _____; Air Temp _____°F; Surface Temp _____°F
Relative Humidity _____%; Dew Point _____°F
Coating Used _____; Dry Film Obtained _____ mils.

****END OF SECTION 9900****

SECTION 16000

GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 DESCRIPTION OF WORK

- A.** Furnish and install all electrical Work as shown on the Drawings and specified. Work includes electrical connections to equipment, wiring devices, disconnects, panelboards for electrical distribution, service entrance, conduit, conductors, and control panels.

1.2 RELATED WORK

- A.** Refer to all drawing sheets for the scope of the electrical work.

1.3 QUALITY ASSURANCE

- A.** All work to be completed to latest edition of National Electrical Code.
- B.** All material to be U.L. listed.
- C.** All equipment to conform to ANSI and NEMA standards.

1.4 SHOP DRAWINGS

- A.** Submit complete Shop Drawings for:
 - 1.** Conduit, Fittings and accessories, (See Section 16111)
 - 2.** Wire, Cable and accessories (See Section 16120)
 - 3.** Grounding (See Section 16450)
 - 4.** Panelboards (See Section 16462)

1.5 CERTIFICATES AND FEES

- A.** The Electrical Contractor will pay for all fees, connection charges, permits and inspections.

1.6 GROUNDING

- A. All grounding, as a minimum, will be according to the latest edition of the National Electrical Code, Article 250. Provide a full-size grounding conductor in all conduits.

1.7 DELIVERY, STORAGE AND HANDLING

- A. Deliver all materials and equipment direct to the job site utilizing Contractor's personnel and not to the Owner's receiving area.
- B. Store all materials and equipment in a dry area, protected from the weather. Verify location of storage areas with the Owner.

1.8 EXISTING CONDITIONS

- A. Visit the site and become familiar with existing conditions and limitations.
- B. Perform all cutting necessary to install the electrical work indicated and all patching, painting, etc. to return the finished surfaces to the original condition. All wiring devices to be installed flush unless noted otherwise.

PART 2 PRODUCTS – NOT USED

PART 3 EXECUTION

3.1 GENERAL

- A. Install all electrical Work as shown on the Drawings.
- B. Utilize conduit for all feeders, branch circuiting, and control wiring.

**** END OF SECTION 16000 ****

SECTION 16111

CONDUIT, FITTINGS AND ACCESSORIES

PART 1 - GENERAL

1.1 Description: This Section includes all conduit, fittings and accessories.

1.2 References

1. American National Standards Institute (ANSI)

ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated.

2. American Society For Testing and Materials (ASTM)

ASTM A123 - Zinc (Hot Galvanized) Coating on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strips.

ASTM A153 - Zinc Coating (Hot Dip) on Iron and Steel Hardware.

3. National Electrical Code (NEC)

4. National Electrical Manufacturers Association (NEMA)

FB1 - Fittings and Supports for Conduit and Cable Assemblies.

RN1 - Polyvinyl-Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing.

5. Underwriters' Laboratories, Inc. (UL)

1 - Flexible Metal Electric Conduit.

6 - Rigid Metal Electrical Conduit.

263 - Fire Tests of Building Construction and Materials.

360 – Liquid tight Flexible Steel Conduit

514A - Metallic Outlet Boxes, Electrical.

514B - Fittings for conduit and Outlet Boxes.

514C - Nonmetallic Outlet Boxes, Flush Device Boxes and Covers.

6. Steel Structures Painting Council (SSPC)

SP3 - Power Tool Cleaning.

SP11 - Power Tool Cleaning to Bare Metal.

- 7.** All electrical and control equipment and material shall bear the recognized Underwriters Laboratories, Inc. (UL) seal of approval. It is Vendor's responsibility to obtain local inspection approval for all non-UL labeled equipment and pay all fees in connection with the same.

1.3 Submittals

- A.** Submit as specified in SECTION 1330.

PART 2 - MATERIALS

2.1 Acceptable Manufacturers

A. Rigid Steel Conduit

- 1.** Allied Tube and Conduit Corporation.
- 2.** LTV Steel.

B. Rigid Steel Conduit with Bonded Polyvinyl Chloride (PVC) Jacket

- 1.** OCAL Inc.
- 2.** Robroy Industries.
- 3.** Perma-Cote Industries.

C. Liquid-tight: Flexible Metal Conduit:

- 1.** Anamet, Inc.

2. Electri-Flex Company.

D. Rigid Polyvinyl Chloride (PVC) Conduit

1. Kraloy Plastic Pipe Company.
2. Certain-Teed Products Corporation.
3. Carlon Products Division

E. InnerDuct for Fiber Optic Cable

Smoothwall, HDPE Innerduct may be used only and exclusively for underground installation of fiber optic cable.

1. Kraloy Plastic Pipe Company.
2. Certain-Teed Products Corporation.
3. Carlon Products Division

E. Rigid Steel Conduit Fittings

1. Heavy-duty Cast Malleable Iron Fittings

- a. Appleton Electric Company.
- b. Crouse Hinds Company.

2. Conduit Expansion and Deflection Fittings

- a. O-Z /Gedney Company.

F. Rigid Steel Conduit Boxes

1. Indoor and Outdoor Boxes

- a. Hoffman Engineering Company of Anoka, Minnesota.

2. Conduit Hubs

- a. Appleton Electric Company.
- b. Myers Industries, Inc. (ITT).
- c. Crouse-Hinds Company.
- d. O-Z /Gedney Company.

G. Supports

- 1. B-Line Company.
- 2. Midland-Ross Corporation.
- 3. Unistrut Products Corporation.
- 4. U.S. Gypsum Company.
- 5. Van-Huffel Tube Corporation.

H. Wall Entrance Seals

- 1. O-Z/Gedney Company.

I. Explosion-proof Fittings

- 1. Crouse-Hinds Company
- 2. Appleton Electric Company

J. Fire-stopping Materials

- 1. 3M, (Minnesota Mining and Manufacturing Company)
- 2. Thomas and Betts
- 3. Hilti
- 4. Dow Corning

K. Duct Seal

- 1. Ideal Industries
- 2. 3M, (Minnesota Mining and Manufacturing Company)

2.2 Design Requirements

- A.** Each length of threaded conduit furnished with coupling on one end and metal or plastic thread protector on other end.
- B.** UL listed and labeled conduit, on each length, fittings and accessories.
- C.** Sizes of conduit, fittings and accessories as indicated, specified or as required by Electrical Codes and Standards.
- D.** Provide and meet the requirements of the following sections for the conduit, fittings and accessories indicated.

2.3 Rigid Steel Conduit

- A.** Conform to ANSI C80.1 and UL-6.
- B.** Mild ductile steel, circular in cross section with uniform wall thickness sufficiently accurate to cut clean threads.
- C.** Each length threaded on both ends with threads protected.
- D.** All scale, grease, dirt, burrs and other foreign matter removed from inside and outside prior to application of coating materials.
- E.** Galvanized by the hot-dip process as follows:
 - 1.** Interior and exterior surfaces coated with a solid, unbroken layer of 99% virgin zinc by dipping.
 - 2.** Coating not to show fixed deposits of copper after four 1-minute immersions in a standard copper sulfate solution.
 - 3.** One coat of zinc chromate finish on inside and outside surfaces to prevent oxidation and white rust.
- F.** Couplings and elbows fabricated, coated and finished by the same process as conduit.

2.4 Rigid Steel Conduit and Fittings with Bonded Polyvinyl Chloride (PVC) Jacket

- A.** Conform to hot-dipped galvanized rigid steel conduit as specified in NEMA-RN1, RIGID STEEL CONDUIT, this Section, and as follows.

- B.** Prior to application of PVC coating, clean interior and exterior surfaces to remove contaminants to provide a suitable surface for bonding.
- C.** Bond the PVC coating to the conduit. Extruded PVC jackets are unacceptable.
- D.** Coated externally with PVC to a nominal 40 mils, 0.035-inch to 0.045-inch.
- E.** Uniformly coat around outside diameter and full length of the conduit.
- F.** Coat the prethreaded ends with a urethane coating having a nominal thickness of 2 mils (0.002-inch).
- G.** Coat the interior surfaces of all conduits and feed-through fittings (except where prohibited by design) with a two-part, chemically cured, urethane coating having a nominal thickness of 2 mils (0.002-inch).
- H.** Exceed the tensile strength of coating with bond between metal and jacket.
- I.** Couplings, elbows, and other conduit fittings, boxes, cover-plates, supports, hardware and related items shall be treated and coated with the same process as conduit.
- J.** Each coupling and fitting shall include a PVC sleeve that overlaps the conduit.
- K.** Length of the overlapping sleeve equals diameter of the conduit or 2 inches, whichever is least.
- L.** Final cured PVC coating capable of withstanding a minimum electrical potential of 2000V.
- M.** All conduit accessories, clamps, and hardware that are uncoated shall be stainless steel.

2.5 Liquid-Tight Flexible Metal Conduit

- A.** Conform to UL-360.

- B.** Liquid-tight conduit with flexible galvanized-steel core and a synthetic rubber, polyvinyl chloride, or thermoplastic covering.
- C.** Spiral encased copper bonding conductors for conduit in sizes 1-1/4 inches and smaller.
- D.** External grounding jumper as required.
- E.** Polyvinyl chloride (PVC) jacket, Type HA or Type O.R. "Seal-Tite" for oil-resistant applications.

2.6 Rigid Polyvinyl Chloride (PVC) Conduit

- A.** Fabricated from self-extinguishing high-impact polyvinyl chloride designed for aboveground and underground installations.
- B.** Type EPC Schedule 80 heavy-wall rigid conduit.
- C.** Fittings and accessories fabricated from same materials as conduit.
- D.** Solvent-cement-type joints as recommended by manufacturer.

2.7 Rigid Steel Fittings

A. Heavy-Duty Cast Malleable Iron Fittings

- 1.** Mogul type for conduit sizes 1-1/2 inches and larger.
- 2.** LBD or roller action type LB for right angle fittings for conduit sizes 2 inches and larger.
- 3.** Full-threaded hubs and rubber-gasketed covers.
- 4.** Zinc, cadmium-plated or bronze hardware bolts and screws for assembly.
- 5.** Finish with cadmium-plated or galvanizing.
- 6.** Standard and junction fittings.

B. Conduit Expansion Fittings

1. Line of Conduit Type

- a. Galvanized expansion fittings for rigid conduit movement up to 4 inches.
- b. Insulated metal bushing on ends of the conduit, bonding jumper, and with expansion head sealed with a high-grade graphite packing.
- c. O-Z/Gedney Company, Type AX with Type AJ bonding jumper or Thomas and Betts Corporation, Type XJG.

2. End Type

- a. For conduit terminating in a junction box.
- b. O-Z/Gedney Company, Type EXE with Type BJ-E bonding jumper.

C. Conduit Expansion and Deflection Fittings

- 1. Provide for movement of 3/4-inch from normal in all directions between two rigid conduits.
- 2. Integral bonding jumper.
- 3. O-Z/Gedney Company, Type DX.

D. Conduit Wall Entrance Seals

- 1. Provide where required or indicated.
- 2. O-Z/Gedney Company Type FSK.

- E. Conform to NEMA Type 3R enclosure in all nonhazardous areas except as specified or indicated otherwise.

2.8 Fittings, Couplings and Boxes for Rigid Steel Conduit

A. Fittings

- 1. Explosion-proof or weather-proof as specified.
- 2. Cast malleable iron.
- 3. Threaded cover to conform to NEC.

4. Full thread hubs.
5. Seal compound well for seal.
6. Drain seals as indicated or required to provide a continuous automatic drain of water.
7. Chico compound for all sealing fittings.
8. PVC jacketed in corrosive areas and where indicated.

B. Couplings

1. Explosion-proof or weather-proof as specified.
2. Flexible.
3. Conform to NEC.
4. Threaded, steel or bronze end fittings securely fastened to the core and braided to ensure electrical continuity.
5. Vinyl plastic coating in severely corrosive locations as indicated.

2.9 Rigid Steel Conduit Boxes

A. Indoor Boxes

1. Hot-dipped galvanized steel.
2. Galvanized steel covers.
2. For special boxes where it is not possible to provide hot-dip galvanizing, apply organic zinc-rich primer at 3 mils dry film thickness after SSPC-SP3 Power Tool Cleaning.
3. Minimum gage requirements:

No surface area exceeds	No single dimension exceeds	Steel Gage
1000 sq in.	40 in.	14

1500 sq in.	60 in.	12
over 1500 sq in.	over 60 in.	10

4. Explosion-proof or weather-proof as specified.
5. Threaded conduit entrances or rigid conduit hubs on all boxes.
6. Include piano-hinged, gasketed cover, and interior mounting panel when used for enclosing terminal blocks and control relays.
9. Oiltight JIC boxes modified for NEMA Type 3R or Type 4 enclosure for non-explosion-proof areas.

B. Outdoor Boxes

1. 11-gauge minimum galvanized steel with drip lip and galvanized-steel covers fastened with bronze or cadmium-plated screws or bolts, or cast iron with galvanized finish and flanged bolted covers.
2. For special boxes where it is not possible to provide hot-dip galvanizing, apply organic zinc-rich primer at 3 mils dry film thickness after SSPC-SP3 Power Tool Cleaning.
3. Threaded conduit entrances or rigid conduit hubs on all boxes.
4. Rubber or neoprene gasket for cover.
5. Explosion-proof or weather-proof as specified. Conform to NEMA Type 3R enclosure for non-explosion-proof applications in all outdoor installations unless indicated otherwise.
6. Include piano-hinged, gasketed cover, and interior mounting panel when used for enclosing terminal blocks and control relays.
7. Oiltight JIC boxes modified for NEMA Type 3R or Type 4 enclosure in non-explosion-proof applications.

B. Metallic Barriers

1. Designed not to separate phases of a power circuit.

- 2.** Provide as indicated for the isolation of power circuits from other type circuits.
- C.** Box size as required, or as indicated, for each particular installation.
- D.** Include provisions for mounting cable supports where indicated, specified or as required by NEC.
- E.** Provide as required for cable pulling, junctions, terminals, and for mounting of switches, outlets and control devices.

2.10 Support System

- A.** Fabricated from structural steel or manufactured framing members equal to "Unistrut" P-3000 series as manufactured by Unistrut Corporation.
- B.** Minimum 12 gage.
- C.** Construct as required to rigidly support all conduit runs and boxes.
- D.** Hot-dip galvanized steel conduit clamps or stainless steel, sized for the specific conduit size, to support all exposed metallic conduit.
- E.** Nonmagnetic clamps to support nonmetallic conduits.
- F.** Provide stainless steel rods, anchors, inserts, bolts, washer, and nuts.
- G.** Materials shall be compatible with the equipment supported.
- H.** Manufactured Framing Members
 - 1. Wet Locations**
 - a.** Channel hot-dipped galvanized after all manufacturing operations are completed.
 - b.** Galvanizing zinc weight of 2 ounces per square foot on surface to conform to ASTM A123 and ASTM A153.

2.11 Fire-stopping and Duct Seal

A. Fire-stopping

1. Weather-resistant silicone sealant.
2. Provide 4-hour fire rating.
3. UL tested system.

B. Duct Seal

1. Non-corrosive, permanently soft compound.
2. Nontoxic.
3. Provide flexible re-enterable and repairable seal around cables in conduit.
4. Prevent air movement and drafts through conduits.
- 5.

PART 3 - EXECUTION

3.1 Preparation

- A.** Provide suitable protection for conduit risers against damage during construction.
- B.** Cap ends of all conduits before concrete is poured.
- C.** Cap all conduits and provide pullstring after cleaning where conduits are to be left empty by this contract.
- D.** Carefully ream ends of all conduit lengths after cutting to eliminate sharp burrs.
- E.** Clean out all conduit before pulling wire.
- F.** Clean out all conduits immediately after concrete work is finished.

3.2 Installation

A. General Requirements

1. Location

- a. Install conduit as near as possible to the routing indicated.
 - b. Shift locations as required to avoid interference with other equipment and piping being installed.
 - c. Where routing of conduit is not indicated, such as for lighting home run circuits and other systems requiring small conduit runs, route conduit as specified subject to approval by Engineer.
2. Do not use conduit in sizes smaller than 3/4-inch, except 1/2-inch may be used for connections to control devices and thermocouples where necessary.

3. Holes and Sleeves

- a. Provide through floors, walls and roofs as necessary for conduit runs, including approved flashing and weather proofing at outside walls and on roofs.
- b. Install sleeves or forms for all openings in new work.
- c. Provide the required inserts and holes, completely sleeved, bonded, curbed, flashed and finished off in an approved manner, whether in concrete, steel grating, metal panels or roofs.
- d. Core-drill all holes required in existing building work using a dustless method.
- e. Place nonshrinking grout or Dow Corning 3-6548 Silicone RTV (or equivalent General Electric RTF 762) foam as specified, in the following locations:
 - (1) All holes in concrete, walls, floor and roof slabs after installation of conduit.
 - (2) All unused holes and sleeves as approved by Engineer.
- f. Install wall entrance seals where conduit enters the building or vaults from exterior underground.

- 7.** Comply with applicable requirements of NEC pertaining to installation of conduit systems.
- 8.** Place drainage fittings or weep holes at unavoidable low points where moisture can collect.
- 9.** Install an entire conduit system that is electrically continuous with bonding jumpers provided as necessary to conform to NEC.
- 10.** Install expansion fittings at all building expansion joints and every 100 feet of continuous conduit.
- 11.** Provide all spare or empty conduits with pullstrings for future use.

B. Rigid Steel Conduit

1. Exposed

- a.** Install where specified or indicated on drawings.
- b.** Install above grade outdoors.
- c.** Install horizontal runs as high above floor as possible and in no case lower than 7 feet above floor, walkway or platforms in passage areas.
- d.** Run conduit parallel or perpendicular to walls, ceiling, beams, and columns unless indicated otherwise.
- e.** Route to clear all doors, windows, access wells, and openings.
- f.** Group parallel runs in neatly aligned banks where possible with minimum of 1-inch clearance between conduits.
- g.** Maintain 6-inch clearance between conduit and coverings on all hot lines; steam, hot water, etc.
- h.** Do not exceed a distance of 8 feet between supports on horizontal or vertical runs.

- i. When terminating at cable tray, attach conduit to tray and electrically bond conduit with ground wire to the cable tray. Install duct seal in conduits around cables to prevent ingress of water.

2. Concealed

- a. Conceal conduit for lighting, convenience outlets, and other circuits in walls, ceiling and floors where possible.
- b. Do not install conduit in concrete where conduit outside diameter exceeds one-third of concrete thickness.
- c. Install parallel runs with a minimum spacing of three conduit diameters between conduits.
- d. Use expansion and deflection fitting with bonding jumpers at all concrete expansion joints.
- e. Tie securely in place to prevent movement when concrete is poured.
- f. Install in floor slabs in as straight a run as possible. Conduit crossovers are not permitted unless conduit total outside diameter is one-third of the concrete thickness or less.
- g. Use long radius elbows except on risers where curved portion of elbow would extend above the finished floor or foundation.
- h. Make all joints watertight after installation by coating all finished joints with coal tar solution applied at 15 mils minimum dry film.
 - (1) Kop-Coat - No. 50.
 - (2) Tnemec - 46-449.

3. Buried

- a. Place where indicated.

- b.** Use PVC jacketed conduit or rigid PVC Schedule 80 as indicated.
- c.** Make all joints watertight by field-applied coat of vinyl plastic compound or PVC welding solution furnished by the conduit manufacturer.
- d.** Use bender one size larger for conduit sized 1 inch or less and conventional bender for conduit sized above 1 inch.
- e.** Use strap wrench to tighten conduit. Repair damaged coating with liquid patching compound recommended by conduit manufacturer.
- f.** Install in as straight a run as possible between termination points of exact routing to be determined in the field and subject to approval by Engineer.
- g.** Bury conduits a minimum of 24 inches (to top of conduit) below finish grade unless indicated otherwise or required by code.
- h.** Slope conduit away from conduit risers where possible.
- i.** Maintain 6-inch separation from underground piping.
- j.** Use long radius bends at all risers unless indicated otherwise.
- k.** After trench bottom has been finished to grade, lay conduit. Backfilling shall be as specified in DIVISION 2.
- l.** Cap ends of all conduit risers before backfilling.
- m.** Provide watertight seal around wires where conduit terminates in pull box.
- n.** Use PVC coated rigid galvanized steel conduit when making transitions from buried to above ground conduit runs.

C. Liquid-Tight Flexible Metal Conduit

1. Use between rigid conduit and motor terminal boxes except where conduit runs down from above and cannot be conveniently supported by a floor flange.
2. Place between rigid conduit or conduit box and control device cases where direct connection is not desirable for reasons of equipment movement, vibration, or for ease of maintenance.
3. Install at all points of connection to equipment mounted on supports to allow for expansion and contraction.
4. Conform to NEC with installation of conductors.
5. Install at locations where rigid conduit connections are impractical.
6. Use minimum length consistent with manufacturer's standard lengths, the acceptable bending radius, and with required movement of equipment.
7. Maximum length of 3 feet unless otherwise approved by Engineer.
8. Install an external bonding jumper to conform to NEC on conduit sized 1-1/2 inches and larger.

D. Flexible Metal Conduit

1. Use between rigid conduit and devices, except in hazardous areas and areas subject to dampness, water, and corrosive fumes. Do not use with vapor-tight fixtures. Use in accordance with the National Electrical Code Article 350.
2. Use in lieu of direct connection of rigid conduit where it is not desirable for reasons of equipment movement, vibration, or for ease of maintenance.
3. Install as required for expansion and contraction.
4. Use minimum length consistent with manufacturers' standard lengths, the acceptable bending radius, and with required movement of equipment.

5. Maximum length of 3 feet unless otherwise approved by Engineer.
6. Install in sizes smaller than 3 inches.
7. Install an external bonding jumper to conform to the National Electrical Code on conduit sized 1-1/2 inches and larger.

E. Conduit Fittings

1. Installations of special fittings as required.
2. All materials shall be compatible.
3. Install as required.

F. Boxes

1. Install special boxes as indicated of size required for conduits and cables entering and leaving box.
2. Install where required for pull or junction boxes and for mounting or connecting to switches, outlets, intermediate terminal blocks or control devices.
3. Provide 1/4-inch weep holes in interior boxes where conduits enter from exterior or buried installation.

G. Supports

1. Construct with sufficient rigidity to hold all mounted equipment and material in permanent and neat alignment.
2. Design to provide 1/4-inch space between equipment housings and walls or columns upon which they are mounted.
3. Do not exceed load requirements in NEC and NEMA standards.
4. After Power Tool Cleaning SSPC-SP11, paint all welds, field cuts and damaged areas with organic zinc-rich primer at 3 mils dry film thickness.
 - a. Ameron - 68HS.

- b.** Carboline - Carbozinc 858.
 - c.** Porter - Zinc-Lock 308.
 - d.** Tnemec-Tneme Zinc 90-93.
- 5.** Use electrogalvanized steel conduit clamps and nonmagnetic conduit clamps to support electrogalvanized steel conduit and nonmagnetic conduit, respectively.
- 6.** Provide stainless steel rods, anchors, inserts, bolts, washers and nuts.

I. Explosion-proof Fittings

- 1. Install explosion-proof fittings in the rigid steel conduit system as required by the NEC.
- 2. Install necessary fittings where not indicated, but required by code.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

- A.** No measurement will be made for this item.

4.2 Payment

- A.** Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

**** END OF SECTION 16111 ****

SECTION 16120

WIRE, CABLE, AND ACCESSORIES

PART 1 - GENERAL

1.1 Description

A. This Section includes furnishing and installing (including terminations) of all electrical wire, cable, and accessories.

B. Related Work Specified Elsewhere

Lighting.....Section 16500

GroundingSection 16450

Field Testing..... Section 16950

1.2 References

1. American Society for Testing and Materials (ASTM)

ASTM B3 - Soft or Annealed Copper Wire.

ASTM B8 - Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.

ASTM B33 - Tinned Soft or Annealed Copper Wire for Electrical Purposes.

ASTM B172 - Rope-Lay-Stranded Copper Conductors, Having Bunch Stranded Members, for Electrical Conductors.

ASTM B189 - Lead-Coated and Lead-Alloy-Coated Soft Copper Wire for Electrical Purposes.

2. Insulated Cable Engineers Association (ICEA)

S-19-81 - Rubber Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

S-61-402 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

S-66-524 - Cross-Linked Thermosetting-Polyethylene-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

S-68-516 - Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

S-81-570 – 600-Volt Rated Cables of Ruggedized Design for Direct Burial.

S-105-692 – 600-Volt Single Layer Thermoset Insulated Utility Underground Distribution Cables.

T-29-520 – Vertical Cable Tray Flame Tests at 210,000 Btu.

3. National Electric Manufacturers Association (NEMA) and Insulated Cable Engineers Association (ICEA)

WC55/S-82-552 – Instrumentation Cables and T.C. Wire.

WC57/S-73-532 – Standard for Control Cables.

WC70/95-658 - Non-Shielded Power Cables Rated 2000V or Less.

4. Institute of Electrical and Electronic Engineers (IEEE)

48 - Test Procedures and Requirements for High Voltage Alternating-Current Cable Terminations.

5. National Fire Protection Association

National Electrical Code (NEC) NFPA-70.

Standard for Electrical Safety in the Workplace, NFPA 70E

6. Underwriters Laboratories, Inc. (UL)

44 - Rubber-Insulated Wires and Cables.

83 - Thermoplastic-Insulated Wires and Cables.

263 - Fire Tests of Building Construction and Materials.

854 - Service Entrance Cables.

1277 - Electrical Power and Control Tray Cables with Optional Optical Fiber Members.

- 7. National Electrical Safety Code, IEEE C2.**
- 8. Occupational Safety and Health Administration, OSHA.**
- 9.** All electrical and control equipment and material shall bear the recognized Underwriters Laboratories, Inc. (UL) seal of approval. It is Vendor's responsibility to obtain local inspection approval for all non-UL labeled equipment and pay all fees in connection with the same.

1.3 Submittals

- A.** Submit as specified in Section 1330.
- B.** Includes, but not limited to, the following:
 - 1.** Data sheets for each wire and cable type specified.
 - 2.** Data sheets for wire and cable accessories.
 - 3.** Cable manufacturer's approval of splicing and terminating materials.
 - 4.** Cable manufacturer's approval of pulling compounds.
 - 5.** Cable manufacturer's installation requirements such as maximum pulling tensions, sidewall pressures, minimum bending radii, etc.
 - 6.** Other equipment and materials to be used.

PART 2 - MATERIALS

2.1 Acceptable Manufacturers

A. Wire and Cable

Acceptable manufacturers for each wire and cable type will be manufacturers that have been manufacturing the specified cable for a minimum of five years and meet all the requirements listed on the Wire and Cable Specification Sheets.

B. Wire and Cable Accessories

1. Cable Connectors for Control and Instrument Cable

- a.** AMP Special Industries.
- b.** Hollingsworth Solderless Terminal Company.
- c.** Panduit Corporation.
- d.** Minnesota Mining and Manufacturing (3M).
- e.** Thomas and Betts Company, Inc.

2. Cable Connectors for Power Cable

- a.** AMP Special Industries.
- b.** Thomas and Betts Company, Inc.
- c.** Minnesota Mining and Manufacturing (3M).
- d.** Panduit Corporation.

3. Termination and Splice Kits

- a.** Minnesota Mining and Manufacturing (3M).
- b.** Raychem.

4. Tape and Insulation Putty: Minnesota Mining and Manufacturing (3M).

5. Cable Ties

- a.** AMP Special Industries.
- b.** Dennison Manufacturing Company.
- c.** Panduit Corporation.
- d.** Minnesota Mining and Manufacturing (3M).

- e. Thomas and Betts Company, Inc.

6. Cable Supports

- a. O-Z/Gedney Company.
- b. Hubbell, Kellems Grips.

7. Terminal Blocks

- a. Allen-Bradley.
- b. Buchanan.
- c. Phoenix Contact.
- d. Weidmuller.

8. Cable Identification Tags

- a. Allen Marking Products, Kansas City, MO.
- b. Floy Tag and Manufacturing Co., Seattle, WA.
- c. Panduit Corporation (Panduit).
- d. Specialty Products Company, Rock Hill, SC.
- e. Thomas and Betts Company, Inc. (Thomas and Betts).

9. Cable Fire and Smoke Stop Fittings

- a. Crouse Hinds.
- b. Nelson Electric.
- c. O-Z/Gedney Company.

2.2 Wire and Cable

A. Building Wires

- 1. Conductors: stranded for 12 AWG and larger. Minimum size: 12 AWG.

2. Copper conductors: size as indicated, with 600 V insulation of chemically cross-linked thermosetting polyethylene material rated RW90.

B. MC, Metal Clad Cables

1. Conductors:

.1 Grounding conductor: copper.

.2 Circuit conductors: copper, size as indicated.

2. Insulation: Chemically cross-linked thermosetting polyethylene rated type RW90, 600 V.

3. Inner jacket.

4. Armour: continuous aluminum.

5. Overall covering: flame retardant polyvinyl chloride material meeting requirements of Vertical Tray Fire Test.

C. Instrument Cable – Shielded Twisted Pairs/Triads

1. Conductors: stranded for 16 AWG and larger. Minimum size: 16 AWG.

2. Copper conductors: size as indicated, with 600 V insulation of PVC material rated RW90. Color code shall use pigmented compounds, white and black for pairs, white, black and red for triads. Each conductor shall include sequential numbers printed on surface of conductors.

3. Conductor jacket: nylon.

4. Shields: aluminized mylar or polyester tape with tinned copper drain wire.

5. Jacket: Polyvinyl chloride (PVC).

D. Control Cables

1. Class B or C soft annealed stranded copper conductors, sized as indicated, with cross-linked thermosetting polyethylene, outer PVC jacket rated for outdoor use.

2. 600 V type: with cross-linked polyethylene type, RW90 (x-link) and overall jacket.

E. Temperature Rating

Cables shall be suitable for operation with a maximum conductor temperature of 90°C, continuous, wet or dry locations.

F. Insulation and Jacket Thickness

See references, Section 1.2.

G. Factory Tests

See references, Section 1.2, including the flame test requirement, ICEA T-29-520 and UL 1277.

H. Certification

Cables shall be certified to be in conformance with all applicable codes and standards as referenced.

All cables shall include surface identification showing manufacturer's name, insulation type, conductor size, conductor type, voltage rating and UL label.

2.3 Connectors

A. General Requirements

1. Designed and sized for specific cable being connected.
2. Solderless, pressure-type connectors constructed of non-corrodible tin-plated copper.
3. Rated current-carrying capacity equal to or greater than the cable being connected.
4. Application tooling for connectors shall contain die or piston stops to prevent over-crimping and cycling or pressure relief to prevent under-crimping. Dies of all application tooling shall provide dot or wire size coding for quality control verification. All tooling shall be manufactured by the connector manufacturer.

B. Power Connectors (10 AWG and Smaller) 600V and Below

1. "Scotchlok" preinsulated spring wire connectors.
2. Buchanan open-end copper splicing caps, applied with "Lok-Seal" tool, with nylon snap-on insulators.

C. Power Connectors (sizes 8-4 AWG) 600V and Below

1. Noninsulated ring-tongue type.
2. Ring tongue sized to match terminal stud size.
3. Brazed barrel seam.
4. Application tooling designed to crimp the wire barrel (conductor grip) with a one-step crimp.

D. Power Connectors (sizes 2 AWG - 750 kcmil) 600V and Below

1. Non-insulated one-hole rectangular tongue for sizes 2 AWG through 3/0 AWG and two-hole rectangular tongue for 4/0 AWG through 750 kcmil.
2. Application tooling shall be hydraulically operated.

E. Control, Instrument, and Specialty Cable Connectors

1. Tin-plated copper.
2. Vinyl preinsulated spring-type spade terminals. (Hollingsworth "Mini Spring Spades"; Thomas and Betts "Locking-Fork"; Panduit "Locking Fork.")
3. Sized to match terminal stud size.
4. Have insulation grip sleeve to firmly hold to cable insulation.
5. Insulation grip sleeve shall be funneled to facilitate wire insertion and prevent turned-back strands.
6. Application tooling designed to crimp the wire barrel (conductor grip) and the insulation grip sleeve with a one-step crimp.

2.4 Motor Lead Termination/Splice (Low-Voltage, 600v and Below, Power Cable)

- A.** Splices shall be made using compression-type connectors bolted together. The compression-type connectors shall be properly sized for the cables.
- B.** Splice to be covered with heat-shrinkable tubing connector insulators or slip-on rubber boot or sleeve.
- C.** Splicing shall be done in accordance with the instructions provided with the Raychem brand MCK Motor Connector Kit or 3M Company 5300 Series Motor Lead Splice Kit.

2.5 Cable Supports

- A.** Cable supports for cables in vertical conduit risers shall be O-Z/Gedney Type "R" wedging plug type or approved equal.
- B.** Kellems basket type wire mesh grip for cables in vertical installations.

2.6 Cable Ties

- A.** Nylon self-locking type.
- B.** Have a normal service temperature range of -40°C to 85°C.
- C.** Be weather-resistant and sun-light resistant type for outdoor use.
- D.** Meet requirements of Military Specifications MIL-S-23190D.
- E.** AMP Special Industries "AMP-TY," Dennison Manufacturing Company "BAR-LOK," Panduit Corporation "PAN-TY," Thomas & Betts "TY-RAP," or Minnesota Mining and Manufacturing 3M Brand cable ties.

2.7 Terminal Blocks

- A. For mounting in terminal boxes (TBs)**
 - 1.** Designed and sized for the cables being terminated.

2. Block rated 600V.
3. Binding screw-type terminals for power cables and strap screw or tubular clamp terminals for control and instrument cables.
4. Rated current carrying capacity equal to or greater than the cable being terminated.
5. Marking strip.

B. For Mounting in Cabinets, Panels, Control Boards, Etc.

1. Designed and sized for the cables being terminated.
2. Block rated 600V.
3. Binding screw type terminals for power cables and current transformer circuits and strap screw or tubular clamp terminals for control and instrument cables.
4. Rated current carrying capacity equal to or greater than the cable being terminated.
5. Marking strip on blocks for power cables and control and instrument cables.
6. Short-circuit strips with one shorting screw for each terminal for current transformer circuits.

2.8 Cable Identification Tags

- A. Designed to provide a permanent wire and cable identification system.
- B. Show complete cable number. Cable numbers are defined in the Cable Schedule and/or Contract Drawings.
- C. Cable numbers may be stamped or typed in a legible and permanent manner. Hand-lettering is not acceptable.
- D. Character size for cable numbers shall be a minimum of 1/8-inch.

- E.** Material shall be nonmetallic and impervious to moisture and resistant to fading in sun-light.
- F.** Be securely attached to cables and accessible for inspection.
- G.** Cable identification tags, marking and attachment methods shall be subject to approval of the Engineer.

2.9 Fastenings

- 1.** One hole malleable iron straps to secure surface cables 2 inch diameter and smaller. Two hole steel straps for cables larger than 2 inches.
- 2.** Channel type supports for two or more cables.
- 3.** Threaded rods: 3/8 inch dia. stainless steel to support suspended channels.

PART 3 – EXECUTION

3.1 Installation

A. Wire and Cable

1. General Requirements

- a.** Install in conduit, duct system or tray as indicated.
- b.** Do not subject cable to pulling tensions or sidewall pressures in excess of manufacturer's recommendations.
- c.** Attach pulling grips over the cable sheath to prevent slipping of the insulation.
- d.** Do not subject cable to bending radius less than those recommended by the cable manufacturer or as noted below (whichever is greater) during or after installation:
 - (1)** Eight times the cable outside diameter for 600V or lower rated cables.

- e. Install intermediate splices only as indicated or as required to avoid subjecting cable to excessive pulling tension or sidewall pressures. Cable splicing locations shall be approved by Engineer prior to cable installation.
- f. Support cables at connections or termination points such that any strain on cable will not be transmitted to the connection or termination.
- g. Install cable supports in vertical runs of conduit, at boxes and at terminations in equipment, and as required to meet intermediate support requirements of National Electrical Code (NEC).
- h. All pulling compounds shall be approved by wire and cable manufacturer as being compatible with cable materials.
- i. Attach a cable identification tag to each cable at all termination or end points.
- j. Install fire and smoke stop fittings at all cable penetration of fire rated walls, floors and ceilings.

2. Power (600V and Below), Control, Instrument, and Specialty Cable

- a. Install metallic barrier in all tray and boxes to separate power, control and instrumentation from low-level signal (50V or less) instrumentation circuits where run in the same box.
- b. Cables in vertical trays shall be secured every 3 feet or less.
- c. Tie together with cable ties all single conductor cable on each individual circuit in each junction box, and equipment at intervals not to exceed 6 feet.
- d. **Attach a cable identification tag to each cable.**
 - (1) At each terminal to identify the circuit and cable.

(2) Use nylon ties and identification tabs color coded as follows:

(a) 480V circuits - Red.

(b) 277, 240, or 208Vac circuits - Orange.

(c) 120V circuits - White.

(d) Control cables - Natural Nylon.

e. Insulation Color Coding

(1) Conductors shall be coded or numbered over the entire length.

(2) Colors shall not be changed between source and device. No white wire shall be used in lighting and convenience outlets except as a grounded neutral conductor.

f. Tag each individual conductor or wire with wire markers as follows:

(1) With terminal designation indicated on schematic diagrams or given on manufacturer's equipment drawings.

(2) At each terminal.

(3) In addition to specified circuit tags.

g. Terminate and ground, control, instrument, and specialty cable shields as indicated and recommended by the manufacturer of the equipment being connected. In general, ground the shields at the control boards for control cables and at the receiving end equipment for instrumentation and specialty cables.

h. Control and instrument cable splices shall be as follows:

- (1) Made only in junction or terminal boxes.
 - (2) Made on terminal blocks with marking strips.
 - (3) Conductor color coding shall be maintained.
 - (4) For shielded cables, shield continuity and isolation shall be maintained.
- i. **Power cable (600V or below) splices and motor terminations shall be as follows:**
- (1) Made only in junction or terminal boxes.
 - (2) Splices shall be made using compression type connectors bolted together.
 - (3) Splice to be covered with a heat-shrinkable connector insulator.
- j. **Lighting Cable:** Install as specified in this Division.
- k. **Ground Cable:** Install as specified in this Division.
- l. Install fire and smoke stop fittings at all cable penetrations of fire-rated walls, floors, and ceilings.

3. Cable Connections and Terminations

- a. Make up clean and tight to assure a low-resistance joint.
- b. Make only in terminal boxes, equipment or other accepted enclosures and not in conduit.
- c. Install all connectors with tooling manufactured by the connector manufacturer and as specified.

3.2 Field Quality Control

- A. **Manufacturer's Field Services:** Provide as specified in DIVISION 1.
- B. **Field Testing:** Specified in Section 16950.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement

- A.** No measurement will be made for this item.

4.2 Payment

- A.** Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

**** END OF SECTION 16120 ****

SECTION 16450

GROUNDING

PART 1 - GENERAL

1.1 Description

- A.** This Section includes the following:
- 1.** Facility ground grid and ground rod system.
 - 2.** Ground riser extensions to structural steel, electrical equipment, and mechanical equipment.

1.2 References

1. American Society For Testing and Materials (ASTM)

ASTM B8 - Concentric-Lay Stranded-Copper Conductors, Hard, Medium-Hard, or Soft.

2. National Electrical Safety Code (NESC)

3. National Fire Protection Association (NFPA)

70 - National Electrical Code.

70E – Standard for Electrical Safety in the Workplace

4. Underwriters' Laboratories (UL)

467 - Electrical Grounding and Bonding Equipment.

5. Occupational Safety and Health Administration, OSHA.

- 6.** All electrical and control equipment and material shall bear the recognized Underwriters Laboratories, Inc. (UL) seal of approval. It is Vendor's responsibility to obtain local inspection approval for all non-UL labeled equipment and pay all fees in connection with the same.

1.3 Submittals

- A.** Submit as specified in Section 1330.
- B.** Includes, but not limited to, catalog cuts for the following:
 - 1.** Ground Rods.
 - 2.** Cable.
 - 3.** Grounding Lugs.

PART 2 - MATERIALS

2.1 Acceptable Manufacturers

A. Ground Rods

- 1.** Joslyn Manufacturing and Supply Company.
- 2.** Copperweld Bimetallics Group.
- 3.** Knight-Metalcraft, Division of Whitaker Cable.
- 4.** ITT Blackburn Company, a Division of International Telephone and Telegraph Corporation.
- 5.** Harger

B. Cable-to-Equipment Ground Lugs

- 1.** Burndy Corporation (Burndy).
- 2.** Knight-Metalcraft, Division of Whitaker Cable.
- 3.** Harger

2.2 Wire and Cable

- A.** Type BC2 as specified in this Division (Section 16120).
- B. Conductor Sizes**

1. As indicated for specific connections.
2. For required connections not indicated, use conductor size not less than No. 4/0 AWG if buried in earth or cast in concrete, or No.2 AWG at other locations, unless otherwise noted.

2.3 Ground Rods

- A. Copper-clad steel or copper-alloy sectional-type rods.
- B. One end pointed to facilitate driving.
- C. 3/4-inch diameter x 10 feet long with diameter and length stamped near top of rod.

2.4 Connection Materials

- A. Cable-to-cable and cable-to-rod cable-to-connector connections of exothermic-welding-type process.
- B. **Cable-To-Equipment Ground Lugs**
 1. Compression type.
 2. Bolted to equipment housing with silicon bronze bolts and lock washers.

2.5 Coatings

- A. **Coal Tar**
 1. Kop Coat - No. 50.
 2. Tnemec - 46-449.

PART 3 - EXECUTION

3.1 Inspection: Do not cover up connections before they are inspected by Engineer.

3.2 Installation

A. Wire and Cable

1. Install using as few joints as possible.
2. Protect against abrasion by several wrappings of rubber tape at all points where cable leaves concrete in exposed areas.
3. Suitably protect cable against damage during construction.
4. Replace or suitably repair cable if damaged by anyone before final acceptance.
5. All Connections to be metal to metal. Remove all paint, grease, dirt, etc. before making connections.

6. In Exposed Installations

- a. Route runs as indicated.
- b. Route along the webs of columns and beams, and in corners where possible for maximum physical protection.
- c. Support at intervals of 3 feet or less with nonmagnetic clamp-type supports.
- d. Where exposed and no natural protection available, provide physical protection as required to protect ground conductor.

7. In Buried Installations

- a. Lay in bottom of trench or in other excavations at least 30 inches below finished grade.
- b. Maintain clearance of at least 12 inches from all underground metal piping or structures, except where connections thereto are specifically indicated.
- c. Backfill as specified in DIVISION 2.

B. Ground Rods

1. Install rods as indicated by driving and not by drilling or jetting.

2. Drive rods into undisturbed earth where possible.
3. Where rods must be installed in excavated areas, drive rods into earth after compaction of backfill is completed.
4. Drive to a depth such that top of rods will be approximately 18 inches below final grade or subgrade, and connect main grid ground cable thereto.

C. Connections

1. Conform to manufacturer's instructions.
2. Chemically degrease and dry completely before welding.
3. Apply one coat of coal tar coating at 15 mils dry film thickness to all exothermic-welded connections to be buried.
4. **Make connections to equipment as follows:**
 - a. Make up clean and tight to assure a low-resistance connection with resistance not exceeding 1 ohm.
 - b. Install so as not to be susceptible to mechanical damage during operation or maintenance of equipment.
 - c. Provide direct copper connection to buried ground grid system.
 - d. Prior to making connections remove all paint, grease, etc. from connection location.

D. Metallic Conduit Grounds

1. Adequately and properly ground at all terminal points and wherever isolated from equipment or grounded steel.
2. Where extending into floor-mounted equipment from below, connect to equipment ground bus or frame.
3. Where extending into manholes, handholes, or cable trenches, connect to the ground riser or cable at that structure using grounding bushings.

E. Rack Grounds

1. Ground at intervals not to exceed 20 feet.
2. Ground all continuous runs as well as isolated sections at least at one point.

F. Box Grounds: Unless grounded by conduit system, ground all boxes by direct copper connection to the buried ground grid system.

G. Motor Grounds: Ground all motors with "identified" ground conductor in addition to conduit system. Route in conduit with phase conductors unless external ground is indicated.

3.3 Field Testing: Specified in Section 16950.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

A. No measurement will be made for this item.

4.2 Payment

A. Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

**** END OF SECTION 16450 ****

SECTION 16462

PANELBOARDS

PART 1 - GENERAL

1.1 Summary

A. This Section includes:

1. Panelboards.

B. Related Work Specified Elsewhere

Grounding.....Section 16450

2.2 References

1. Federal Specifications

W-P-115b - Panelboards.

W-C-375b - Molded-Case Circuit Breakers.

2. National Fire Protection Association (NFPA)

3. National Electrical Code (NEC)

4. National Electrical Manufacturers Association (NEMA)

AB1 - Molded-Case Circuit Breakers.

ICS - Industrial Control and Systems.

PB1 - Panelboards.

ST20 - Dry-Type Transformers for General Applications.

5. Underwriters' Laboratories, Inc. (UL)

50 - Electrical Cabinets and Boxes.

67 - Electric Panelboards.

508 - Electric Industrial Control Equipment.

- 6. National Electrical Safety Code**
- 7. Standard for Electrical Safety in the Workplace – NFPA 70E**
- 8. Occupational Safety and Health Administration, OSHA.**
- 9.** All electrical and control equipment and material shall bear the recognized Underwriters Laboratories, Inc. (UL) seal of approval. It is Vendor's responsibility to obtain local inspection approval for all non-UL labeled equipment and pay all fees in connection with the same.

2.3 Submittals

- A.** Submit as specified in Section 1330.
- B.** Includes, but not limited to, the following:
 - 1.** Physical size, number of poles, ratings and nameplate information on panelboards.
 - 2.** Overall dimensions, weight, ratings, impedance and taps on transformers.
 - 3.** Schematic diagrams.
 - 4.** Factory test data if required.
 - 5.** Coating system.

PART 2 - PRODUCTS

2.1 Acceptable Manufacturers

- A. Power Distribution Panelboards:**
 - 1.** Square D Company.
 - 2.** Siemens ITE
 - 3.** Prior Approved Equal
- B. Lighting Panelboards:**

1. Square D Company.
2. Siemens ITE
3. Prior Approved Equal

2.2 Lighting and Small Power Panel-boards

- A. Required final arrangement of breakers determined by system design.
- B. Provide required components with ratings and voltages as indicated on the plans.
- C. Heavy-duty type with size, number of poles, and quantity of breakers as indicated.
- D. **Enclosure:**
 1. NEMA Type as indicated on plans
 2. Code gauge, hot-galvanized sheet steel boxes for surface and flush mounting.
 3. Code gauge steel trim.
- E. Wiring trough at top and bottom.
- F. Hinged door with lock and latch combination in the front trim.
- G. Phenolic nameplate approximately 1-inch x 3 inches on front of panel engraved with the panelboard title and designation such as shown on the project documentation.
- H. Main circuit breaker for incoming line as indicated.
- I. Spare space filler plate if required for panel symmetry.
- J. Minimum symmetrical interrupting rating of as indicated on the plans.
- K. Circuit directory in each panelboard filled in by typed lettering identifying the loads connected to each breaker.

- L. Bus bar material to be copper

2.3 Painting

- A. Paint all items this section with manufacturers standard system suitable for the service intended. System shall include surface preparation, prime and finish coats.
- B. Submit with Submittals the type, color, and manufacturer of paint system used.

PART 3 - EXECUTION

3.1 Panelboard Installation

- A. Install at locations indicated.
- B. Surface-mount on wall (or equipment rack), as indicated, at an elevation 6'-6" to top of panel.
- C. Arrange with proper clearances from other equipment and material to obtain good accessibility for operation and maintenance.
- D. Install circuit directory in each panelboard.
- E. Ground all neutral buses to the building ground system.
- F. Connect feeder circuits as indicated in the panel schedules to obtain best balance of load between phases.

3.2 Field Painting

- A. Preparation of surfaces and touch-up of scratched or damaged painted surfaces is specified in Section 9900.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

- A. No measurement will be made for this item.

4.2 Payment

- A.** Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

**** END OF SECTION 16462 ****

SECTION 16500

LIGHTING DEVICES, SWITCHES, AND RECEPTACLES

PART 1 - GENERAL

1.1 Description

A. This Section includes the following

- 1.** Exterior lighting.
- 2.** Receptacle outlet power systems.
- 3.** Luminaires.
- 4.** All necessary mounting, wiring and accessories required.

1.2 References

1. American National Standards Institute (ANSI)

ANSI C73 Series - Plugs and Receptacles.

ANSI C78 series:

Electric Discharge Lamps (Fluorescent).

Electric Discharge Lamps (H.I.D.).

ANSI C81 Series - Electric Lamp Bases and Holders.

ANSI C82 Series - Lamp Ballasts.

2. Certified Ballast Manufacturers (CBM) - Ballasts.

3. Illuminating Engineering Society of North America (IESNA)

- 4. National Electrical Code (NEC)**
- 5. National Electrical Manufacturers Association (NEMA)**
- 6. Reflector and Lamp Manufacturers (RLM) Standards Institute** - Industrial Lighting Units.
- 7. Underwriters' Laboratories, Inc. (UL)**
- 8. Federal Specification (Fed. Spec.)**

W-C-596 - Connector, Electrical Power.

W-S-896 - Switches, Toggles (Toggle and Lock), Flush Mounted.
- 9. National Electrical Safety Code, IEEE C2.**
- 10. Occupational Safety and Health Administration, OSHA.**
- 11. Occupational Safety and Health Administration, OSHA.**
- 12.** All electrical and control equipment and material shall bear the recognized Underwriters Laboratories, Inc. (UL) seal of approval. It is Vendor's responsibility to obtain local inspection approval for all non-UL labeled equipment and pay all fees in connection with the same.

1.3 Submittals

- A.** Submit as specified in Section 1330.
- B.** Includes, but not limited to, the following information for each luminaire for the lamp specified:
 - 1.** Detailed construction drawings.
 - 2.** Ballast information.
 - 3.** Photometric data.
 - 4.** Catalog data.

5. Lamp type and color.

PART 2 - MATERIALS

2.1 Acceptable Manufacturers

A. Luminaires

Acceptable manufacturer for each luminaire is specified in LUMINAIRES, this Section.

B. Switches

1. Bryant Electric Company (Bryant).
2. Daniel Woodhead Company (Woodhead).
3. Hubbell, Inc. (Hubbell).
4. Leviton Mfg. Co.
5. Pass & Seymour, Inc.

C. Ground Fault Receptacle

1. Arrow Hart, Inc.
2. Bryant Electric Company.
3. General Electric.
4. Leviton Mfg. Co.
5. Pass & Seymour, Inc.

2.2 General Requirements

- A.** All equipment and materials to bear UL label.
- B.** Equipment and materials to be designed to meet the quality and level of illumination established by specified luminaires.
- C.** Provide all necessary wiring and accessories as required for complete installation.

2.3 Systems

- A. 208/120V three phase, 4 wire system with identified grounded neutral and separate ground wire for receptacles and small power loads.

2.4 Lamps

- A. LED Style.

2.5 Luminaires

- A. Furnish luminaires in accordance with the specification sheets at the end of this Section.

2.6 Switches

- A. All single-pole switches as indicated.
- B. **Surface-Mounted, Tumbler, Self-Grounding, Heavy-Duty Switches**
 - 1. Rated 20A at 277Vac.
 - 2. "Specification" grade (Fed. Spec. W-S-896) switch with gray toggle.
 - 3. FS and FD single or multiple gang boxes.
 - 4. 302 stainless steel cover plates and matching countersunk screws.
 - 5. Locations indicated-if located outside-weatherproof.

2.7 Receptacle Outlets

- A. **Flush-Mounted:** Surface-mounted.
 - 1. Rated 20A at 125Vac.
 - 2. Duplex, arc-resistant, back- and side-wired, and 3-wire grounding type. (NEMA Reference 5-20R).
 - 3. 302 stainless steel wall plates and matching countersunk screws.

- a. Gray receptacle with 302 stainless steel Specification grade wall plate.
- 4. "Specification" grade type 5362, Fed. Spec. W-C-596 compliant.
- 5. FS and FD single or multiple gang boxes.
- 6. Locations as indicated.

B. Weatherproof Receptacle Outlets

- 1. Flush or surface mounted.
- 2. Rated 20A to 125Vac, Fed. Spec. W-C-596.
- 3. Duplex, arc-resistant and pre-wired, 3-wire grounding type. (NEMA reference 5-20R).
 - a. Gray Receptacle.
- 4. 302 stainless steel, spring-hinged, PVC-gasketed doors and stainless steel PVC-gasketed coverplate.
 - a. "Specification" grade.
- 5. "Specification" grade, type 5362.
- 6. FS and FD boxes.
- 7. Locations as indicated.

C. Ground-Fault Interrupter Receptacles (GFI):

- 1. Flush or surface mounted as indicated.
- 2. Terminal installation as indicated.
- 3. Rated 20A to 125Vac.
- 4. UL Standard 943 Class A, Group 1.
- 5. Leakage current sensitivity: 5 mA \pm 1 mA.
 - a. Opens circuit within 25 milliseconds of each 5 mA.

6. Duplex, arc-resistant and pre-wired.
 - a. Gray receptacle.
7. 302 stainless-steel coverplate.
8. FD boxes.
9. Locations as indicated.

PART 3 - EXECUTION

3.1 Installation

A. Luminaires

1. Install after pipe, conduit, air ducts and other equipment above luminaires are installed, unless otherwise acceptable to Engineer.
2. Place accurately as to line and level, and at elevations indicated.
3. Shift location if required to avoid interference with plant piping or other apparatus or material.
4. Clean and fully lamp with new lamps.
5. Complete with all required accessories just prior to final acceptance.
6. Install as indicated.

B. Switches

1. Mount 1.2 meters (4 feet) above floor, walkways, or finished grade unless indicated otherwise.

C. Receptacle Outlets

1. Mount receptacles outlets 600 mm (2'-0") above walkways.

D. Wiring Circuits

1. Home Run Groupings

- a. 120/208-volt, single-phase, 3-wire systems. Group in home runs with not more than one conductor of each phase and its associate neutral and ground wire in one conduit.
2. Use circuit numbers as indicated.
3. Use type SVN3 wire for lighting and receptacle circuits unless indicated otherwise.
4. Do not install wire smaller than No. 12 AWG.
5. Install larger size wire as indicated or required to conform to requirement of NEC.
6. Install in concealed and exposed conduit systems as indicated.

PART 4 MEASUREMENT AND PAYMENT

4.1 Measurement

- A. No measurement will be made for this item.

4.2 Payment

- A. Payment will be made at the contract lump sum price bid and shall be considered full payment for providing labor and materials to perform this work.

**** END OF SECTION 16500 ****

SECTION 16712

FIBER OPTIC COMMUNICATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A.** Materials and procedures for installing and testing fiber optic communication systems

1.02 RELATED SECTIONS

- A.** Section 02582 - Underground Electrical Ducts and Manholes

1.03 REFERENCES

- A.** Electronic Industries Association(EIA) and Telecommunications Industry Association(TIA) Specifications
- B.** National Electrical Code(NEC).
- C.** Underwriters Laboratory(UL)

1.04 DEFINITIONS

- A.** OTDR - Optical Time Domain Reflectometer
- B.** SMF - Single Mode Fiber
- C.** OSP - Outside Plant

1.05 SUBMITTALS

- A.** Provide all submittals in accordance to Section 01300.
 - 1.** Provide evidence of training and experience for all fiber optic staff, including but not limited to installation technician, splice technicians and test technicians.
 - 2.** For approval:
 - a.** A detailed construction and installation procedure covering all aspects for the fiber optic cable installation on this project.
 - b.** All Materials for the fiber optic cable installation on this project.
 - c.** Fiber labeling setup

3. Submit OTDR test results to the engineer in a neatly bound and printed form for acceptance. Include the current calibration certificate for the OTDR being used.
4. Submit Power Meter/Light Source test results to the engineer for acceptance.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing the work of this section with minimum 3 years of experience.

1.07 WARRANTY

- A. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.01 GENERAL

- A. All materials are UL listed
- B. Provide all incidental materials including but no limited to fiber optic jumpers, cable ties, labels, and connectors.
- C. All materials meet Fluid Penetration Test standards (TIA/EIA-455-82B)

2.02 FIBER OPTIC CABLE

- A. Fiber must be approved by the USDA Rural Electrification Administration (PE-90).
- B. The fiber optic cable is an Outside Plant (OSP) type, armored dielectric loose tube, single-mode cable.
- C. Include the manufacturer's test documentation. This documentation indicates the attenuation of each cable fiber in dB/km, measured at 1310 nm and 1550 nm for single-mode.

- D.** Outside Plant (OSP) Single-mode.
 - 1.** Fiber Optic Glass: Corning SMF-28E or approved equal.
 - 2.** Gel-Free Fiber Optic Cable: Corning ALTOS Lite or approved equal.
- E.** Fiber optic cable must comply with TIA/EIA-4720000-A.
- F.** Outer jacket labeling:
 - 1.** The date of manufacture and the manufacturer's name.
 - 2.** A numerical sequence, at intervals no greater than 10 ft, to determine the length of cable and amount of cable remaining on the reel.
 - 3.** "Fiber Optic Cable" at an interval of no greater than 10 ft.
 - 4.** Height of the markings is 1/8 inch nominal.

2.03 FIBER OPTIC CONNECTORS

- A.** With the following characteristics and as specified in the contract:
 - 1.** LC – Connectors (Standard)
 - a.** Factory installed pre-polished or field installed Camlock LC connectors.
 - b.** Ceramic ferrules.
 - c.** Maximum insertion loss: 0.30 dB.
 - d.** Connector back reflection: greater than 35 dB.
 - 2.** ST – Connectors (to be used only where approved)
 - a.** Factory installed or field installed ST or ST compatible connectors.
 - b.** Ceramic ferrules and metallic connector bodies.
 - c.** Maximum insertion loss: 0.30 dB.
 - d.** Connector back reflection: greater than 35 dB.
 - e.** Clean all connectors with alcohol wipes and a compressed cleaning gas.

2.04 FIBER OPTIC CABLE SPLICE ENCLOSURES

- A.** Provide enclosure with the following minimum characteristics:
 - 1.** Provide a water and airtight seal for fiber optic splices in any environment (aerial, buried, underground and vault).
 - 2.** Corrosion resistant shell
 - 3.** Allow re-entry without replacing the cable seals
 - 4.** Strength member tie-off
 - 5.** Mechanism to resist cable pull-out.
 - 6.** All required accessories to complete the splice
- B.** Accommodates up to 48 splices
- C.** Contains 2 or more 12-count splice trays
 - 1.** Coyote Runt Closures for Underground, Aerial and buried Splices.

2.05 SPLICE ENCLOSURE FIBER DETAILS

- A.** Provide 3 ft of buffer tube slack from end plate.
- B.** Provide label for each buffer tube located 1 inch from the splice tray. Description on label will identify as to which fiber cable and direction cable is coming from.
- C.** Provide 3 to 4 ft of fiber optic strands, outside of buffer tube, from each cable before splicing.

PART 3 EXECUTION

3.01 INSTALLERS

- A.** Demonstrate two years total and one year continuous work experience with the splicing, termination and testing of fiber optic cable.
- B.** Perform all work with qualified staff

3.02 PREPARATION

- A.** Do not perform fiber splices that are not shown in approved splice details without prior written authorization engineer.
- B.** Restore Contractor damaged facilities within 48 hours.
- C.** Lubricate cable with a lubricant designed for fiber optic cable installation.
- D.** Use shear pins or other failsafe means to prevent exceeding the maximum cable pulling tension specified by the cable manufacturer.
- E.** Maintain the following minimum bend radii:
 - 1.** 20 times Cable Diameter during installation.
 - 2.** 10 times Cable Diameter installed.
- F.** Maintain the following minimum slack requirements:
 - 1.** Splice Points: 100 ft from installed splice enclosure to conduit on all cables.
 - 2.** All Other Junction Boxes: 50 ft.
 - 3.** Cabinets: 50 ft.
- G.** Replace any fiber optic cable segment not meeting the requirements of the specifications in its entirety between full splice points shown in the contract.

3.03 FIBER OPTIC CABLE PREPERATION

- A.** Solvent requirements:
 - 1.** Must not remove any color from individual fibers (Refer to TIA/EIA-598-A) or buffer tubes.
 - 2.** Not harmful to the polyethylene cable jacket.

3.04 ENTRY AND REENTRY OF FIBER OPTIC SPLICE ENCLOSURES

- A.** Perform all work in an environmentally controlled atmosphere. Acceptable environments to work on splice enclosures include office type environments in buildings, splice trailers, and splicing tents with floors. All splicing, testing, connecting, or opening of fiber ends must not occur in locations with freezing temperatures, rain, snow, or wind-blown dust.
- B.** Perform fusion splices as follows:
 - 1.** Use equipment with automatic fiber alignment and automatic light injection with detection devices or profile alignment algorithms to estimate splice losses.
 - 2.** Provide splice enclosure as a protection for all splices and stripped cable.
 - 3.** House all splices in splice trays or organizers.
 - 4.** Use glass capillaries, heat shrink tubing, or silicone sealant to provide additional protection and strain relief.
 - 5.** Comply with maximum splice loss allowance of 0.05 dB.

3.06 CABLE LABELING REQUIREMENTS

- A.** Label all fiber optic cables in every accessible location with a high quality permanent label, indicating the location and type of circuit (e.g., drop cable, distribution-48 count).
- B.** Use Panduit MP-150-C or equivalent.

3.07 ACCEPTANCE TESTING

- A.** Contact the Engineer five business days before performing all acceptance testing (Post Termination and Splicing OTDR and Power Meter).
- B.** Perform all fiber optic testing with an OTDR capable of producing output files compatible with the Siecor OTDR 383PCW Version 1.21 or higher.
- C.** Repair any damaged fiber strands using fusion splicing methods and repeat all tests described below.

D. OTDR Testing Requirements:

- 1.** After completing the required work, test every fiber strand passing through any open splice tray.
- 2.** Conduct all traces with a pigtail or fiber box between the OTDR and the fiber under test. Use pigtail of sufficient length as to show the connector, or the start of the strand under test.
- 3.** Do not exceed launch transition of 0.6 dB.
- 4.** Conduct all traces at both 1310 nm and 1550 nm.
- 5.** Unless otherwise noted, uni-directional traces are acceptable.
- 6.** Provide traces with the following information:
 - a.** Horizontal Axis: Distance in Feet and Kilometers.
 - b.** Vertical Axis: Attenuation scale in dB.
 - c.** Traces showing attenuation versus distance.
 - d.** Cursors positioned at cable ends.
- 7.** Tabulate for each trace: method, fiber type, wavelength, pulse width, refractive index, range, search threshold, reflection threshold, end threshold, warning threshold, backscatter, jumper length, file date, file time, fiber ID, cable ID, OTDR location, far end location, operator initials.
- 8.** Provide an event table showing all events having more than 0.05 dB loss, containing event type, position from OTDR end, loss and reflectance.
- 9.** For cables less than 3300 ft (1 km) in length, the maximum total allowable attenuation is 1.0 dB.
- 10.** Identify fibers by strand number.
- 11.** Submit results in printed form on 8 ½-inch x 11-inch paper in a suitable binder organized by cable and strand number.
- 12.** A cover sheet is required for each binder indicating which cable(s) were tested, the OTDR users name, the reviewers name, the type of test performed and the date(s) of the test.
- 13.** Cover sheets for final test results bearing the reviewers signature, the date, and a statement indicating that the installation complies with the requirements of this section is required.
- 14.** The Contractor's employee who has reviewed the traces is required to sign or initial them. A check mark is required on all traces that satisfy the requirements identified herein. For intermediate test results, flag any discrepancies that may exist with a short description of the proposed corrective action (e.g. resplice).

E. Post Installation / Pre-Splicing Test:

- 1.** Fibers Tested: Normally, one strand per buffer tube. Test every strand when evidence of physical damage, excessive pulling tension, and kinks exist, or when any damaged strand is found.

2. Light Frequency: 1310 nm and 1550 nm.
 3. Direction: Uni-directional.
 4. Location of test: One field location for each cable installed.
 5. Test after installing cable in duct but before splicing.
 6. Tested by: Qualified Staff.
 7. Acceptance Criteria:
 - a. Cable attenuation 0.4 dB/km at 1310 nm.
 - b. Cable attenuation 0.25 dB/km at 1550 nm.
 - c. Strand lengths are consistent.
 - d. Launch Transition < 0.6 dB.
 - e. No event > 0.10 dB.
 8. Trace available for one strand in every buffer tube in the cable.
- F. Post Termination and Splicing Test:**
1. Test every strand in all cable segments including connectorized strands of drop cables.
 2. Light Frequency: 1310 nm and 1550 nm.
 3. Direction: Unidirectional.
 4. Location of test: Every field location required to obtain access to each cable segment.
 5. Test after terminating and splicing at all points described in the contract.
 6. Cable Tested by: Certified Staff.
 7. Acceptance Criteria:
 - a. Cable attenuation 0.4 dB/km at 1310 nm excluding splices described in the contract or authorized by the Engineer.
 - b. Cable attenuation 0.25 dB/km at 1550 nm excluding splices described in the contract or authorized by the Engineer.
 - c. Strand lengths are consistent.
 - d. Launch Transition < 0.6 dB.
 - e. No event > 0.30 dB.
 - f. Maximum splice attenuation 0.05 dB per splice unless otherwise described in the contract.
 8. Trace available for each strand in all cable segments.
- G. Power Meter/Light Test:**
1. Connect the light source to the connectorized fiber at the location identified on the Fiber Optic Light Source Power Meter Test Form provided by the Resident Engineer or Department Fiber Representative at the pre-construction meeting. Connect a power meter to the other end of the fiber at the location identified on the Test Form. Record the results and submit the completed form to the Engineer.
 2. Use the light frequencies of 1310 nm and 1550 nm, or as indicated in test forms.

3. Perform the test bi-directional.
4. Test every field location required to obtain access to each cable segment.
5. Perform all testing using a qualified staff member.
6. Acceptance Criteria:
 - a. Cable attenuation as called for in test plans.
 - b. Test is available for each strand indicated in test plans.
Otherwise, test will be available for each strand in each cable segment.
7. All work to conform to the NEC.

**** END OF SECTION 16712 ****

SECTION 02 65 00

FUEL STORAGE TANK REMOVAL

PART 1 GENERAL

1.1 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. American Petroleum Institute (API):
 - a. RP 2003, Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents.
 - b. RP 2219, Safe Operation of Vacuum Trucks in Petroleum Service.
 - c. STD 2217A, Guidelines for Safe Work in Inert Confined Spaces in the Petroleum and Petrochemical Industries.
 - d. STD 2015, Requirements for Safe Entry and Cleaning of Petroleum Storage Tanks.
 - e. PUBL 1629, A Guide for Assessing and Remediating Petroleum Hydrocarbons in Soils.
2. Environmental Protection Agency (EPA):
 - a. Spill Prevention, Control and Countermeasure (SPCC) regulation, 40 CFR 112

1.2 SUBMITTALS

A. Informational Submittals:

1. Scope of Work. The Scope is a list of the tasks to be performed. For example, a typical tank removal:
 - a. Secure the electric power at the source.
 - b. Remove the remaining product from the tank.
 - c. Disconnect piping to the generator.
 - d. Empty the piping of product.
 - e. Purge or inert the tank for safety.
 - f. Remove the piping, and other appurtenances.
 - g. Remove the tank and prepare it for transport.
 - h. Haul the tank to a licensed disposal facility for disposal.
 - i. Remove any raised concrete pad or foundation.
 - j. Specify whether the piping will be either capped or removed, including the vent line and vent stack.
2. Personnel Qualifications:
 - a. Prior to start of Work, submit names, qualifications, and experience of key supervisory, health and safety, and quality control personnel proposed for Project.
 - b. Where Work requires health and safety trained and medically screened personnel, provide documentation of training and medical qualifications for personnel working inside exclusion zone.
3. Any other submittals necessary for compliance with local, state and federal requirements.

1.3 REGULATORY REQUIREMENTS

A. Work under this section, including transportation and disposal of tank, contents, piping, debris, and contaminated soil shall be done in conformance with applicable local, state, and federal requirements.

- B. Prior to commencing removal operations, obtain local, state, and federal permits and licenses that directly impact Contractor's ability to perform Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 GENERAL

- A. Conduct tank removal operations in accordance with approved work plan and applicable guidelines.
- B. Conduct the Work with appropriate means, methods, equipment, and materials as to minimize potential for fires, explosions, accidents, and release of contaminants into environment.
- C. Take precautions to avoid damage to existing structures, their appurtenances, monitoring wells, utilities, or other facilities affected by Work activities.

3.2 REMOVAL OF TANK CONTENTS AND PURGING

- A. Inspect tank for presence of liquid and sludge prior to start of the Work.
- B. Remove liquid from tank. Drain and purge appurtenant piping into tank as liquid is removed from tank.
- C. Remove solids and residual liquid.
- D. Analyze vapors within tank for explosive potential with combustible gas indicator. Purge and vent tank and piping if combustible gas concentration is equal to or greater than 10 percent of lower explosive limit.
- E. Contain and store tank product, pumpable liquid, and sludge in approved containers until testing is completed, applicable manifests are provided, and transportation and disposal have been arranged.
 - 1. Provide temporary storage area with appropriate dikes, secondary containment lining, and spill control measures.
 - 2. Minimum volume of containment area shall be at least the volume of the largest tank plus a minimum of 1 foot of freeboard.

3.3 REMOVAL OF APPURTENANT PIPING

- A. Disconnect piping and ancillary equipment from tank. Remove piping from interior and exterior of tank.

3.4 TANK REMOVAL

- A. Once tank has been freed of vapors and before it is removed, plug or cap accessible holes, except one plug should have a 1/8-inch hole to prevent excessive differential pressures caused by

temperature changes. Locate this vent plug so it will be on top of tank during subsequent storage and transport.

- B. Remove tank from excavation, clean exterior to remove soil, and inspect for signs of corrosion, structural damage, or leakage. Materials, equipment, and tools, including shovels and slings that come in contact with tank containing flammable vapors or in vicinity of excavation for such tanks, shall be nonsparking type.
- C. Remove tank to contractor staging area, subject to final approval by Owner, and secure it with wooden blocks to prevent movement. Remove Underwriters Laboratories label from tank if label exists.
- D. On tanks that will not be cut up or crushed onsite, install label or mark with letters denoting removal date, former contents, current vapor state, and appropriate warning against certain re-use.

3.5 TANK CLEANING

A. Interior Cleaning:

- 1. Tank interior shall be cleaned if necessary for disposal.
- 2. Clean interior surfaces of piping using same method used for cleaning tank.
- 3. Contaminated water resulting from cleaning operations shall be containerized and sampled in accordance with applicable laws and regulations to determine disposal requirements. Temporary storage shall be located in area provided with secondary containment and spill control measures.

3.6 ANCHORAGE REMOVAL

- A. Remove any raised concrete pad or foundation.

3.7 DISPOSAL

- A. Dispose of tank, appurtenances, soil, water, and other debris materials at approved disposal facilities.
- B. Transportation and Disposal:
 - 1. Obtain acceptance letters from applicable disposal facilities.
 - 2. Provide licensed transporters.
 - 3. Prepare manifests and bills of lading.
 - 4. Package and process materials to meet transportation and disposal requirements.
 - 5. Obtain confirmation from disposal facility that materials have been accepted and properly disposed.

PART 4 MEASUREMENT AND PAYMENT

- 4.1 The measurement and payment will be based on the contract lump sum price. This price shall be full compensation for furnishing all labor, equipment, materials, tools and incidentals necessary to complete the item.

END OF SECTION

SECTION 22 12 10

UNDERGROUND OIL/WATER SEPARATOR

PART 1 GENERAL

1.1 SCOPE

- A. This section specifies the requirements for underground storage tanks (UST) used for oil/water separation and required accessories.

1.2 APPLICABLE PUBLICATIONS

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 30A – Code for Motor Fuel Dispensing Facilities and Repair Garages
- B. Underwriters Laboratories, Inc. (UL):
 - 1. UL 1746—External Corrosion Protection Systems for Steel Underground Storage Tanks
 - 2. UL 58—Steel Underground Tanks For Flammable And Combustible Liquids
- C. International Code Council (ICC)
 - 1. IFC - International Fire Code, 2018, including Lake Havasu City amendments.

1.3 APPLICABLE LOCAL AND STATE REGULATIONS

- A. Arizona Administrative Code

1.4 DESCRIPTION OF WORK

- A. Furnish all labor, materials, tools, equipment and incidentals required to install underground oil-water separator as shown on the drawings and described in the specifications.
- B. After construction, piping and equipment will be turned over to the Owner cleaned, completely drained of water, and ready to be placed into service.
- C. General Requirements:
 - 1. Oil Water Separator:
 - a. Tank Capacity: 1000 gallons.
 - b. Inlet flow rate: 100 gpm (max)
 - c. Product: Water w/trace of oil.
 - d. Tank Type: Double wall underground horizontal steel cylinder.

1.5 QUALITY

- A. Thoroughly trained and experienced workers familiar with the requirements and procedures shall be used. They shall possess the appropriate skills, experience, competence and required certification to complete the work in accordance with the provisions of these specifications.

1.6 SUBMITTALS

- A. The Contractor shall provide three (3) sets of submittals including manufacturer's product data sheets for all components, tank outline drawings, platform drawings, installation instructions, certificates of compliance with testing requirements, engineering data, and equipment specifications.
- B. The Contractor will be responsible to obtain the necessary permits.
- C. Comply with the following submittal schedule:

ITEM NO.	SUBMITTAL REQUIREMENT	AS INDICATED
22 12 10-001	Description of QA/QC procedures and quality program.	In accordance with Section 01330
-002	Tank design criteria, including tank dimensions, materials of construction, design pressure and temperature, hydro test pressure.	In accordance with Section 01330
-003	Materials of construction for bolting, gaskets and accessory items.	In accordance with Section 01330
-004	Equipment weight empty and weight full of water.	In accordance with Section 01330
-005	Shell plate and head thicknesses.	In accordance with Section 01330
-006	Tank fabrication drawings, including dimensional and fabrication details and shell and head materials and thickness.	In accordance with Section 01330
-007	Nozzle details showing types, sizes, and locations.	In accordance with Section 01330
-008	Internal component details including components designed, fabricated and furnished by any third party manufacturers.	In accordance with Section 01330
-009	External and internal painting/coating materials, preparation and application procedures.	In accordance with Section 01330
-010	Fabrication and Test Procedures, including: <ul style="list-style-type: none"> • Weld preparation • Radiographic examination • Other non-destructive examinations • Testing procedures 	In accordance with Section 01330

	<ul style="list-style-type: none"> • Cleaning Procedures 	
-011	Recommended installation procedures.	In accordance with Section 01330
-012	Test results/certifications	In accordance with Section 01330
-013	Compliance statement to Contract documents with any exceptions noted.	In accordance with Section 01330

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All materials and equipment used in this project shall be new and shall meet or exceed the following specifications.
- B. Steel Plate:
 - 1. All steel plate used in the construction of the tank and related accessories shall conform to ASTM A36.
- C. Steel Sheet:
 - 1. All steel sheet used in the construction of the tank and related accessories shall conform to ASTM A570 Grade 33.
- D. Pipe and Tubing:
 - 1. All pipe used for fuel tank and piping shall conform to ASTM A120 or ASTM A53 Grade B. All tubing used shall conform to ASTM A179. All couplings, unions, elbows, tees, and fittings used shall conform to the ASTM standard appropriate for the pipe or tubing being connected.

2.2 PRODUCTS

- A. Double Wall Underground Oil Water Separator:
 - 1. The UST shall be constructed with materials conforming to the specifications found in Section 2.1 and the entire assembly shall be listed by a nationally recognized testing laboratory. The UST shall be constructed by a manufacturer that has been regularly engaged in the manufacture of UL Listed Underground Steel Tanks for Flammable and Combustible Liquids. The UST shall be designed and constructed in conformance with NFPA 30. It shall consist of a steel tank and shall meet or exceed the following minimum specifications:
 - a. The tank shall be constructed of steel plate not less than 3/16" thick for tanks with a total capacity of 4,000 gallons or less and not less than 1/4" for tanks with a total capacity over 4,000 gallons. However, in no case shall the tank be thinner than specified by UL Standard 58.
 - b. The external tank shall be steel.

- c. Provide polyurethane coating on external tank in accordance with UL 1746.
- d. Provide ballast and tie downs.
- e. Tank interior shall be coated with polyurethane coating.
- f. Except for the vent riser pipe and access assembly, if any, the tank shall be fabricated and assembled at the manufacturer's facility.
- g. The oil water separator shall be by one of the following or approved equal:
 - 1) Highland Tank.
 - 2) Mercer International
 - 3) Oil Water Separator Technologies, LLC.
 - 4) Southern Tank.
- h. Provide the tank with all openings in locations and of sizes and arranged as shown on the plans and elevations, and the following nozzle schedule:

Description	Size	Location	Remarks
Manway	24" x 2	Cylinder (Top)	w/ cover and bolts, and manway extension
Inlet	6"150#	End plate	w/internal pipe
Leak Detection	2"FNPT	Cylinder (Top) (outer tank only)	
Interface Detector	2" 150#	Cylinder (Top)	
Normal Vent	2"FNPT	On Manway Ext	
Oil Outlet	4" 150#	Cylinder (Top)	
Water Outlet	6" 150#	End plate	With internal down comer pipe.

- B. Accessories:
 - 1. Oil/water interface detector.
 - 2. Corrugated plate coalescing elements.
 - 3. Mesh coalescing elements.
 - 4. Grade level manway extensions.
 - 5. Leak detection sensor for interstitial space.
 - 6. Level transmitter.
- C. Level And Leak Monitoring Equipment
 - 1. Oil/water separator will be connected to the tank monitoring controller. Refer to specification 23 11 26, Fuel Piping and Equipment.

PART 3 - EXECUTION

3.1 TANK INSTALLATION

- A. Underground tanks shall be installed as recommended by the tank manufacturer and approved by the contractor. The tanks shall be installed in accordance with the manufacturer's installation procedure in effect at the time of installation. Underground

tanks will be provided with sufficient ballast, and equipment tie downs to prevent the tank from becoming buoyant.

- B. Contractor to perform air test on the interstitial space of each tank prior to installation underground. Follow manufacturer's recommended procedures.
- C. Repair or spark test damaged areas of oil/water separator coating in accordance with manufacturer's instructions in Highland Tank's Oil/Water Separator Users' Manual.
 - 1. Spark Testing: Set holiday detector at a minimum of 15,000 volts.
 - 2. Coat holidays, damaged oil/water separator(s) coating, and exposed steel surfaces in accordance with manufacturer's instructions with compatible coating furnished by separator manufacturer.
 - 3. Retest holidays at 15,000 volts.
- D. Ensure oil/water separator(s) excavation is free from materials that may cause damage to oil/water separator(s) or separator's coating.
- E. Do not allow foreign matter to be introduced into excavation or backfill during oil/water separator(s) installation.

3.2 SUBMITTALS

- A. The Contractor shall provide three (3) sets of submittals including manufacturer's product data sheets for all components, tank outline drawings, tank internals, installation instructions, certificates of compliance with testing requirements, engineering data, and equipment specifications.
- B. The Contractor will be responsible to obtain the necessary permits.

3.3 WARRANTY

- A. The tank manufacturer shall furnish in writing a ten (10) year warranty against external corrosion of the underground tank.
- B. Manufacturer shall warrant its products to be free from defects in material and workmanship for a period of one (1) year from the date of shipment.

END OF SECTION

SECTION 23 00 50

GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.1 SCOPE

- A. Work to be provided under this Division of Specifications includes furnishing, delivering, unloading, handling, erecting, adjusting, and testing of materials and equipment required for mechanical systems, complete in all respects as indicated on Contract Drawings and in Specifications.
- B. Work covered by this Division includes, but is not limited to:
 - 1. Piping systems.
 - 2. Commissioning startup and testing of equipment and systems.
 - 3. Supply and installation (as noted) of equipment on the Contract Drawings and in the Specifications.
- C. As-Built Documentation: Furnish to Owner revisions to Drawings which indicate changes made during construction to resolve space conflicts and/or to meet space and code requirements

1.2 SUBMITTALS

- A. Submit under provisions of Division 1 and 2.
- B. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.
- C. Mark dimensions and values in units to match those specified.

1.3 PROJECT/SITE CONDITIONS

- A. Install Work in locations shown on Drawings, unless prevented by Project conditions.
- B. Carefully examine existing conditions, including existing mechanical, civil, structural, and electrical work, if applicable, and compare Drawings with existing conditions.
- C. Submittal of a bid shall indicate subcontractor has examined site and Drawings and has included all costs associated with the required work. Additional compensation will not be paid to the subcontractor for his failure to visit the job site, review Drawings, and completely identify the work required. Bid shall include the cost for any additions to the work scope identified by the subcontractor during the site visit and review of the Bid Documents.

- D. Review peculiarities and limitations of work space available for installation of materials and equipment furnished and installed under the Contract. Installed work shall be easily accessible for operation and maintenance.

1.4 SEQUENCING/SCHEDULING

- A. Prepare and maintain work schedules which interface with schedules from other subcontractors.
- B. Inform Owner and other subcontractors of construction delays which may adversely affect the work schedules. Take corrective actions necessary to prevent work slippages.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Unless otherwise specified, provide only new, first grade equipment and materials that comply with requirements of this Specification and applicable Standards. Where conflicts arise within these Specifications or Drawings regarding same or similar equipment, the more stringent specification will apply.
- B. Furnish, if requested, satisfactory evidence of kind and quality of materials proposed for use.
- C. Similar items of material and equipment shall be product of same manufacturer.

2.2 SUBSTITUTION

- A. Use only materials and equipment of manufacturers listed in this Specification. Where the term "or equal" is used, obtain approval from Owner before substitution is made.

PART 3 - EXECUTION

3.1 GENERAL

- A. Drawings:
 - 1. For purposes of clarity and legibility, Drawings are essentially diagrammatic and, although size and location of equipment are drawn to scale wherever possible, the subcontractor shall make use of all data in Contract Documents to verify this information.
 - 2. Drawings indicate required size and points of termination of pipes and conduits and suggest proper routes to conform to structure, avoid obstructions, and preserve clearances. However, it is not intended that Drawings indicate all necessary offsets, and it shall be the work of the subcontractor to make installation in such a manner as to conform to structure, avoid obstructions, preserve headroom, and keep openings and passageways clear.

3.2 PIPING INSTALLATION

- A. Install piping as close as possible to locations shown on Drawings. Notify Owner when any conflicts arise during erection of piping. Make no improvisations or field changes without Owner's written approval.
- B. Piping shall be installed to pass inspections by Owner's construction inspection department, state and federal authorities and insurance company having jurisdiction. Any changes or additions which may be necessary to obtain such inspections and approval shall be made by the subcontractor as part of this Contract and without additional cost to Owner.
- C. Drainage: Space pipe supports for process lines requiring draining to permit normal pitch of pipe lines with deflection maintained at a minimum. In no case shall support spacing for carbon steel pipe be more than spans specified herein.
- D. Expansion: Turns, expansion loops or long offsets: Provided wherever necessary to allow for expansion of piping. Remove and replace broken pipe or fittings due to stiff connections at subcontractor's expense.
- E. Spans: Span per the following table unless otherwise noted. The following table shows recommended horizontal spans for different pipe sizes. Note that addition of loads, as for valves, fittings and accessories, will affect span length or require additional support. Provide supports at changes of direction, but at locations that will not limit system flexibility. In general, have horizontal pipe located 3 feet or more above a floor from above; support pipe within 3 feet of floor with stands or piers. Provide hangers or supports at every joint for cast iron pipe. Support plastic pipe as recommended by piping manufacturer, as a minimum, and continuously support where indicated by ambient or operating conditions and material characteristics.

MAXIMUM SPAN IN FEET

<u>Nominal Pipe or Tubing Diameter</u>	<u>Standard or X-tra Heavy Steel</u>	<u>Copper Tubing</u>
1/4" thru 3/4"	7	5
1"	7	6
1-1/4"	7	7
1-1/2"	9	8
2"	10	8
2-1/2"	11	9
3"	12	10
3-1/2"	13	11
4"	14	12
5"	16	13
6"	17	14
8"	19	16
10"	22	

3.3 SURFACE FINISH

- A. Clean all parts free of extraneous materials. Smooth external surfaces and round or bevel all edges where practical.

3.4 INTERCHANGEABILITY

- A. Corresponding units and replaceable assemblies, sub-assemblies, and parts having same part number shall be physically and functionally interchangeable as complete items without modification thereto, or of other articles with which items are used. Where dimensions, ratings, characteristics, etc., are not specified, manufacturer's design limits shall be used to determine compliance with foregoing.

3.5 PAINTING

- A. Painting of all pipes, ductwork, fittings, equipment, and related components shall be performed in accordance with Section LHC 09900 except as specifically required under this Division.
- B. Touch up factory painted equipment that has been damaged during handling or installation. Feather damaged area and apply primer plus two fresh coats to match existing finish.

3.6 INCIDENTAL WORK

- A. Owner's approval is required before cutting any part where strength or appearance of finished work is involved. Finish in a neat manner to match existing work.

3.7 INSPECTIONS

- A. Give Owner seven days' notice of tests and inspections.
- B. Conduct tests to satisfaction of Owner.
- C. Make site available at all times for inspection by Owner.
- D. In addition, the following formal inspections by Owner or authorized representative shall be conducted for each building or part of building and site:
 - E. Above floor work before being concealed or covered.
 - F. Final inspection after completion of work.
 - G. Additional inspections as may be deemed necessary by Owner.

3.8 FINAL ACCEPTANCE

- A. Completed work shall be in proper working order and clean. Leave premises and site in presentable condition, free of surplus materials and debris.

- B. Furnish necessary inspection reports, approvals, certificates, warranties, labels, stamps, or nameplates required by specific standards cited in individual specifications.

END OF SECTION

SECTION 23 11 26

FUEL PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SCOPE

- A. The following provisions generally define materials and methods to be used in fabrication, erection, and installation of piping systems and components.
- B. This section also defines requirements for the following fueling equipment:
 - 1. Submersible pumps
 - 2. Fuel Dispensers
 - 3. Tank Inventory Management Equipment.
 - 4. Vehicle Management Equipment.
 - 5. DEF (Diesel Exhaust Fluid) Tank and dispenser.

1.2 APPLICABLE PUBLICATIONS

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 30A – Code for Motor Fuel Dispensing Facilities and Repair Garages
- B. International Code Council (ICC)
 - 1. IFC - International Fire Code, 2018, including Lake Havasu City amendments.

1.3 APPLICABLE LOCAL AND STATE REGULATIONS

- A. Arizona Administrative Code

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Receive and handle materials in accordance with Section LHC 01600.
- B. Do not allow stainless steel or copper alloys to contact carbon steel.
- C. Use proper tools, equipment and procedures to handle pipe.
- D. Do not damage pipe coatings, wrapping, or linings.
- E. Repair or replace damaged pipe coatings, wrappings, or linings in accordance with manufacturer's instructions or as required to restore original protection.
- F. Tag, stencil, or otherwise permanently identify materials and specialty items.
- G. Store pipe, piping materials, and equipment to prevent deterioration while in storage.

- H. Store loose materials such as fittings, gaskets, bolts, nuts, small valves, traps, and specialties in adequate number of bins to properly separate.

1.5 QUALITY

- A. Thoroughly trained and experienced workers familiar with the requirements and procedures shall be used. They shall possess the appropriate skills, experience, competence and required certification to complete the work in accordance with the provisions of these specifications.
- B. Piping support systems shall be designed, and Shop Drawings prepared and sealed by a Registered Professional Engineer in the state of Arizona.

1.6 QUALITY ASSURANCE

- A. Qualifications for pipe welding:
 - 1. Qualify welders and bonders using procedures cited in ASME B31.3
 - 2. Comply with welder qualifications per ASME Boiler and Pressure Vessel Code, Section IX, and the Arizona Boiler Code except as modified by ASME B31.3.
 - 3. Renew performance qualification of welder if welder has not used procedure for 3 months or more, or if welder has been employed on different process for 6 months or more. Refer to ASME Section IX for additional items affecting requalification.
 - 4. Renew performance qualification of brazer if brazer has not used specific brazing process for a period of 6 months or more. Refer to ASME Section IX for additional items affecting requalification.
 - 5. Renew bonding performance qualification when bonder has not used specific bonding process for a period of 3 months or more.

1.7 DESIGN REQUIREMENTS FOR PIPE SUPPORTS

- A. General:
 - 1. Design, size, and locate piping support systems throughout facility, whether shown or not.
 - 2. Meet requirements of Manufacturer's Standardization Society (MSS) SP 58 and ASME B31.1 or as modified by this section.
- B. Pipe Support Systems:
 - 1. Design pipe support systems for gravity and thrust loads imposed by weight of pipes or internal pressures, including insulation and weight of fluid in pipes.
 - 2. Seismic loads in accordance with governing codes.
 - 3. Wind loads in accordance with governing codes.
 - 4. Maximum Support Spacing: In accordance MSS SP 58 Table 3 and Table 4.
- C. Anchoring Devices: Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor support, to withstand shear and pullout loads imposed by loading and spacing on each support.

1.8 SUBMITTALS

- A. The Contractor shall provide three (3) sets of submittals including manufacturer's product data sheets for all components, tank outline drawings, platform drawings, installation instructions, certificates of compliance with testing requirements, engineering data, and equipment specifications.
- B. The Contractor will be responsible to obtain the necessary permits.
- C. Comply with the following submittal schedule:

ITEM NO.	SUBMITTAL REQUIREMENT	AS INDICATED
22 12 05-001	Fabrication and Test Procedures, including: <ul style="list-style-type: none"> • Weld preparation • Radiographic examination • Other non-destructive examinations • Testing procedures • Cleaning Procedures 	In accordance with Section 01330
-002	Performance data, pump performance curves based on liquid to be pumped, with rated condition point marked, also showing performance with minimum and maximum impeller diameter for casing.	In accordance with Section 01330
-003	Installation and Operations Manual (IOM), including a list of any special tools needed.	In accordance with Section 01330
-004	Outline Drawing showing assembled pump, driver, auxiliary systems and baseplate, with dimensions and nozzle sizes.	In accordance with Section 01330
-005	Spare parts with itemized price list.	In accordance with Section 01330
-006	Cross sectional drawing with Bill of Materials (BOM).	In accordance with Section 01330
-007	Piping shop drawings, including pipe support systems.	In accordance with Section 01330
-008	Piping material, pipe fittings, and valve submittals.	In accordance with Section 01330
-009	Equipment cut sheets, and technical data on all instruments and accessories.	In accordance with Section 01330

PART 2 - PRODUCTS

2.1 ABOVEGROUND PIPING

- A. Pipe material:

1. For piping 2” and smaller, ASTM A53, Gr.B sch.80 with plain ends. Use socket weld fittings, and valves.
 2. For piping larger than 2”, ASTM A53, Gr.B sch. 40 with beveled ends. Use welded fittings, and 150# raised faced flanges.
- B. Valves:
1. For piping 2” and smaller, Ball valve: CS, SW, NIBCO – KM-590-CS-R-66-FS-LL or equal.
 2. For piping larger than 2”, Ball valve: 150 lb RF, CS body. NIBCO F-515-CS-F-66-FS or equal; or Gate valve. 150 lb. RF, CS body, Crane-47XUF or equal.
 3. Check valves: 150 lb. RF flanged CS body, wafer style.
- C. Bolts
1. Alloy stud bolts, ASTM A 193 Grade B7, ANSI B18.2.1 w/heavy hex nuts, ASTM A 194 Grade 2H, ANSI B18.2.2.
- D. Gaskets
1. 1/8 inch thick graphite sheet gasket, Klingersil SLS, or equal

2.2 UNDERGROUND PIPING

- A. Pipe material: UL Listed, PVDF double wall flexible piping system. Piping to comply with UL 971.
- B. Provide transition sump to accommodate transitioning from aboveground steel piping to underground double containment piping. Provide leak detection level switch in sump.

2.3 FUEL DISPENSE AND MANAGEMENT

- A. Fuel Pumps to serve island dispensers:
 1. Submersible.
 2. 3/4-horsepower, fixed speed.
 3. Rated at 60 gpm at 20 ft of head.
 4. Include line leak detector, check valve, and relief valve on pump discharge.
- B. Vehicle Management System:
 1. Owner will provide stand-alone kiosk to allow authorized users to access the fuel dispensers.
 2. Owner’s representative will install kiosk and fully integrate kiosk with new island fuel dispensers, DEF dispensers, and tank mounted red diesel dispenser.
- C. Fuel Dispensers:
 1. Provide new two hose mechanical fuel dispensers including containment sump and shear valve.
 2. Quantity: 4 diesel dispensers and 4 gasoline dispensers. This is the total for both the public works site, and the public safety site.
 3. Dispensers shall accommodate pulse type sensors to communicate with vehicle management system.

2.4 TANK INVENTORY MANAGEMENT SYSTEM

- A. At each site, provide one tank inventory management system, that will monitor fuel tank level instruments, tank leak detection devices, and sump leak detection devices.
- B. Controller: The controller shall be microprocessor-based, and shall be designed and constructed with modular architecture easily permitting either factory or field upgrades and servicing. Configuration and set-up data shall be maintained in non-volatile memory. Real-Time clock and non-critical log data, such as inventory, delivery, alarm, theft, error, and leak reports shall be maintained in battery backed non-volatile memory. System shall include digital display for viewing tank information and LED indicators for the alarm conditions. The RS-232 serial port shall be standard for communications with a local PC computer. Provide Ethernet network interface card for LAN/WAN connections.
- C. Console: The console shall be housed in a lockable wall mounted NEMA 4X enclosure. The console shall include microprocessor board, probe/sensor card, power supply, control I/O and communications interfaces. Front panel display shall include audible and visual alarms, and pushbutton controls. Displays shall include product gross or net, percent of capacity, 90/95/100% ullage, product and water level, product temperature, and product type. The system shall be independently third party certified for UST petroleum storage tanks and have the capability to conduct a static volumetric tank tightness test to an accuracy of 0.2 GPH for monthly monitoring and 0.1 GPH for annual precision testing, with minimum test times of two hours and eight hours respectively. System shall be capable of performing both tests with as little as 20% of tank capacity.

2.5 BULK DEF TANK AND DISPENSER

- A. Provide complete fully pre-wired and assembled, packaged DEF storage and dispense system including insulated tank, heat trace, pump, pulse flow meter, and instrumentation.
- B. Tank:
 - 1. Tank Material HDPE (High Density Polyethylene)
 - 2. Capacity: 400 gallons (Nominal).
 - 3. Provide 110% secondary containment.
 - 4. Provide 400 W heater.
 - 5. Provide tank insulation.
- C. Accessories:
 - 1. Pump: 6gpm, 110V.
 - 2. Hose 3/4" diameter x 25 ft long with hose reel and stainless-steel nozzle.
 - 3. 2" fill connection
 - 4. Tank liquid level gauge.
 - 5. Pulse flow meter.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation:

1. Route piping by shortest run consistent with good installation practice, clearance requirements, and expansion and flexibility provisions.
2. Arrange piping to facilitate support of piping and ease of removal for inspection or servicing.
3. Ensure roadways, and maintenance areas are clear of piping.
4. Space pipe supports and arrange reducers to allow system to be drained at low points and vented at high points. Provide 1" valved vents at high points, and drains at low points.
5. Avoid installing pockets in pipe lines.

B. Fabrication:

1. Use proper tools, equipment, and procedures to lay pipe.
2. Plug openings when work is not being performed on pipe, including at end of work day.
3. Provide for expansion, with pipe loops, where possible.
4. Make changes in size and direction of piping with fittings. Do not use miter fittings, face, or flush bushings, close nipples or street elbows, except as shown on Drawings.

C. Fittings:

1. Do not bend, spring, or deform piping to prepare joints for fitting connections.
2. Do not use bushings except where specifically approved.

D. Screwed Connections:

1. Use clean cut screwed threads with no stripping, or burrs from cutting or threading, in accordance with ANSI B1.20.1.
2. Use only dies that are new, sharp, and properly designed for piping material.
3. Clean threads on pipe and fittings thoroughly of cuttings, dirt, oil, or other foreign matter, immediately before installation.
4. Liberally coat male threads with thread lubricant or TFE thread tape and make up piping sufficiently for threads to seize.
5. Do not mar or damage pipe and fitting surfaces.
6. Use reducing fittings for reducing in line size.
7. Do not use bushings or close nipples.

3.2 DEF TANK INSTALLATION

- A. DEF tanks shall be installed in accordance with the manufacturer's installation procedure in effect at the time of installation. DEF tanks shall be placed on the concrete fuel island in accordance with the tank manufacturer's approved design.

3.3 SUBMITTALS

- A. The Contractor shall provide three (3) sets of submittals including manufacturer's product data sheets for all components, tank outline drawings, platform drawings, installation instructions, certificates of compliance with testing requirements, engineering data, and equipment specifications.
- B. The Contractor will be responsible to obtain the necessary permits.

3.4 INSPECTION AND EXAMINATION OF PIPING WELDS

- A. General: ASME B31.3 distinguishes between “inspection” and “examination”.
- B. Subcontractor shall inherit all costs associated with inspections and examinations.
- C. All welds visually inspected by Independent Certified Inspector. Inspector shall be pre-approved by Owner. Radiograph 10% of the welds on all primary containment fuel piping. No radiograph is required for welds on secondary containment fuel piping or CAS piping.
- D. Welding Examination:
 - 1. Perform examination and inspections in accordance with written procedure that conforms to ASME B31.3.
 - 2. Certify records of examination procedures employed, showing dates and results of procedure qualifications.
 - 3. Maintain records and make available to Inspector.
 - 4. Plan radiograph inspections at a minimum at the beginning of welding and at the completion of welding.

3.5 TESTING

- A. Perform hydrotest in accordance with ASME B31.3 at 1.5 times the system design pressure on all pressure piping. Hold test pressure for 60 minutes. Fully drain, and dry piping prior to putting system in service.

3.6 WARRANTY

- A. The tank manufacturer shall furnish in writing a thirty (30) year warranty.

END OF SECTION

SECTION 23 13 23

ABOVE GROUND FUEL STORAGE TANKS

PART 1 GENERAL

1.1 SCOPE

- A. This section specifies the requirements for aboveground storage tanks (ASTs) used for fuel storage.

1.2 APPLICABLE PUBLICATIONS

- A. National Fire Protection Association (NFPA):
 - 1. NFPA 30A – Code for Motor Fuel Dispensing Facilities and Repair Garages
- B. Underwriters Laboratories, Inc. (UL):
 - 1. UL 2085 – Standard for Protected Aboveground Tanks for Flammable and Combustible Liquids.
- C. International Code Council (ICC)
 - 1. IFC - International Fire Code, 2018, including Lake Havasu City amendments.

1.3 APPLICABLE LOCAL AND STATE REGULATIONS

- A. Arizona Administrative Code

1.4 DESCRIPTION OF WORK

- A. Furnish all labor, materials, tools, equipment and incidentals required to install aboveground fuel storage tanks and fuel systems as shown on the drawings and described in the specifications.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Receive and handle materials in accordance with Section LHC 01600.
- B. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
- C. General:
 - 1. Clean each vessel thoroughly inside and outside to remove grease, weld splatter, scale, slag, rust, and other foreign matter.
 - 2. To prevent damage during shipment, protect flange facings with securely fastened covers. Tape/seal the cover and flange for protection from water.
 - 3. Provide steel or steel-reinforced timber construction shipping saddles contoured to fit with sufficient contact surface to prevent damage or permanent distortion to the vessel assembly. Provide a minimum contact arc length of 120 degrees.

Provide auxiliary removable spiders, struts, bands, and/or stiffening rings where required to reinforce relatively thin-shell and/or heavy vessels to prevent damage during handling and transporting.

- D. Marking:
 - 1. Clearly identify vessels or sections of vessels by painting or dye stenciling the purchase order number and vessel number in a conspicuous location on the shell, head, or support.
- E. Store materials according to manufacturer instructions.

1.6 QUALITY

- A. Thoroughly trained and experienced workers familiar with the requirements and procedures shall be used. They shall possess the appropriate skills, experience, competence and required certification to complete the work in accordance with the provisions of these specifications.
- B. Piping support systems shall be designed, and Shop Drawings prepared and sealed by a Registered Professional Engineer in the state of Arizona.

1.7 SUBMITTALS

- A. The Contractor shall provide three (3) sets of submittals including manufacturer's product data sheets for all components, tank outline drawings, platform drawings, installation instructions, certificates of compliance with testing requirements, engineering data, and equipment specifications.
- B. The Contractor will be responsible to obtain the necessary permits.
- C. Comply with the following submittal schedule:

ITEM NO.	SUBMITTAL REQUIREMENT	AS INDICATED
23 13 23-001	Description of QA/QC procedures and quality program.	In accordance with Section 01330
-002	Tank design criteria, including tank dimensions, materials of construction, design pressure and temperature, hydro test pressure.	In accordance with Section 01330
-003	Materials of construction for bolting, gaskets and accessory items.	In accordance with Section 01330
-004	Equipment weight empty and weight full of water.	In accordance with Section 01330
-005	Shell plate and head thicknesses.	In accordance with Section 01330

-006	Tank fabrication drawings, including dimensional and fabrication details and shell and head materials and thickness.	In accordance with Section 01330
-007	Nozzle details showing types, sizes, and locations.	In accordance with Section 01330
-008	Internal component details including components designed, fabricated and furnished by any third party manufacturers.	In accordance with Section 01330
-009	Attachment details including stairs, ladders, platforms, railings and supplementary details required for fabrication.	In accordance with Section 01330
-010	External and internal painting/coating materials, preparation and application procedures.	In accordance with Section 01330
-011	Anchor bolt details, including quantity, material, diameter, length, and required embedment depth. Provide anchor bolt template for bolts that are cast-in-place.	In accordance with Section 01330
-012	Complete design calculations required by the code that are stamped/sealed by an engineer registered in the state of project jurisdiction.	In accordance with Section 01330
-013	Fabrication and Test Procedures, including: <ul style="list-style-type: none"> • Weld preparation • Radiographic examination • Other non-destructive examinations • Testing procedures • Cleaning Procedures 	In accordance with Section 01330
-014	Color sample of exterior finish for Owner approval	In accordance with Section 01330
-015	Recommended installation procedures.	In accordance with Section 01330
-016	Test results/certifications	In accordance with Section 01330
-017	Compliance statement to Contract documents with any exceptions noted.	In accordance with Section 01330

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All materials and equipment used in this project shall be new and shall meet or exceed the following specifications.
- B. Steel Plate:
 - 1. All steel plate used in the construction of the AST and related accessories shall conform to ASTM A36.

- C. Steel Sheet:
 - 1. All steel sheet used in the construction of the AST and related accessories shall conform to ASTM A570 Grade 33.
- D. Pipe and Tubing:
 - 1. All pipe used for fuel tank and piping shall conform to ASTM A120 or ASTM A53 Grade B. All tubing used shall conform to ASTM A179. All couplings, unions, elbows, tees, and fittings used shall conform to the ASTM standard appropriate for the pipe or tubing being connected.

2.2 EQUIPMENT

- A. Double Wall Aboveground Storage Tank:
 - 1. The AST shall be constructed with materials conforming to the specifications found in Section 2.1 and the entire assembly shall be listed by a nationally recognized testing laboratory. The AST shall be constructed by a manufacturer that has been regularly engaged in the manufacture of UL Listed Protected Aboveground Tanks for Flammable and Combustible Liquids. The AST shall be designed and constructed in conformance with NFPA 30A. It shall consist of a steel tank and shall meet or exceed the following minimum specifications:
 - a. The tank shall be constructed of steel plate not less than 3/16" thick for tanks with a total capacity of 4,000 gallons or less and not less than 1/4" for tanks with a total capacity over 4,000 gallons. However, in no case shall the tank be thinner than specified by UL Standard 2085.
 - b. The external surfaces of the tank, nozzles and supports shall be protected from the elements with two coats of a high performance industrial epoxy and urethane coating system. Finish color shall be white.
 - c. Except for the vent riser pipe and access assembly, if any, the tank shall be fabricated and assembled at the manufacturer's facility.
 - d. Provide the tank with all openings in locations and of sizes and arranged as shown on the plans and elevations, and the attached tank data sheets.
- B. Tank Access Platform and Ladder:
 - 1. Provide the tank with a full height ladder on one side, to be used to reach an access platform across the top of the tank. The access platform shall provide access to the piping connections and the gauging opening on the top of the tank. Provide an OSHA approved handrail on all sides of the access platform.
 - 2. Tank shall be provided with an internal ladder.
- C. Tank Supports:
 - 1. Provide the tank with two tank supports, saddle type welded to the bottom radius of the tank. Each support is to have two anchor plates, one at each end of the support. Anchor plates are to have at least one anchor bolt hole each. Bolt holes on one end to be slotted.
 - 2. Seismic Design Criteria:
 - a. Importance Factor, I: 1.0
 - b. Site Class: C

c. Spectral Response Accelerations:

- | | | |
|----|------|------|
| 1) | Ss: | 0.25 |
| 2) | S1: | 0.10 |
| 3) | Sms: | 0.30 |
| 4) | Sm1: | 0.17 |
| 5) | Sds: | 0.20 |
| 6) | Sd1: | 0.11 |

d. Seismic Design Category: A

D. Tank Signage:

1. Each tank shall be provided with signs affixed to the tank exterior in the proper location and configuration to meet applicable code requirements. As a minimum provide OSHA/NFPA Hazard Communication label on Tank. Label the tank with contents "GASOLINE", or "DIESEL".

E. Accessories:

1. Tank level gauge.
2. Fill tube on tank inlet.
3. Pressure/vacuum vent valve (on gasoline tanks), or rain cap (on diesel tanks).
4. Emergency vent.
5. Overfill protection valve on inlet.
6. High level switch, set to 90% of tank capacity.
7. Leak detection for interstitial space (pop-up type).
8. Solenoid fuel shutoff valve.
9. Fuel link strainer.
10. Class B fire extinguisher.
11. Remote fill box with spill containment.

- F. Refer to section 23 11 26 for fuel piping, additional accessories, and tank leak detection equipment.

PART 3 - EXECUTION

3.1 TANK INSTALLATION

- A. Aboveground tanks shall be installed as recommended by the tank manufacturer and approved by the contractor. The tanks shall be installed in accordance with the manufacturer's installation procedure in effect at the time of installation. Aboveground tanks shall be placed on a reinforced concrete slab in accordance with the tank manufacturer's approved design.

3.2 SUBMITTALS

- A. The Contractor shall provide three (3) sets of submittals including manufacturer's product data sheets for all components, tank outline drawings, platform drawings, installation instructions, certificates of compliance with testing requirements, engineering data, and equipment specifications.

B. The Contractor will be responsible to obtain the necessary permits.

3.3 FUEL STORAGE TANKS

A. Contractor shall provide aboveground steel fuel storage tanks as specified in the attached tank data sheets and as shown on the drawings. Included with the delivery of each tank shall be the manufacturer's certification of listing and compliance with NFPA 30A and/or specified UL standards.

B. The completed installation shall comply with the requirements of NFPA 30A and the conditions of approval stated on the permits. The tank(s) shall carry a label from a nationally recognized independent test laboratory stating that fire, hose steam, ballistics and impact tests were all performed on a single fully-assembled test tank.

3.4 WARRANTY

A. The tank manufacturer shall furnish in writing a thirty (30) year warranty.

3.5 ATTACHMENTS

A. Tank Data sheets.

ATTACHMENT A - TANK DATA SHEETS

Equipment Name		Gasoline Tank	
Quantity		2 (1-Public Works, 1- Public Safety)	
DESIGN CRITERIA			
Operating Temperature		Ambient	
Operating Pressure		Atmospheric	
Specific gravity		0.75	
Viscosity, cP		0.8 @ 60 deg F	
Location (Indoor/Outdoor)		Outdoor	
DETAILED CRITERIA			
<u>Tank Details</u>			
Volume, normal (Gallons)		12,000 Gallons	
Tank diameter (ft-in)		8'-0" (inner), 8'-6" (outer)	
Length, straight side (ft-in)		32'-0" (inner), 32'-7" (outer)	
Minimum corrosion allowance (in)		N/A	
Orientation (horizontal or vertical)		Horizontal	
Head type		Flat	
Supports		2 saddle supports	
Tank Type		UL-2085 Protected Double Wall Tank	
NOZZLE SCHEDULE			
Description	Size	Location	Remarks
Manway	24"	Cylinder (Top)	w/internal ladder. w/ cover and bolts
Inlet	3" 150#	Cylinder (Top)	w/internal pipe, anti-syphon/ shutoff valve, and ¼"thk.x 6"dia. Striker plate
Leak Detection	*2" NPT	Cylinder (Top) (outer tank only)	
Emergency Vent	8" 150#	Cylinder (Top) (outer tank only)	
Emergency Vent	8" 150#	Cylinder (Top)	
Level Indicator	3" 150#	Cylinder (Top)	
Normal Vent	*4" NPT	Cylinder (Top)	w/pressure/vacuum vent
Pump	4" 150#	Cylinder (Top)	Provide submersible pump.
ADDITIONAL COMMENTS		* - Tank Manufacturer to confirm size	

ATTACHMENT A - TANK DATA SHEETS

Equipment Name	Diesel		
Quantity	2 (1-Public Works, 1- Public Safety)		
DESIGN CRITERIA			
Operating Temperature	Ambient		
Operating Pressure	Atmospheric		
Specific gravity	0.85		
Viscosity, cP	2.5 @ 60 deg F		
Location (Indoor/Outdoor)	Outdoor		
DETAILED CRITERIA			
<u>Tank Details</u>			
Volume, normal (Gallons)	12,000 Gallon (10,000 / 2,000)		
Tank diameter (ft-in)	8'-0" (inner), 8'-6" (outer)		
Length, straight side (ft-in)	32'-0" (inner), 32'-7" (outer)		
Minimum corrosion allowance (in)	N/A		
Orientation (horizontal or vertical)	Horizontal		
Head type	Flat		
Supports	2 saddle supports		
Tank Type	UL-2085 Protected Double Wall Tank		
Other	Two compartment tank		
NOZZLE SCHEDULE (10,000 gallon compartment)			
Description	Size	Location	Remarks
Manway	24"	Cylinder (Top)	w/internal ladder. w/ cover and bolts
Inlet	3" 150#	Cylinder (Top)	w/internal pipe, anti-syphon/ shutoff valve, and 1/4"thk.x 6"dia. Striker plate
Leak Detection	*2" NPT	Cylinder (Top) (outer tank only)	
Emergency Vent	8" 150#	Cylinder (Top) (outer tank only)	
Emergency Vent	8" 150#	Cylinder (Top)	
Level Indicator	3" 150#	Cylinder (Top)	
Normal Vent	*	Cylinder (Top)	w/rain cap
Pump	4" 150#	Cylinder (Top)	Provide submersible pump.

ATTACHMENT A - TANK DATA SHEETS

NOZZLE SCHEDULE (2,000 gallon compartment)			
Inlet	3" 150#	Cylinder (Top)	w/internal pipe, anti-syphon/ shutoff valve, and 1/4"thk.x 6"dia. Striker plate
Emergency Vent	8" 150#	Cylinder (Top)	
Normal Vent	*	Cylinder (Top)	w/raincap
Pump	4" 150#	Cylinder (Top)	Tank mounted fuel pump with mechanical readout, and 20 ft of hose.
ADDITIONAL COMMENTS		* - Tank Manufacturer to confirm size	

ATTACHMENT A - TANK DATA SHEETS

Equipment Name		Diesel – Police Station	
Quantity		1	
DESIGN CRITERIA			
Operating Temperature		Ambient	
Operating Pressure		Atmospheric	
Specific gravity		0.85	
Viscosity, cP		2.5 @ 60 deg F	
Location (Indoor/Outdoor)		Outdoor	
DETAILED CRITERIA			
<u>Tank Details</u>			
Volume, normal (Gallons)		2,000	
Width (ft-in)		6’-4” (inner), 6’-10” (outer)	
Length (ft-in)		10’-8” (inner), 11’-3” (outer)	
Height (ft-in)		8’-0” (inner), 8’-6” (outer)	
Minimum corrosion allowance (in)		N/A	
Orientation (horizontal or vertical)		Horizontal	
Tank Configuration		Rectangular	
Supports		Structural base	
Tank Type		UL-2085 Protected Double Wall Tank	
NOZZLE SCHEDULE			
Description	Size	Location	Remarks
Inlet	3”CamLok fitting	Top	w/spill containment, internal pipe, anti-syphon/ shutoff valve, and ¼”thk.x 6”dia. Striker plate.
Leak Detection	*	Top (outer tank only)	
Emergency Vent	6” 150#	Top (outer tank only)	
Level Indicator	2” Thrd	Top	
Normal Vent	*	Top	w/rain cap
Emergency Vent	6” 150#	Top	
Pump	2” Thrd	Top	Tank mounted fuel pump with mechanical readout, and 20 ft of hose. Provide means to lock dispenser to prevent unauthorized use.
ADDITIONAL COMMENTS		* - Tank Manufacturer to confirm size	

END OF SECTION