



EXPIRES 9/30/2023



EXPIRES 6/30/2025

LAKE HAVASU CITY

INVITATION TO BID

CONTRACT DOCUMENTS

AND

TECHNICAL SPECIFICATIONS

Wash Crossing Improvements

EL Dorado Avenue N.

B24-PW-105007-500392

LAKE HAVASU CITY
CONTRACT DOCUMENTS
VOLUME 1

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LHC 05120 - MISCELLANEOUS STEEL

The remaining applicable specifications can be accessed at:

<https://www.lhcaz.gov/public-works/engineering>

Please scroll down to the bottom of the webpage and notice there are clickable page numbers to access all specification documents.

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DIVISION I

BID AND CONTRACT DOCUMENTS

SECTION 00020
NOTICE INVITING BIDS
Lake Havasu City

PROJECT NO.: B24-PW-105007-500392

PROJECT NAME: Wash Crossing Improvements EL Dorado Avenue N.

PRE-BID MEETING: A **NON-MANDATORY Pre-Bid Meeting** will be held at 900 London Bridge Road, LAKE HAVASU CITY, AZ. Room OpsA101 at 10:00 AM, Arizona Time, on Monday, August 28, 2023.

BID DUE DATE: September 13, 2023

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

PROJECT DESCRIPTION:

The project is located at the crossing of El Dorado Wash and El Dorado Ave North. Improvements consist of six reinforced concrete box culverts, inlet/outlet channels, inlet/outlet cutoff walls, safety railing, four catch basins, drainage piping, roadway, gutter, sidewalk, and water line piping.

QUESTIONS: All questions that arise relating to this solicitation shall be directed in writing to purchasing@lhcaz.gov with a copy to engineeringinfo@lhcaz.gov. To be considered, written inquiries shall be received at the above-referenced email address by September 04, 2023, 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://bluejeans.com/2330864044?src=calendarLink>

Meeting ID: 233 086 4044

Phone Dial-in

+1.408.740.7256 (US (San Jose))

+1.888.240.2560 (US Toll Free)

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.

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.

For technical information, contact Shawn M. Clarke, P.E., Civil Engineer/Project Manager, at Clarkes@lhcaz.gov with a copy to purchasing@lhcaz.gov.

BONDS:

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

Project Completion Date: 270 calendar days after Notice to Proceed.

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 HEARLD - August 15th, 2023 and August 22nd, 2023
ARIZONA BUSINESS GAZETTE - August 17th, 2023 and August 24th, 2023

**** 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 **Wash Crossing Improvements EL Dorado Avenue N., Project No. B24-PW-105007-500392** will be received by the **City Clerk's office, 2330 N. McCulloch Boulevard, Lake Havasu City, Arizona 86403 no later than 3:00 P.M., Arizona Time, September 13, 2023**, where said Bids will be publicly opened and virtually 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. 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.

4. 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 Class 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.

5. 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.

6. 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.

7. 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.

8. 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.

9. 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.

10. 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.

11. 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.

12. 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;

The number and scope of any conditions attached to the Bid; and;

The life cycle, maintenance, and performance of the equipment or product being offered.

13. 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.

14. 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 within **270 calendar days** 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
From More Than	To and Including	Calendar Day or Fixed Rate
2,000,000	5,000,000	1,070
5,000,000	10,000,000	1,420
10,000,000	---0---	1,780

15. 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.

16. ADDENDA AND INTERPRETATIONS

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

purchasing@lhcaz.gov with a copy to engineeringinfo@lhcaz.gov

Administrative Services Department, Procurement Division

Lake Havasu City

2330 McCulloch Blvd. North

Lake Havasu City, AZ 86403

Updated 10/23/2018

To be considered, written inquiries shall be received by the above-referenced contact by **September 04, 2023, 3:00 p.m. 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 five (5) 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.

17. 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.

18. 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.

19. 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.

20. 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:

Lake Havasu City, 2330 N. McCulloch Boulevard, Lake Havasu City, AZ 86403, 928.453.4188, <https://www.lhcaz.gov/budget-and-finance/bids-rfps>

Dodge Data & Analytics, 3315 Central Avenue, Hot Springs, AR, 71913, 871.375.2946, FAX: 501.625.3544, www.construction.com, dodge.bidding@construction.com

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

Performance Graphics Blueprinting, 4140 Lynn Drive, Suite 107, Fort Mohave, AZ, 86426, 928.763.6860, FAX 928.763.6835, prints@pgblueprinting.net

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

ISqFt, 3301 N 24th Street, Phoenix, AZ, 85016, 800.364.2059, FAX: 800.792.7508, www.isqft.com, arizonaplanroom@isqft.com

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

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

Arizona Builders Exchange, 1700 N. McClintock Drive, Tempe, AZ, 85281, (480) 227-2620, www.azbex.com, rkettenhofen@azbex.com

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

Construction Reporter, 4901 McLeod Rd NE #200a, Albuquerque, NM, 87102, 505.243.9793, FAX: 505.242.4758, www.constructionreporter.com, rebecca@constructionreporter.com

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

Shirley's Plan Service, 425 S. Plumer Ave, Tucson, AZ, 85719, 520.791.7436, FAX: 520.882.9208, www.shirleysplanservice.com, bids@shirleysplanservice.com

Construction Notebook Nevada, 3131 Meade Ave, Suite B, Las Vegas, NV, 89102-7885, 702.876.8660, FAX: 702.876.5683, www.constructionnotebook.com

The Blue Book Building & Construction Network, Jefferson Valley, NY 10535, 800.431.2584, www.thebluebook.com, info@thebluebook.com, tdizon@mail.thebluebook.com

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 "**Wash Crossing Improvements EL Dorado Avenue N., Project No. B24-PW-105007-500392**" 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 **Wash Crossing Improvements EL Dorado Avenue N., Project No. B24-PW-105007-500392** at the prices and on the terms and conditions herein contained.

We agree that the Contract Documents include Volumes I and II of the Contract Documents as well as the referenced documents.

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

		Enclosed
Section	Title	<u>✓</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.

Cooperative Use of Contract

This solicitation is being prepared by the City of Lake Havasu, Arizona ("City") for the use of the City. While this solicitation is for the use of the City, other eligible public agencies may have an interest in utilizing the resulting contract. After an award, and with the approval of the bidder, this solicitation may be utilized by eligible public agencies. Any such usage by other entities must be in accordance with the ordinance, charter and/or procurement rules and regulations of the respective political entity.

Please indicate below your acceptance or rejection regarding such participation of other governmental entities. Your response will not be considered a bid response requirement in awarding a contract. If you do not wish to grant such access to other eligible public agencies, please so state in your bid response below. In the absence of a statement to the contrary, the City will assume that you do wish to grant access to any contract that may result from this solicitation.

Bidder hereby grants _____, or does not grant _____, cooperative purchase access to other eligible public agencies.

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: _____

Email Address: _____

Seal - If bid by a Corporation:

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

Federal Tax ID No.: _____

**** END OF SECTION ****

SECTION 00310

BID SCHEDULE
LAKE HAVASU CITY

Wash Crossing Improvements
EL Dorado Avenue N.
B24-PW-105007-500392

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 September 13, 2023 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 word and figure amount description, the word description shall control extensions.

Prices must be entered for each item and the appropriate subtotal and total blank 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 **Wash Crossing Improvements EL Dorado Avenue N., Project No. B24-PW-105007-500392.**

SECTION 00310

BID SCHEDULE – Wash Crossing Improvements EL Dorado Avenue N.

ITEM NO.	DESCRIPTION	UNIT OF MEASURE	EST QTY	UNIT PRICE (WORD)¹	UNIT PRICE (FIGURE)¹	ITEM TOTAL COSTS²
1	CONSTRUCTION STAKING	LS	1		\$	\$
2	MOBILIZATION	LS	1		\$	\$
3	QUALITY CONTROL	LS	1		\$	\$
4	ENVIRONMENTAL CONTROL	LS	1		\$	\$
5	TRAFFIC CONTROL	LS	1		\$	\$
6	SWPPP	LS	1		\$	\$
7	REMOVE EXISTING IMPROVEMENTS	LS	1		\$	\$
8	REMOVE FIRE HYDRANT, WATER MAIN, WATER SERVICE	LS	1		\$	\$
9	SIX BARREL 10'X5' RCBC (ADOT SD 6.06)	LS	1		\$	\$
10	INLET CONCRETE HEADWALL	EA	1		\$	\$

SECTION 00310

11	INLET CONCRETE WINGWALLS (ADOT SD 6.10)	EA	2		\$	\$
12	INLET REINFORCED SHOTCRETE CHANNEL W/ CUTOFF WALL	EA	1		\$	\$
13	OUTLET CONCRETE HEADWALL	EA	1		\$	\$
14	OUTLET CONCRETE WINGWALLS (ADOT SD 6.10)	EA	2		\$	\$
15	OUTLET REINFORCED SHOTCRETE CHANNEL W/ CUTOFF WALL	EA	1		\$	\$
16	SAFETY RAIL (MAG 145)	LF	245		\$	\$
17	EARTHWORK (CUT TO FILL)	CY	2,795		\$	\$
18	EARTHWORK (EXPORT)	CY	1,475		\$	\$
19	RIPRAP (D50=18") (T=36") & GEOSYNTHETIC FABRIC	CY	635		\$	\$
20	RIPRAP (D50=6") (T=12") & GEOSYNTHETIC FABRIC	CY	124		\$	\$
21	ASPHALTIC CONCRETE PAVEMENT (4" THICK)	TON	374		\$	\$
22	AGGREGATE BASE COURSE (4" THICK)	CY	180		\$	\$

SECTION 00310

23	VERTICAL CURB & GUTTER TYPE A (MAG 220-1)	LF	536		\$	\$
24	SIDEWALK (MAG 230)	SF	2,873		\$	\$
25	3/4" LANDSCAPE ROCK (2" THICK)	SY	2,306		\$	\$
26	24" CMP	LF	103		\$	\$
27	SCUPPER (MAG 203)	EA	1		\$	\$
28	CATCH BASIN (MAG 533) (L=17')	EA	3		\$	\$
29	CATCH BASIN (MAG 533) (L=6')	EA	1		\$	\$
30	8" C-900 DR-14 PVC WATER MAIN W/ RESTRAINED JOINTS	LF	370		\$	\$
31	1" AIR/VACUUM VALVE (LHC 310)	EA	1		\$	\$
32	6" FIRE HYDRANT ASSEMBLY (LHC 320)	EA	2		\$	\$
33	8" GATE VALVE (MJXMJ) (LHC 300)	EA	1		\$	\$
34	24" STL CASING (LHC 403 MODIFIED)	LF	110		\$	\$

SECTION 00310

35	1" WATER SERVICE (LHC 301)	EA	1		\$	\$
36	VALVE BOX, LID, & CONCRETE COLLAR (LHC 300)	EA	1		\$	\$
37	PERMANENT STRIPING AND SIGNAGE	LS	1		\$	\$
FORCE	FORCE ACCOUNT	LS	1	EIGHTY THOUSAND	\$ 80,000.00	\$ 80,000.00
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" column.

The unit prices for **Wash Crossing Improvements EL Dorado Avenue N., Project No. B24-PW-105007-500392**, 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 _____

EMAIL: _____

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

Wash Crossing Improvements EL Dorado Avenue N., B24-PW-105007-500392

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: _____
Principal Attorney-in-Fact

Its: _____
Principal's Title Agency of Record

Agency Address

What percent of the work do you normally perform with your own forces?

List trades:

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 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 MSDS;
- * 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 MSDS's for all hazardous chemicals to which employees may be exposed will be kept

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

- * MSDS's for the new chemicals are available;
- * MSDS'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)

SECTION 00450
HAZARD COMMUNICATION PROGRAM
Lake Havasu City

- (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 MSDS'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 MSDS'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

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.

**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 Native American tribal document
Unexpired foreign passport with I-551 stamp or attached federal Form I-94		Voter's registration card		U.S. Citizen ID Card
Permanent Resident Card or Alien		U.S. Military card or draft record		ID Card for the use of Resident Citizen in the
Unexpired Temporary		Military dependent's ID card		Unexpired employment authorization document issued by DHS
Unexpired Employment		U.S. Coast Guard Merchant Mariner Card		
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,		

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 Wash Crossing Improvements EL Dorado Avenue N. B24-PW-105007-500392 ("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 **XX calendar days** of the date of the Notice to Proceed. 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 **\$XXX** 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 \$XXXXXX 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. Conflict of Interest. The Contract may be cancelled in accordance with Arizona Revised Statutes Section 38-511.

12. Forced Labor of Ethnic Uyghurs Certification. If applicable, Contractor certifies that it does not currently, and agrees for the duration of the Contract that it will not, use: (1) the forced labor of ethnic Uyghurs in the People's Republic of China; (2) any goods or services produced by the forced labor of ethnic Uyghurs in the People's Republic of China; or (3) any contractors, subcontractors, or suppliers that use the forced labor or any goods or services produced by the forced labor of ethnic Uyghurs in the People's Republic of China. If Contractor becomes aware it is not in compliance with this certification, it shall notify the City within five business days after becoming aware. This Contract will terminate upon failure to remedy the noncompliance within 180 days of the notification. (A.R.S. § 35-394)
13. Export Administration Act. The CONTRACTOR warrants compliance with the Export Administration Act.
14. 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.
15. Asbestos License. The CONTRACTOR shall possess an asbestos abatement license if required under A.R.S. Title 32 or 49.
16. 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]

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 ****

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

I. INDEMNIFICATION

CONTRACTOR agrees to indemnify, defend, save, and hold harmless the City, its departments, agencies, boards, commissions, officers, officials, agents, volunteers, and employees ("INDEMNITEE") from and against any and all claims, actions, liabilities, damages, losses, or expenses (including court costs, attorney's fees, and costs of claim processing, investigation, and litigation) ("Claims") for bodily injury or personal injury (including death), or loss or damage to tangible or intangible property caused, or alleged to be caused, in whole or in part, by the CONTRACTOR or any of its owners, officers, directors, agents, employees, or contractors. This Indemnity includes any claim or amount arising out of or recovered under Workers' Compensation law or arising out of the failure of CONTRACTOR to conform to any federal, state, or local law, statute, ordinance, rule, regulation, or court decree. It is the specific intention of the parties that the INDEMNITEE shall, in all instances, except for Claims arising solely from the negligent or willful acts or omissions of the INDEMNITEE, be indemnified by CONTRACTOR from and against any and all claims. It is agreed that Permittee 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

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 five (5) 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, Administrative Services 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, Administrative Services 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 Administrative Services 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 **WRITTEN AMOUNT AND 00/100** (Dollars)
(\$#,###,###.##-NUMERIC AMOUNT), 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

**Wash Crossing Improvements EL Dorado Avenue N., PROJECT NUMBER B24-PW-
105007-500392**

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
WRITTEN AMOUNT AND 00/100 (Dollars) ((\$#,###,###.##-NUMERIC AMOUNT)
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
**Wash Crossing Improvements EL Dorado Avenue N.,
PROJECT NUMBER B24-PW-105007-500392**
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: Wash Crossing Improvements EL Dorado Avenue N.

The OWNER has considered the BID submitted by you for the above described WORK in response to its Advertisement for BIDS dated September 13, 2023, and Information for Bidders.

You are hereby notified that your BID has been accepted for items in the amount of \$, to include: [LIST BID ITEMS AWARDED]

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 [DATE] day of [MONTH], 20##.

Lake Havasu City, Arizona

BY: _____

NAME: Lynette Singleton

TITLE: Procurement Official

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 _____, 20##.

BY: _____

TITLE: _____

** END OF SECTION **

REV 3/30/16

**SECTION 00685
CERTIFICATE OF SUBSTANTIAL COMPLETION**

I hereby state that the degree of completion of:

**Wash Crossing Improvements EL Dorado Avenue N.
Project No. B24-PW-105007-500392**

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: _____

E-original: [CONTRACTOR]

E-copy: Procurement (Purchasing@lhcaz.gov)

Lake Havasu City, City Clerk (CityClerk@lhcaz.gov)

CERTIFICATE OF COMPLETION

I hereby state that all goods and services required by:

**Wash Crossing Improvements EL Dorado Avenue N.
Project No. B24-PW-105007-500392**

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: _____

E-original: [CONTRACTOR]

E-copy: Procurement (Purchasing@lhcaz.gov)

City Clerk (CityClerk@lhcaz.gov)

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

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:

Wash Crossing Improvements EL Dorado Avenue N., PROJECT NO. B24-PW-105007-500392

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 "ENGINEER" appears, it shall be understood to mean Lake Havasu City Public Works Department, Engineering Division.

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 full-time resident inspector for the project. The resident inspector will be available for a forty (40) hour period during the week from Monday through Friday during the period of the Contract. In the event the Contractor elects to work outside the forty (40) hour week that occurs between Monday through Friday, such as Saturday, Sunday or legal holidays, in accordance with Article 17.0 of the General Conditions the Contractor will be responsible for all inspection, engineering, and testing costs incurred during that period. For any inspection work performed on Saturday, Sunday, or local municipal holidays the minimum chargeable time shall be four (4) hours. The Owner reserves the right to deduct these additional inspection, engineering, and testing costs directly from the Contractor's payments.

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 Street 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
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 (i.e. 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

TECHNICAL SPECIFICATIONS

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 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

This Section includes the following administrative and procedural requirements:

A. Project Meetings

1. Preconstruction conference.
2. Progress/Coordination meetings.

B. Schedules and Reports

1. Initial Project schedules.
2. Weekly Construction progress schedule.
3. Procurement schedule.
4. Construction progress reports.
5. Schedule of values.
6. Special reports.
7. Quality Control Testing Plan and Reports.
8. Health and Safety Plan.

C. 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 4.0, 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/Owner
 - c. Utilities
 - d. City Departments
 - e. Representatives of principal Subcontractors and Suppliers.
3. **Meeting Agenda**
 - a. Construction schedules.
 - b. Critical Work sequencing plan/Baseline schedule with milestones
 - 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 finalize 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

C. Progress Meetings

1. Engineer will schedule and conduct a weekly meeting, and as necessary, as determined by the 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 the Project 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 the proposed Work.
3. Contractor shall be responsible for addressing any issues with subcontractors, and provide 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 and responsibilities.
 - h.** Temporary facilities and services.
 - i.** Hours of Work.
 - j.** Hazards/Safety.
 - 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 office of the Owner, unless otherwise approved.
- 6. Reporting:**
- a.** Within 5 working days after each meeting, Engineer will prepare and distribute minutes of the meeting to 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 of 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, 1 electronic copy in approved 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. Within each activity, indicate estimated completion percentage in 10% increments.
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 ID's will be allowed, but only for new work outside the original project baseline schedule activities.
 3. If required by Engineer, 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 one (1) electronic copy in approved 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 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. Contractor shall make all required revisions as specified, prior to acceptance of schedule.
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 monthly basis. More frequent reports may be required should the Work fall behind the accepted schedule.
 - a. Submit a weekly report to coordinate with, and supplement the monthly construction progress report, and which details Work scheduled for the following one-week interval, including:
 - (1) Work activities which will occur.
 - (2) Number and size of crews.
 - (3) Construction equipment on Site.
 - (4) Major items of Equipment and Material to be installed.

- b. Submit plan to Engineer before implementing the plan.
- c. Take actions as accepted 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. Contractor shall provide a paid in full invoice.
 - (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 Engineer.

G. Quality Control Testing Plan and Reports

1. A Quality Control Testing Plan shall be developed by the CONTRACTOR and submitted to the ENGINEER no later than the Preconstruction Conference. The Plan will include the following items:
 - a. Qualifications of the proposed laboratory including laboratory accreditations and certifications for technicians proposed for the work.
 - b. Test Frequency Table (one table for each specification section requiring CONTRACTOR quality control) establishing the proposed number of tests. The Table shall include columns for:
 - (1) Material Tested
 - (2) Sampling and Testing Points
 - (3) Test Method
 - (4) Minimum Sampling Frequency
 - (5) Estimated Quantity of Materials

(6) Number of Tests Required

(7) The Table shall also include columns for number of tests complete and % of tests complete. These last two columns are for use in periodic reporting of QC testing to the ENGINEER.

2. The CONTRACTOR shall submit reports of Quality Control Testing to the ENGINEER at each Coordination Meeting. The report shall include all Quality Control test reports for testing completed during the prior week, and shall include updated Test Summary Tables. The Tables shall include updated values for cumulative number of tests completed and % of required number of tests completed. One Table shall be submitted for each specification item requiring CONTRACTOR quality control testing, and it shall be updated through the end of the prior week.

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

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

Contractor shall provide adequate photography such that he can document conditions. Inadequate documentation not being able to prove responsibility for damages will hence cause the contractor to be responsible.

PART 2 - PRODUCTS

2.1 Photographic Requirements

Specified in PART 3, this Section.

PART 3 - EXECUTION

3.1 Project Site Photographs

- A. The CONTRACTOR shall be responsible for photographing the entire project site to show the existing and general condition of the site prior to construction. Each photograph must be time stamped with the date of the photograph. In addition, the CONTRACTOR shall take photographs before, during, and after each of the following phases of construction:

1. Site clearing
2. Demolitions
3. Excavations
4. Installation
5. Final completion

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

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 each 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 to document the existing condition of items not scheduled for replacement or items to be removed and replaced in kind such as landscaping, privacy walls, wash locations, etc., as may be necessary for the completion of the WORK. The photographs may, in some degree, preclude the possibility of post construction litigation between CONTRACTOR, adjacent property owners, and the OWNER.

D. Digital Images

1. Submit one (1) complete set of digital image electronic files 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.

- d. Any media submitted shall be labeled with Project name, area and street. Station and/or address shall be included as applicable.
- e. Identify electronic media with date digital photographs were taken.

E. Deliver to Engineer/Owner

3.2 PROPERTY PHOTOGRAPHS FOR WORK ON PRIVATE PROPERTY

Photographs shall be taken at each residential property in sufficient detail to record the existing condition of the property and all existing improvements including trees, shrubs decorative rock and other ornamental or functional improvements. The photographs must be approved by the Engineer and Owner prior to any construction activities on the property. When taking property photos, the street name needs to be properly defined.

3.3 Additional Photographs

- A. From time to time Engineer/Owner may issue requests for additional photographs, in addition to periodic photographs specified
 - 1. Engineer will give the contractor notice, where feasible.
 - 2. In emergency situations, the contractor 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.

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. Designation of selection

Drawings such as reproducible shall be useable for further reproduction to yield legible hard copy.

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 must 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 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 to 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 20 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 Submittals pertaining to storage, installation, and operation at the Site for Engineer's approval prior to delivery of the Equipment and Materials.
5. Submittals shall be resubmitted until the Engineer determines the submittals are acceptable. Any delay in the submittal acceptance, due to the submission of unacceptable submittals, does not warrant any extension of contract times.
6. Contractor shall provide submittals for the following items no later than 30 days after Notice to Proceed:
 - A. Pumps and motors
 - B. Valves 20" and larger
 - C. Emergency Generator
 - D. Precast Electrical Building
 - E. Electrical Switchgear
 - F. Work Plan for Existing Pump Station Shutdown and Connections

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.** 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.
 - b.** 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.
 - c.** 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.
 - d.** 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 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.

- e. 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."
- f. Keep a copy or sample of each Submittal in good order at the project site.

- 3. **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 - APPROVED: Signifies Equipment or Material represented by the Submittal, conforms to 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 by Engineer for final distribution.

B - APPROVED AS NOTED (RESUBMIT): Signifies Equipment and Material represented by the Submittal conforms to 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 - RETURNED FOR REVISION (RESUBMIT): Signifies Equipment and Material represented by the Submittal appears to conform to 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 - NOT APPROVED (SUBMIT ANEW): Signifies Equipment and Material represented by the Submittal does not conform to 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: 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 - REFERENCE ONLY, NO APPROVAL IS 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 - FOR DISTRIBUTION: (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. **Format Requirements:**

- a. Technical reports and administrative Submittals except as otherwise specified shall be submitted in a .pdf format
- b. 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.
- c. 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 in .pdf format.

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, air, 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, heating and placards 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 FacilitiesSection 01560
Traffic Control..... Section 02560

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, Equipment, and Materials free from 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 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.
7. Any equipment or materials left in the Right-of-Way over night shall be properly barricaded, including a minimum of two lighted barricades.

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, unless otherwise directed by Engineer
 - 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 animals 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 Engineer, 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 shall meet all MUTCD standards, 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 any damage caused by installation and restore area to original or better condition. Clean the work 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.

pit 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:

Refer to Section 2650

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 contractor 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.

a)

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. 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

Contractor shall obtain required certifications and permits. Arrange for authorities having jurisdiction to inspect and test each temporary utility before use.

1.3 Submittals

Temporary Utilities

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

1.4 Project Conditions

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. 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

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

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.
6. Supply garbage containers for misc. construction trash and debris, with cover.

3.3 Temporary Safety and Health

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.
 - e. Responsible Individual Phone Number

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. If within ROW signs should be designed with quick releases or break points.

PART 3 - EXECUTION

3.1 Installation

A. Project and Contractor Identification Sign

1. CONTRACTOR shall obtain OWNER's approval for the location of the CONTRACTOR's identification sign. The sign shall be installed in an 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, or Engineer's request.
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.

- a. Name of product and manufacturer including address (and telephone number).
- b. Model and serial number.
- c. Capacity.
- d. Speed.
- e. Ratings.

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 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 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 as approved by engineer.
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.

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

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 release 2004.
 - 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.

a)

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 ****

SECTION 02050
DEMOLITION AND REMOVALS

PART 1 - GENERAL

1.1 Description

- A.** The work of this Section consists of the demolition, removal, and disposal of the existing designated facilities, including pavement, pipelines, sidewalk, appurtenances, fencing, as designated in the CONTRACT DOCUMENTS all as necessary for the performance of this Contract.

- B.** All items designated for removal shall be completely removed from the site, hauled and disposed in a legal manner. No on-site disposal shall be permitted.

1.2 Related Sections

- A.** The work of the following Sections applies to the Work of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of this WORK.

Measurement and Payment.....Section 01210
SubmittalsSection 01330
Water Piping SystemsSection 02550

1.3 CONTRACTOR Submittals

- A. Affidavit of Compliance.** Prior to commencing with demolition work, the CONTRACTOR shall submit to OWNER an affidavit of compliance detailing the final disposition for items and materials to be removed from the site. Said affidavit shall list the locations of all off site disposal sites to be utilized, and shall include the CONTRACTOR's certification that those sites are legal for the disposal of the subject items or materials. The affidavit shall include a similar list of recyclers and CONTRACTOR's certification, if utilized.

- B. Receipts.** CONTRACTOR shall submit receipts from all disposal sites and recyclers utilized for the disposal of items and materials removed from the site. Said receipts shall account for the entire quantities of all items and materials removed from the site.

PART 2 - GENERAL

2.1 General

- A.** All demolition and removals shall be of the types shown on the CONTRACT DOCUMENTS and shall conform to the applicable Sections of these SPECIFICATIONS.
- B.** All concrete products to be demolished and removed shall be disposed of off-site to an approved disposal facility. At no time will concrete be allowed to be crushed on-site, nor shall it be re-used in any way for the WORK identified in the CONTRACT DOCUMENTS.

PART 3 - EXECUTION

3.1 General

- A.** Execution of all demolition and removals shall be per the CONTRACT DOCUMENTS and shall conform to the applicable Sections of these SPECIFICATIONS.

3.2 Salvage Work

- A.** When the CONTRACTOR is required to remove existing pipe and appurtenances, or portions thereof, from the ground, such materials may, at the discretion of the ENGINEER, be considered salvage. All materials identified as salvage are considered property of the OWNER.
- B.** The CONTRACTOR shall remove and carefully stockpile all materials identified as salvage in a safe location that will not disrupt traffic until the times can be delivered to the OWNER's Public Works Maintenance Facility or other location specified by the OWNER. The CONTRACTOR shall coordinate with the OWNER of all salvage materials. The CONTRACTOR shall be responsible for delivery of all salvageable materials to the OWNER.
- C.** The CONTRACTOR shall legally dispose of all other materials in an appropriate manner. Disposal is the responsibility of the CONTRACTOR. The CONTRACTOR shall coordinate with the appropriate jurisdictional agency with respect to disposal sites locations, limitations, and transportation methods.

3.3 Asbestos Removal

- A.** Asbestos cement pipe is anticipated to be contained in the pipeline material within the existing project area. The CONTRACTOR shall

remove these materials as part of the demolition phase of the work. All asbestos operations regarding removal, handling, containment, transportation, and disposal shall be in accordance with all federal, state, county, and local regulations, recommendations, and guidelines and as per 29 CFR 1926.1101 Federal OSHA Asbestos Standard for the Construction Industry, and 40 CFR Part 61 National Emission Standards for Hazardous Air Pollutants (NESHAP).

3.4 Protection of Items to Remain

- A.** CONTRACTOR shall be responsible to protect from damage any items not subject to removal, including, but not limited to, existing vegetation and landscaping, and above and/or below ground utilities.
- B.** Should damage occur to items not subject to removal due to CONTRACTOR's operations during any phase of the WORK, CONTRACTOR shall repair or replace said items to the satisfaction of the OWNER at CONTRACTOR's expense.

3.5 Demolition and Removal

- A.** CONTRACTOR shall demolish, dismantle and remove all items scheduled for demolition and removal as shown on the drawings and as specified herein that will interfere with the planned construction, or as otherwise directed by ENGINEER. CONTRACTOR shall comply with all pertinent regulations of OSHA and local codes and practices. The site shall be kept neat and orderly during the demolition. Adjacent public right-of-way and private property shall be kept free of debris at all times. Stockpiles of items or materials to be removed shall be removed from the site on a daily basis, or stored in a dumpster or other portable trash receptacle, which shall be stored in an approved location, and shall be emptied on a weekly basis. Accumulations of flammable material shall not be permitted.
- B.** CONTRACTOR shall seal all open ends of water mains to be abandoned in place with a concrete plug having a length equal to minimum one diameter of the pipe being plugged.

3.6 Disposal and Recycling

- A.** All items or debris removed from the site shall be transported offsite in a legal manner and disposed of at a legal disposal site. Concrete debris shall be transported to an appropriate recycler of such materials. All disposal sites and recycling facilities shall be approved by the OWNER prior to initiation of the work. Hazardous materials (i.e. asbestos and/or lead-containing materials) shall be handled and

disposed of at a legally acceptable recycler or placed into a legally acceptable landfill, all in accordance with all applicable laws, codes, and regulations.

3.7 Abandonment

- A.** Where shown on the drawings, where specified herein, or as approved by the ENGINEER, CONTRACTOR may select to abandon in place those existing facilities that are not required to remain in service and that will not otherwise interfere with execution of this Contract. Facilities to be abandoned shall be abandoned in accordance with the CONTRACT DOCUMENTS.

3.8 Records Research

- A.** CONTRACTOR shall be responsible to familiarize himself with the existing conditions and system operation prior to commencing with the work of this Section, or any other work under this CONTRACT.
- B.** Available record drawings can be provided by the OWNER upon formal written request from the CONTRACTOR. It shall be noted that there will be no warranty or guarantee of the accuracy or completeness of the as-built drawings what-so-ever made or inferred by furnishing them for reference.

PART 4 – MEASUREMENT AND PAYMENT

4.1 Measurement and Payment

See Section 01210 "Measurement and Payment".

**** END OF SECTION 02050 ****

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 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

No measurement will be made for this item.

4.2 Payment

No payment will be made for **Clearing and Grubbing**. Clearing and grubbing shall be considered incidental to other items.

****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 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 existing fences and gates.
- B.** Remove planter boxes, block walls, concrete walls and footings.
- C.** Remove existing irrigation systems and replace or plug.
- D.** Removal and relocation of signs and mailboxes. 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.

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 shall be made for this item.

4.2 Payment

A. Removal of Existing Improvements

If no item is listed in the bid tab or the measurement and payment section, this item is to be considered incidental.

B. Removal of Existing Improvements

Payment will be made at the contract lump sum price. This price shall be full compensation for furnishing all materials, labor, equipment, tools and appurtenances necessary to complete the work.

C. Miscellaneous Removals

All other removals shall be considered incidental to other items. No payment will be made for miscellaneous removals.

See Section 00310 Bid Schedule for Bid Items.

**** END OF SECTION 02110 ****

SECTION 2200

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 ".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 overexcavation 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 2600, 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 2600, 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 the item, Earthwork.

B. Overexcavation

Overexcavation shall be measured by the cubic yard. The quantity

will be computed by the average end area method. The end area is that bound by the original ground line established by field cross sections and the final theoretical pay line established by cross sections shown on the plans subject to verification by the **OWNER**. After completion of all operations and prior to the placing of base or subbase material, the final embankment shall be verified by the **OWNER** by means of field cross sections taken randomly at intervals not exceeding 500 linear feet.

Final field cross sections shall be employed if the following changes have been made:

1. Plan width of embankments or excavations are changed by more than plus or minus 1.0 foot; or
2. Plan elevations of embankments or excavations are changed by more than plus or minus 0.5 foot.

4.2 Payment

A. Earthwork

Payment for earthwork will be made at the contract lump sum price. The lump sum payment shall be full compensation for excavation of existing materials to the new subgrade elevation, subgrade preparation, fill placement, waste, borrow, hauling, and testing required to complete the item. The item shall be full compensation for all materials; for all preparation, hauling, and placing of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

B. Overexcavation

Payment for overexcavation will be made at the contract cubic yard price. The payment shall be full compensation for excavating the existing material to the depth and section required, hauling and wasting the overexcavated material and backfilling with suitable material. This item shall be full compensation for all work including furnishing all materials; for all preparation, hauling, and placing of these materials; and for all labor, equipment, tools, and incidentals necessary to complete the item.

The quantity of this item listed in the bid schedule represents no actual estimate, is nominal only, and may be greatly increased or decreased or reduced to zero. The increase or reduction of this quantity as compared with that set forth in the bid schedule shall not constitute a basis for claim by the **CONTRACTOR** for extra payment or damages.

See Section 00310 Bid Schedule for Bid Items.

SECTION 02254

SHEETING AND SHORED EXCAVATIONS

PART 1 - GENERAL

1.1 Summary

- A.** Work under this Section consists of furnishing, placing, maintaining and subsequently removing, to the extent required, a positive system of temporary supports for cut and cover, open cut, and trench excavations, including bracing, dewatering, and associated items to support the sides and ends of the excavations. The support system shall prevent lateral and vertical ground movements which will cause damage to buildings, structures, pavements, utilities, and any other adjacent improvements.
- B.** The excavations for the structures shall be made vertical and shored according to this Section. The Contractor shall construct sheeting and shoring to construct all structures and protect all existing structures, improvements, aboveground utilities, and below-ground utilities.
- C.** Contractor shall make his own assessment of existing conditions including adjacent property, the possible effects of his proposed temporary works and construction methods, and shall select and design such support systems, methods, and details as will assure safety to the public, adjacent property, and the completed Work.
- D.** The positive system of support may consist of soldier piles and lagging, sheet piling, or other methods as may be approved by Engineer; secured in place by means of bracing members which may include wales, struts, tieback anchors, or similar members. A trench box is not considered a positive means of support and will not be permitted.
- E.** Utility modification or relocation shall be performed by Contractor at no additional cost to Owner or Engineer, if existing utilities interfere with Contractor's proposed method of support.
- F. Related Work Specified Elsewhere:**

EarthworkSection 2200
Trench Excavation and BackfillSection 2300
Excavation, Filling, and Backfilling for StructuresSection 2321

1.2 Quality Assurance

A. Reference Standards and Specifications:

1. American Society for Testing and Materials (ASTM):

ASTM A36/A36M - Carbon Structural Steel.

ASTM A328/A328M - Steel Sheet Piling.

2. American Welding Society (AWS):

D1.1 - Structural Welding Code, Steel.

3. American Institute of Steel Construction (AISC):

Manual of Steel Construction.

1.3 Submittals and Construction Records

A. Submittals:

1. Submit as specified in Section 1330.

2. Preliminary Shoring Report:

a. A Preliminary Shoring Report outlining the entire scope of the Contract shoring to the specified requirements shall be prepared by or under supervision of Contractor's shoring engineer. The Preliminary Shoring Report shall be submitted for Owner and Engineer review in accordance with Section 1330 prior to the commencement of any shoring work.

3. Working Drawings:

a. Working drawings, by a licensed professional engineer, shall be submitted for Owner and Engineer review in accordance with Section 1330 prior to the commencement of work on each individual item of shoring.

b. The following shall be included on the working drawings:

- (1) Details, arrangement, and method of assembly of the proposed system.
 - (2) The method of bracing and preloading.
 - (3) The full excavation depth.
 - (4) Loads for various stages of bracing removal during concrete placement and backfilling.
 - (5) The anticipated lateral earth pressure, hydrostatic pressure, utility, rail, traffic, and equipment loads.
 - (6) The maximum design load to be carried by the various members of the support system and a tabulation of the required preloads.
 - (7) The depth to which the support system will be installed.
 - (8) The proposed sequence of strut and shore removal as applicable and as related to concrete placement and backfilling operations.
 - (9) Proposed monitoring plan, including location of monitoring points, inclinometers, and seismographs.
- c. Complete design calculations and the maximum theoretical deflections of the support members shall be included.
 - d. Existing utility facilities shall be included and, after checking their locations by field investigations, the working drawings shall be revised to show the actual locations of facilities, location of excavation supports, interference with the proposed Work, and how Contractor proposes to overcome these interferences.
 - e. Documents provided with evidence of an Arizona State registered Professional Engineer's seal, signature, and date.

- f. Welder certificates signed by Contractor certifying that welders comply with requirements under "Quality Assurance" Article.
- g. Qualifications of vibration monitoring firm.

B. Construction Records:

- 1. The summary of monitoring data prepared by Contractor's shoring engineer shall be submitted for Owner and Engineer review on a weekly basis.
- 2. Results of pre-excavation survey prior to any excavation.

1.4 Qualifications

- A. Contractor and his subcontracted shoring engineer shall furnish evidence of having successfully completed one project that meets the following criteria:
 - 1. Equal or larger total linear footage of sheeting or shoring for one project of similar scope and conditions.
 - 2. Complete within the specified contract time.

1.5 Dewatering

- A. Dewatering plan shall be based on the criteria specified in Section 2300.

1.6 Protection

- A. **Sheeting and Shoring:** Provide shoring, sheeting, and bracing as indicated or required. Meet the following requirements:
 - 1. Prevent undermining of pavements and slabs. Remove and replace all undermined pavements, either concrete or asphalt, at Contractor's expense.
 - 2. Excavations shall be accomplished with vertical banks wherever possible. All excavations shall remain within the property lines of the pump station as shown on the Drawings.

3. Except as otherwise specified herein, shoring and sheeting materials may be extracted and reused at Contractor's option; however, Contractor shall remove and replace any existing structure or utility damaged during shoring and sheeting. Where shoring and sheeting materials must be left in place in the completed Work to prevent settlements or damage to adjacent structures or as directed, backfill the excavation to 1 meter (3 feet) below the finished grade and remove the remaining exposed portion of the shoring before completing the backfill. If H-piles and wood lagging are used for shoring, remove wood lagging to within 1 meter (3 feet) of finished grade in incremental steps of approximately 150 mm (6 inches) as the backfill is constructed. The location of all shoring and sheeting left in place shall be documented on drawings and given to Engineer and Owner.

1.7 Quality Assurance

A. Design Criteria:

1. The design and construction of the support system, and the adequacy thereof, shall be the responsibility of Contractor. Contractor's shoring engineer shall be a professional engineer, legally authorized to practice in the jurisdiction where the Project is located, experienced in the design of earth support systems, and required to visit the Site prior to development of any sheeting and shoring system designs in order to become familiar with existing Site conditions.
2. During installation and removal of the any shoring, Contractor's shoring engineer shall visit the Site to observe the Work and to verify the compatibility of the Work with design assumptions. Contractor's shoring engineer shall prepare a status report with each visit to the Site. This report shall be submitted to Engineer within three days of each Site visit. This status report shall contain certification that the Work is in concurrence with design assumptions. If deficiencies are observed, these must be noted and the corrective action outlined in the report. In the event that deficiencies are noted in Contractor's shoring engineer's report, Contractor's shoring engineer shall return to the Site within three days after the corrective action has begun to verify that the deficiencies are adequately being corrected. A corrective action status report shall be prepared by the

Contractor's shoring engineer. The above outlined procedures shall be repeated until the corrective action status report confirms that all deficiencies have adequately been corrected.

3. Design the excavation support in accordance with the design criteria specified herein and in the Contract Documents. The criteria are intended for guidance and are the minimum acceptable.
4. Where applicable, the design and construction of the support system shall conform to the requirements of the AISC Manual of Steel Construction, unless otherwise stated.
5. Design the excavation support system and components to support lateral earth pressures, unrelieved hydrostatic pressures, utility loads, rail loads, traffic and construction loads, and building and other surcharge loads to allow the safe and expeditious construction of the permanent structures without movement or settlement of the ground, and to prevent damage to or movement of adjacent buildings, structures, utilities, and other improvements. The minimum lateral design earth pressure in all cases shall be determined by the Contractor's Shoring Engineer. All of the other above loadings shall be determined by Contractor's shoring engineer and added to the minimum design criteria. The design shall account for staged removal of bracing to suit the sequence of concrete placement for permanent structures and of backfill.
6. Design members to support the maximum loads that can occur during construction. For the purpose of this Section, the design load is the maximum load the support member will have to carry in actual practice, and the proof load is a specified test load greater than the design load.
7. Employ wales, struts, rakers, and tieback anchors for horizontal support for excavation faces retained by soldier piles and lagging, sheet piling, or other methods as may be approved by Engineer. Provide struts with intermediate vertical and horizontal supports if necessary to prevent buckling. Bracing members shall be structural steel. Tiebacks shall be high strength tendons or rods.

8. Take into account stresses due to temperature variations in the design of the struts. Make provisions to protect struts against deformations and stress variations induced by temperature fluctuations.
9. The splicing of an element of the support system will not be permitted.
10. Analyze elements supporting vertical loads and lateral pressures for combined axial load and bending.
11. Lateral loads due to soil and surcharges shall not be transmitted to the permanent structures, or portions thereof, until the concrete has reached sufficient strength to resist said loads, and then, not until the section to be loaded has been checked for strength and deflection and the method of load transmittal accepted by Engineer. The removal of struts shall not increase the design loading on the permanent structures.
12. In a bracing system where wales are not used and a direct strut to soldier pile connection is used, consider an additional provision for bending stress due to the eccentricity of lateral loading of 10% of the depth of the member in each direction in the design of the strut member.
13. Design compression member connections for their compressive loads and for a tensile and shearing load equal to 10% of the design compressive load unless tensile or shearing loads are greater.
14. Driven soldier piles may be assumed as fully braced against buckling in the plane of lagging. In the plane perpendicular to the lagging, the column length shall be taken as the distance between braced points.
15. Backfill soldier piles installed in predrilled holes with lean concrete and allow to set up prior to the start of excavation.
16. Vertical members of flexible wall systems may be designed under the assumption that they are hinged at the bottom of the pile supported excavation and at all bracing levels except the topmost level.

- 17.** In order to satisfy a hinge condition at the bottom of excavation in soil, the vertical wall members shall have at least the minimum penetration necessary to develop the passive resistance of ground material in which piles are embedded, or cantilever action shall be assumed about the lowest installed brace.
- 18.** The calculated deflection of any element of the support system shall not exceed 13 mm (1/2-inch) during excavation or brace removal.
- 19.** Apply active pressure above the pile subgrade elevation to the full panel width between soldier pile centers and to the width of the soldier pile or encasement below pile subgrade. Passive pressure for calculation of embedment required shall be taken as acting on 1.5 times diameter for soldier piles circular in plan and 2.0 times width for soldier piles rectangular in plan.
- 20.** To account for the concentration of soil pressures at struts and tieback locations, the bending moments taken from pressure diagrams (hydrostatic and surcharge pressures excluded) may be reduced by 20 percent when calculating flexure requirements for vertical members and wales of flexible wall systems.
- 21.** Where the loading conditions on opposite sides of an excavation are not equal, analyze the stability of the temporary retaining structure and design structural members so as to take this condition into account.
- 22.** In design of vertical members and wales of flexible wall systems, basic allowable unit stresses may be increased 20%. Design bracing members and connections using basic allowable unit stresses.
- 23.** For calculation of brace loads, vertical wall members may be assumed as several independent simple beams supported at brace levels and their continuity effects ignored. The sum of reactions at each support is used as the design brace load. The full loading on cantilevered portions shall be considered as acting directly upon the supporting brace level. An assumed strut shall be considered to exist at the bottom of the excavation when the minimum pile penetration below subgrade, or deeper, is satisfied. Where wales are a part of the support system, they shall be designed according to the principles of statics.

B. Tieback Analysis and Design:

1. Investigate loading and use the most critical case for design.
2. Make a check of the overall stability (sliding, rotational, etc.) of the zone forming the anchoring mass of earth. The width of resisting surface shall be taken not greater than the distance from the support wall back to the vertical plane passing through the end of the shortest anchor. For a rotational analysis using the slip circle method the design shall yield a factor of safety of at least 1.5, based on loading and the physical properties tabulated.
3. For purposes of determining the effective length of anchors, take the failure plane of the soil mass behind the wall at a minimum angle of 45 degrees measured from the vertical. Anchors shall be considered as receiving resistance from only the soil mass acting beyond the indicated failure plane. Consideration shall be given to increased extent of the failure zone due to high surcharge loads.
4. For loading combinations found, determine the allowable value of adhesion between the soil and the anchor for design of effective embedded length of each individual anchor in various strata. The effective length thus found shall be increased by at least 10% to make allowance for unforeseen field variables.
5. The angle between the direction of the anchor and the horizontal line perpendicular to the support of excavation wall shall be chosen by the Contractor within a range of 0 degrees to 30 degrees. Account shall be taken of the effects of resulting vertical components and associated structural implications arising therefrom, particularly regarding toe penetration requirements.
6. Install anchors in predrilled holes and pressure grout to ensure firm contact with the surrounding soil.
7. For drilled-in anchors, the total anchor load shall be developed in bond between steel and grout acting within effective length of the anchorage.

8. The final working stress shall not exceed 60% of the ultimate tensile strength of the steel nor 70% of its yield strength loads where high-strength tie rod steel is used.
9. For tieback anchors of high strength steel, a pretest load of at least 140% of working load shall be applied. The load shall then be relaxed to not less than 100% of the working load. Final pretest stress in the steel is not to exceed 80% of the ultimate strength nor the manufacturer's recommendations as shown in his catalog or otherwise stated by him in writing.
10. Spacing of the tiebacks shall ensure no overlap of resisting soil stress bulbs in assuming full value of anchorage for each tieback. In the event of overlap, then a reduction factor shall be used for ties effected. In any one plane the anchors shall have a minimum clear distance between them of 1.5 meters (5 feet). Tiebacks having overlapping soil stress bulbs shall be pretested simultaneously.
11. Use good engineering practice, a knowledge of the local or regional subsurface conditions, available geotechnical or subsurface information, and studies performed by the Contractor to investigate the subsurface conditions at the Site in the analysis and design of tieback systems.
12. The value of overburden pressure, if used for adhesion calculations, shall not include surcharge loads.
13. Tiebacks shall not be placed closer than 3 meters (10 feet) to foundation structures of existing buildings.

C. Monitoring:

1. Pre-excavation Survey:
 - a. Contractor shall document all existing damage to adjacent facilities and submit the information to the Owner prior to performing any excavation. Documentation shall include a written description, diagrams, measurements, and photographs as appropriate.
 - b. Establish lines of monitoring points, perpendicular to the excavation face, for at least two sides of each excavation where monitoring is required. Space the lines of monitoring points no more than 6 meters (20 feet) apart, and a minimum of three lines shall be established for each

excavation side to be monitored. Each monitoring line shall consist of a minimum of four monitoring points spaced no more than 3 meters (10 feet) apart. Locate the first monitoring point in each line at the top of the braced excavation. The monitoring lines shall extend from the excavation face to a distance equivalent to twice the total excavation depth. The base of each monitoring point monument shall extend to a depth of at least 1.5 meters (5 feet) below the ground surface. Establish surface monitoring points prior to beginning an excavation.

- c. Each survey reading shall consist of measuring the vertical and horizontal location of each monitoring point. Make the initial set of readings prior to the start of the excavation. Make each additional set of readings at each 1.5-meter (5-foot) increment of vertical excavation depth, immediately before and immediately after internal bracing or tiebacks are installed. After the excavation has been completed, take readings at 7-day intervals thereafter and until movements have been determined by Contractor's shoring engineer to have ceased. If portions of the bracing system are removed at any time, make readings immediately prior to removal and immediately after removal.
- d. Contractor's shoring engineer shall reduce and review the monitoring data and submit a summary of the data to Engineer on a weekly basis. As a minimum, this summary shall include graphical plots of the monitoring data and Contractor's shoring engineer's interpretation thereof.

D. Work Site Conditions:

- 1. Provision for Contingencies:
 - a. Monitor the performance of the components of the support system for both vertical and horizontal movement at regular intervals not to exceed three days.
 - b. Provide a contingency plan or alternative procedure for implementation if unfavorable performance is evident.
 - c. Keep the materials and equipment necessary to implement the contingency plan on hand.

2. Employ caution in the areas of utility facilities, which shall be exposed by hand or other excavation methods acceptable to Owner.

E. Welding Standards:

1. Comply with applicable provisions of AWS D1.1.
2. Certify that each welder has satisfactorily passed AWS qualification tests for welding processes involved, and if pertinent, has undergone recertification.

PART 2 - MATERIALS

- 2.1 Structural Steel:** Steel H-piles, WF shapes, bracing members, fabricated connections, and all other accessories shall conform to the requirements of ASTM A36.

2.2 Structural Steel Sheet Piles

- A. Steel sheet piling shall conform to the requirements of ASTM A328.
- B. Steel sheet piling and interlocks shall not have excessive kinks, camber, or twists that would prevent the pile from free sliding.

- 2.3 Reinforcing Steel:** Shall conform to the requirements of Section 3200.

- 2.4 Field Welding:** Shall be performed by certified welders and be in accordance with AWS D1.1.

- 2.5 Tiebacks:** Shall be high strength steel tendons or rods encased in concrete grout. Use of helical screw anchors is strictly prohibited.

2.6 Concrete

- A. Lean grout shall be a mixture of Type V cement, sand, and fly ash in the proportions of one bag cement, 5 cubic feet fly ash, and sufficient aggregate and mix water to yield 27 cubic feet and shall be placed in such a manner as to present a firm, stable mass capable of retaining shape and position during excavation operations, yet allow relative ease in chipping out for placement of lagging.

- B. All other concrete shall conform to the requirements of Section 03300.

2.7 Timber Lagging: Shall be of a structural grade providing a minimum allowable working stress of 7.6 MPa (1,100 psi) where a system of timber lagging is to be used to support earth excavation.

2.8 Other Materials: Shall be of the size, shape and properties best fitted for their intended use.

2.9 Materials: Whether new or used, shall be sound and free of defects that might impair strength or function.

PART 3 - EXECUTION

3.1 Soldier Piles Installation

A. In the initial positioning of soldier piles at the ground surface, make allowances for installation deviations, and the probable inward movements of the support wall during excavation. Intrusion of wall members into the neat lines of the structures will not be permitted. Where sheeting systems are located contiguous to the neat lines of the structure, provide a reasonable percentage of the depth of excavation to subgrade for initial installation offset.

B. Install soldier piles by preboring or other preexcavating methods to tip elevation shown on the approved working drawings.

C. Case or fill the prebored holes with drill mud, as required, to prevent caving of the sides of the hole prior to placement of the soldier pile and encasement.

D. Pile Embedment:

1. Carry the bottom of the support system to a depth below the main excavation to provide sufficient lateral support to limit the maximum pile deflection to 13 mm (0.5-inch).

E. After seating the soldier piles, encase the piles with lean grout, completely encasing the pile.

F. Design of soldier piles shall conform to the criteria specified in PART 1 - QUALITY ASSURANCE, this Section.

G. Vertical Support System with Tiebacks:

1. Install piles or other vertical support system members incorporated in a system using tieback anchors so that

vertical support members are capable of resisting vertical components of tieback loads without significant settlement during excavation and construction.

2. Install the vertical support members so that settlements will not be caused by construction. In general, install the members to be end bearing in a stratum below the maximum depth of excavation and capable of carrying the total vertical loads without assistance of skin friction in the depth of the excavation.

3.2 Lagging and Sheeting Installation:

- A. Use timber lagging or contact sheeting, steel sheeting, or precast reinforced concrete members secured in place for sheeting of excavations.
- B. Install sheeting and lagging with no gap between the boards. Carefully perform excavation for the installation of sheeting and lagging to minimize or eliminate the formation of voids behind the lagging. As installation progresses, backfill voids between the excavation face and the lagging or sheeting with sand or soil compacted in place. Pack gaps in lagging with materials such as hay or burlap to allow drainage of groundwater without substantial loss of soil.
- C. If unstable material is encountered, take measures to retain the material in place or to otherwise prevent soil displacement.
- D. Sheeting and lagging placement shall follow the excavation. The maximum height of the unsheeted or unlagged face of excavation shall be determined by the job conditions, but in no case shall it exceed at anytime 1.2 meters (4 feet) in predominately clayey soils or 1 meter (3 feet) in sandy soils. If water flows from the face of the excavation, or soil in the face moves toward the excavated area, the maximum height of the unlagged face shall not exceed 375 mm (15 inches), or as directed by Resident Project Representative.
- E. Sheet piling not cut to length shall be cut off after driving at elevations as indicated, if applicable.
- F. Drive sheet piling by recognized methods of good practice in soil conditions present using a hammer with sufficient energy to penetrate overburden material without damaging the sheet piling or adjacent existing facilities. Avoid splicing of sheet piling when

possible. Z-pile sections shall be driven with ball edge "ahead."

- G.** Provide protection to sheet pile ends, as required, to ease driving, assure penetration and prevent tearing or splitting in hard driving conditions.
- H.** In running sand or silt, provide a positive means of securing the lagging to the soldier piles to avoid shifting or falling off of the lagging. Also provide a positive means of securing the material behind the lagging or sheeting.
- I.** A sufficient quantity of material shall be on hand at all times (for sheeting, shoring, bracing and other purposes) for the safe execution of the work and for use in case of accident or other emergency.
- J.** Place wales, when used, on the inside face of the support wall. Make provisions to wedge, pack, shim, or otherwise assure tight bearing between wales and soldier piles, with ample bearing area to assure transfer of the load.
- K.** Remove lean grout only to the extent that is required for installation of the lagging.

3.3 Internal Bracing Support Systems Installation

- A.** The internal bracing support system includes lagging and sheeting, soldier piles, wales, struts, and shores.
- B.** Brace as soon as possible after reaching prescribed excavation levels.
- C.** Provide struts with intermediate bracing if necessary, to enable them to carry the maximum design load without distortion or buckling.
- D.** Provide diagonal bracing where needed to maintain the stability of the system.
- E.** Include web stiffeners, plates, or angles to prevent rotation, crippling, or buckling of connections and points of bearing between structural steel members. Allow for eccentricities due to field fabrication and assembly.
- F.** Install bracing support members and maintain in tight contact with

each other and with the surface being supported. Install support system instrumentation if directed by Owner or Engineer.

- G.** Coordinate excavation work with installation of bracing and preloading.
- H.** Design primary support members to support the maximum loads occurring during the excavation or removal stages, and as required by design criteria specified under PART 1 - QUALITY ASSURANCE, this Section, and on the Contract Drawings.
- I. Preloading:**
 - 1.** Primary bracing members including struts, shores, and similar members shall be preloaded at installation. The amount of the preload shall be determined by Contractor's shoring engineer. Tiebacks shall be preloaded as specified for those installations.
 - 2.** Use procedures that produce uniform loading of the bracing member without appreciable eccentricities, or overstressing and distortion of the members of the wall system.
 - 3.** Make provisions for permanently fixing the required load in the member using steel shims or wedges welded into place.
 - 4.** Wooden wedges shall not be used to preload a bracing member.
 - 5.** The preloading system shall include a means to determine within 5% the amount of preload induced into the bracing members.
- J.** Excavation shall not go deeper than 1 meter (3 feet) below the point of support about to be placed. Install the support and preload immediately after installation of bracing and prior to continuing excavation.

3.4 Tieback Support Systems Installation

- A.** If Contractor elects to use a support system which includes tieback anchors, he shall submit full details of his proposed system to the Engineer for review prior to commencement of the work. The submittal shall be in accordance with instructions specified under PART 1 - SUBMITTALS, this Section. Design shall be in accordance with tieback criteria specified under PART 1 - QUALITY

ASSURANCE, this Section.

- B.** Install tieback systems in accordance with the working drawings. Install the anchorage in soil no closer than a plane extending upward at an angle of 45 degrees to the horizontal from the limit of the lowest depth of excavation.
- C.** Stress all the tiebacks to proof loads equal to 120% of the maximum design load. Maintain the proof load for 30 minutes prior to reducing it to the design load. Anchors which lose more than 5% of the proof load during the 30-minute period will not be acceptable.
- D.** During proof testing, load in increments of 4.5 metric tons (5 tons) at one-minute intervals providing means to measure the load application within an accuracy of plus or minus 5%. Record axial movement corresponding to incremental applications of load to an accuracy of 0.25 mm (0.01-inch).
- E.** After reducing the tieback load to the design load, encase tiebacks in grout. Maintain the design load until the tiebacks are fixed in place.
- F.** Use a method of fixation which will limit the load loss to no more than 5% of the design load in the transfer of the loads from the jacks to the support system.
- G.** Provide and maintain convenient access and appropriate means so that these observations may be made.
- H.** Grease and wrap drilled-in anchors or otherwise treat to ensure the absence of bond on the portion of the tieback between the face of wall and the anchorage.
- I. Performance Tests on Tiebacks:**
 - 1.** Conduct performance tests on at least three selected tiebacks prior to installing any of the remaining tiebacks, which will all be proof loaded. Test tiebacks at each level of support in the excavation. A minimum of 10% of the tiebacks installed shall be performance tested. All performance tests shall be measured with a load cell accurate to within 1% of the design load.
 - 2.** Performance tests for tiebacks in cohesionless soils shall consist of the following cyclic loadings: 0 tons to 0.25 DL

(Design Load); 0.25 DL to 2 tons; 2 tons to 0.50 DL; 0.50 DL to 2 tons; 2 tons to 0.75 DL; 0.75 DL to 2 tons; 2 tons to 1.0 DL; 1.0 DL to 2 tons; 2 tons to 1.2 DL; 1.2 DL to 2 tons; 2 tons to 1.33 DL. The load shall then be reduced to 100% of the design load and locked off. Record axial movement corresponding to incremental applications of 25% of the design load for each individual cycle of loading to an accuracy of 0.025 mm (0.001-inch).

3. Performance tests for tiebacks in cohesive soils shall consist of the following cyclic loadings: 0 tons to 0.25 DL (Design Load); 0.25 DL to 1.8 m tons (2 tons); 1.8 m tons (2 tons) to 0.50 DL; 0.50 DL to 1.8 m tons (2 tons); 1.8 m tons (2 tons) to 0.75 DL; 0.75 DL to 1.8 m tons (2 tons); 1.8 m tons (2 tons) to 1.0 DL; 1.0 DL to 1.8 m tons (2 tons); 1.8 m tons (2 tons) to 1.2 DL; 1.2 DL to 1.8 m tons (2 tons); 1.8 m tons (2 tons) to 1.33 DL. The load shall then be reduced to 100% of the design load and maintained continuously for a minimum of 10 hours. Measure axial movements to an accuracy of 0.025 mm (0.001 inch) and record on 5-minute intervals for the first 100 minutes and 10-minute intervals thereafter.
4. The data from all performance tests shall be interpreted by Contractor's shoring engineer. This interpretation will constitute an evaluation of anchor allowable load-carrying capacities and shall be used by Contractor's shoring engineer to set a criteria for allowable movement of the proof tests.

3.5 Trench Excavation

- A. Perform sheeting, shoring, and bracing for trench excavation for utility facilities and other purposes in accordance with the safety requirements of the General Conditions.
- B. Provide sheeting, shoring, and bracing for trench excavation in the subgrade of the excavation to prevent movement of the main excavation support system.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement

No measurement will be made for this item.

4.2 Payment

A. Sheeting and Shored Excavations

Payment for Sheeting and Shored Excavations is included in the lump sum price for the appropriate precast concrete structure(s) included in this project.

**** END OF SECTION 2254 ****

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
Ductile Iron Pipe	Section 02648
Cement-Mortar Lined and Coated Steel Pipe and Fittings	Section 02651
General Piping Systems and Appurtenances.....	Section 15000
Valves and Appurtenances.....	Section 15020

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 or DESIGNEE to 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:

- a. 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

- 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.

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 springline.

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 DENSITY REQUIRED				
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 outside 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

A. Trench Excavation and Backfill

No measurement will be made for trench excavation and backfill.

B. Over excavation

Over excavation of unsuitable material will be measured by the average end area method per Section 2200, Earthwork.

C. Surface Repair

Measure surface repair along the centerline of utility over which it occurs from junction center to center.

4.2 Payment

A. Trench Excavation and Backfill

No payment will be made for trench excavation and backfill. All trench excavation and backfill work including but not limited to excavation, material testing, disposal, backfill grading is incidental to the pipelines and appurtenant bid items.

B. Over excavation

Payment for over excavation will be made per Specification Section 2200, Earthwork.

****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.....DIVISION 3

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 DIVISION 3.

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 DIVISION 3.
- 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 – Not Applicable

****END OF SECTION****

SECTION 02445

UTILITY CASINGS

PART 1 – GENERAL

1.1 DESCRIPTION

A. This Section includes casing pipe, installed by boring and jacking, carrier pipe alignment guides, sand fill, end seals, and small diameter carrier pipes where indicated. Use when required to pass other utilities, streets, highways, railroads or obstructions without open excavation.

B. Related Work Specified Elsewhere

1. Force Main Construction: SECTION 02560.

1.2 QUALITY ASSURANCE

A. Reference Test Standards and Specifications

1. American Petroleum Institute (API)

1. APIRP1102 – Recommended Practice for Liquid Petroleum Pipelines Crossing Railroads and Highways.

b. API1104 – Standard for Welding Pipelines and Related Facilities.

2. American Society for Testing and Materials (ASTM)

a. ASTM A36 – Structural Steel.

b. ASTM A570 – Hot-Rolled Carbon Steel Sheet and Strip, Structural Quality.

c. ASTM C32 – Sewer and Manhole Brick (Made from Clay or Shale).

d. ASTM C270 – Mortar for Unit Masonry.

- e. ASTM D1785 – Polyvinyl Chloride (PVC) Plastic Pipe, Schedule 40 and 80.
 - f. ASTM D2466 – Polyvinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40.
 - g. ASTM D2855 – Standard Practice for Making Solvent-Cemented Joints with Polyvinyl Chloride (PVC) Pipe and Fittings.
3. American Water Works Association (AWWA)
- a. AWWA C200 – Steel Water Pipe 6 Inches(150mm) and Larger
 - b. AWWA C206 – Field Welding of Steel Water Pipe.
4. Steel Structures Painting Council (SSPC)
- a. SSPC SP-3 - Power Tool Cleaning.

1.3 **SUBMITTALS**

- A. Submit as specified in Section 01330.
- B. Submit the following for acceptance prior to shipment:
 - 1. Pipe alignment guides.
 - 2. Guide spacer bands.
 - 3. Casing pipe.
 - 4. End seals.
- C. Affidavits
 - 1. Furnish for acceptance prior to shipment to jobsite.
 - 2. Certify compliance with applicable standards for the following:
 - a. Casting material.

- b. Casing paint coating/lining system.
- c. Conduit.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

Take all necessary precautions when unloading, storing, and placing all equipment and components so as not to damage the product. All products with visible damage are subject to rejection.

PART 2 – MATERIALS

2.1 Casing Pipe

New, smooth wall, welded steel pipe fabricated from ASTM A36 plate or ASTM A570 sheet with a minimum yield point of 36,000psi, conforming to AWWA C200. Furnish pipe with minimum wall thickness as follows:

A. Minimum Casing Thicknesses:

<u>Casing Diameter</u> <u>Inches</u>	<u>Wall Thickness</u> <u>Under Highways</u> <u>Inches</u>
Under 14	0.188
14 and 16	0.188
18	0.250
20	0.250
22	0.250
24	0.281
26	0.281
28 and 30	0.312
32	0.312
34	0.312
36	0.344
38, 40, and 42	0.344
48 and 54	0.375

- B.** Minimum casing inside diameter shall exceed outside diameter of carrier pipe joints or couplings by 4 inches.

2.2 Joints

All joints in steel pipe casings shall be field welded to conform to AWWA C206.

PART 3 – EXECUTION

3.1 INSTALLATION

- A.** All work shall, as a minimum, meet the requirements of APIRP 1102 and the highway or utility having jurisdiction, and shall be subject to their inspection and approval.

- B.** Install Casing Pipes
 - 1.** By boring with continuous flight auger, pneumatic or hydraulic jacking, or other acceptable method. Reinforce leading end of casing with jacking band.

 - 2.** Including measures for maintaining indicated line and grade for casings less than 24-inch diameter within a plus or minus tolerance of 0.5%. Maintain indicated line and grade for casings 24-inch and larger within a plus or minus tolerance of 3 inches over length of casing.

 - 3.** With working pits of adequate size to provide safe working conditions. Install sheeting and bracing to conform to Section 2300.

 - 4.** In such a manner as not to disrupt traffic or damage the roadway grade or surface.

 - 5.** Contractor shall pump flowable fill into annular space around outside of casing pipe to completely fill any void created during drilling and/or jacking operations.

3.2 PIPE ALIGNMENT SKIDS

- A.** Furnish skids for pipe alignment guides as indicated for all carrier pipe to be installed in casing.
 - 1.** Minimum spacing of skids shall be 10 feet or every pipe joint, whichever is the lesser.

 - 2.** Skids to be sized slightly larger than carrier pipe's outside joint diameter.

B. Provide any of the following:

1. Stainless steel casing spacers with plastic runners, Cascade Waterworks Style CCS or Engineer-approved equal.
2. Epoxy coated steel casing spacers with plastic runners.

3.3 FLOWABLE FILL AND END SEALS

Construct end seals and fill annular space between carrier pipe and casing with flowable fill as follows:

1. After inside of casing has been thoroughly cleaned and approved by Engineer.
2. After carrier pipe has been permanently placed inside casing, tested, and approved.
3. Brick end seals, or approved equal.

PART 4 – MEASUREMENT AND PAYMENT

4.1 MEASUREMENT

Measurement for the utility casing will be the number of linear feet along centerline of casing.

4.2 PAYMENT

Payment for Utility Casings will be made at the contract lump sum price and shall be considered full payment for the casing in place including excavation, testing, cleaning, trenching, dewatering, backfill, and compaction.

**** END OF SECTION 02445 ****

SECTION 02500

STORM DRAIN CONSTRUCTION

PART 1 - GENERAL

1.1 Description

A. Description of Work

The work to be performed in accordance with this section includes furnishing and installing pipe, manholes and catch basins for the conveyance of storm drainage.

The 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 these specifications.

B. Related Work Specified Elsewhere

Trench Excavation and Backfill.....	Section 02300
Rock Rip-Rap Construction	Section 02510
Manhole Construction.....	Section 02570
Concrete Structures.....	Section 03300

1.2 Quality Assurance

A. Reference Test Standards and Specifications

ASTM A48, Specification for Gray Iron Castings.

ASTM C14, Specification for Concrete Sewer, Storm Drain, and Culvert Pipe

ASTM C76, Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe

ASTM C150, Specification for Portland Cement

ASTM C361, Specification for Reinforced Concrete Low-Head Pressure Pipe

B. Bedding, Backfill and Compaction

Test methods, frequencies and tolerances per Specification Section 2300, Trench Excavation and Backfill.

1.3 Submittals

A. Certificate of Compliance

1. Non Reinforced Concrete Pipe

- a. Compliance with ASTM C14
- b. Cement Mill Certificate

2. Reinforced Concrete Pipe

- a. Compliance with ASTM C76
- b. Cement Mill Certificate
- c. Cement Content
- d. Concrete Asmixture
- e. Reinforcing Steel
- f. Manufacturer Qualifications

3. Corrugated Aluminum Pipe

Compliance with ASTM B209

4. Corrugated Steel Pipe

Compliance with AASHTO M36

5. PVC Ribbed Pipe

Compliance with ASTM F794

6. Concrete Pipe Gaskets

Compliance with ASTM C361

7. Precast Concrete Joint Material

Compliance with ASTM C361 and AASHTO M198

8. Castings

Compliance with ASTM A48

B. Shop Drawings

1. Storm Drain Pipe

a. Layout drawing including size, class, D-load of pipe and number, length and type of pipe sections.

b. Pipe sections including joint with gasket.

2. Catch Basin Frame and Grate

Compliance with ASTM A48

1.4 Product Delivery, Storage and Handling

A. Precast Concrete Components

Take all precautions in unloading, storing and placing precast concrete components to prevent damaging the component. All components with visible damage are subject to rejection by the OWNER.

PART 2 - MATERIALS

2.1 Non Reinforced Concrete Pipe

ASTM C14, ASTM C150, Type V Cement. Size and class indicated. Unless otherwise shown use Class 3.

2.2 Reinforced Concrete Pipe

ASTM C76, except as modified herein.

- A.** Size, class and D-load as indicated.
- B.** ASTM C150, Type V cement.
- C.** Pipe that has a diameter of 36 inches or less shall be supplied with an area of reinforcing steel in the bell not less than the area required for the circumferential reinforcement in the wall of the pipe.
- D.** Minimum cement content of 564 lbs. per cubic yard of concrete.
- E.** No calcium chloride or calcium chloride admixture will be allowed.
- F.** Cure pipe using steam or water techniques to produce a pipe with the specified physical properties.
 - 1.** The manufacturer shall be competent to manufacture the type, size and quality of pipe repaired.

2.3 Corrugated Aluminum Pipe and Pipe Arches

Corrugated aluminum pipe, pipe arches, and connectors and coupling bands shall be manufactured and inspected in conformance with the requirements of AASHTO M196, M197, and as specified herein. The size, type, and gauge of the pipe to be furnished shall be shown on the Plans. Corrugated aluminum sheets covered by this Section shall be fabricated from alloy Alclad 3004 with Temper H-34 and shall conform to ASTM B209.

2.4 Corrugated Steel Pipe and Pipe Arches

Corrugated steel pipe, pipe arches, slotted pipe, and coupling bands shall be manufactured and inspected in conformance with AASHTO M36 and as specified herein. The size, type, and metal thickness of the pipe to be furnished shall be as shown on the Plans.

Corrugated steel pipe arches shall consist of corrugated steel pipe other than spiral rib, which has been re-formed to multi-centered pipe, having an arch-shape top with a slightly curved integral bottom. Nominal diameter shall be the minimum inside dimensions of the round pipe.

The material for corrugated steel pipe, pipe arched and coupling bands shall be zinc coated (galvanized) or aluminum coated (AL-T-2) iron or steel conforming to AASHTO M36 and M218 or M274.

2.5 PVC Ribbed Pipe

Pipe and fittings shall be made from PVC compounds as defined and described in ASTM D1784. The sewer pipe shall meet the performance requirements ASTM F794 for sanitary sewers with minimum pipe stiffness of 46.

PVC sewer pipe and fittings shall be made of PVC material having a cell clarification of 12454C or 13364B as defined by ASTM D1784.

2.6 Manholes

Specification Section 2570.

2.7 Joint Materials

A. Concrete Pipe

O-ring gasket joints conforming to ASTM C361.

2.8 Castings

ASTM A48, Class 30. The bearing of the frames and covers shall be machined and the cover shall seat firmly onto the frames without rocking. All castings shall be painted or dipped in commercial quality asphalt paint.

2.9 Concrete Structures

Specification Section 3300.

2.10 Non-Shrink Grout

ASTM C1107, pre-packaged.

2.11 Steel Shapes

Specification Section 3300.

2.12 Cast Iron Catch Basin Frame and Grate – Bicycle Safe

ASTM A48. Bicycle safe, high capacity vane grate, type L, manufactured by Neenah Foundry or approved equal.

PART 3 - EXECUTION

3.1 Preliminary Investigation of the Work

Verify that all preliminary work has been performed in accordance with the plans and specifications prior to performing storm drain construction.

3.2 Trench Excavation and Backfill

Accomplish excavation, bedding, backfilling, compaction and surface replacement as specified in Section 2300 and as indicated on the plans.

3.3 Storm Drain Collection Systems

A. Pipe Placement

Carefully inspect each pipe section before and after installation with reference to the ASTM specification. Remove those pipe sections found defective and replace with sections which comply with the specification. Place concrete pipe with bell end in the upgrade position. Adjust spigots in bells to produce satisfactory joint. Blocking or wedging between the bell and spigot will not be permitted. Continually monitor pipe end elevations and locations to ensure proper grade and alignment.

B. Jointing of Concrete Pipes

Thoroughly clean all surfaces to receive gaskets. Install gasket and stab pipe per manufacturer recommendations. Check each joint to ensure the spigot end is home.

C. Jointing of Corrugated Metal Pipe

The pipe shall be laid so that the seams are not on the bottom. The inside circumferential seams shall be placed pointing downstream. Care shall be taken to ensure dirt or other particles do not get between the outside of pipe and the pipe coupling. Paved inverts shall be placed and centered on the bottom of the trench. Any

damage done to the protecting lining and coating shall be repaired prior to the backfilling around the pipe.

D. Jointing of Solvent Cemented PVC Pipe

Solvent welded jointing of PVC pipe shall be in accordance with the approved manufacturer's printed instructions, which shall be furnished to the **ENGINEER**.

E. Connections to Manholes, Catch Basins and Existing Systems

All connections shall be watertight. Furnish and install waterstop gaskets and nonshrink grout. Where pipe enters pre-cast concrete structure place gasket in the center of the wall and pack watertight with grout. Where concrete is to be placed around a pipe, provide and install at waterstop gasket. Place gasket in the center of the intersecting wall.

F. Allowable Variation from Plan Line and Grade

The final position of the pipe shall be to the plan line and grade. Variation shall not exceed "0.03 feet vertically. The horizontal alignment shall not vary from plan alignment by more than 0.1 feet.

G. Manholes

Furnish and install manholes in the locations shown per Specification Section 2570, Manhole Construction, and as detailed.

H. Catch Basins and Drop Inlets

Furnish and install catch basins and drop inlets at the location and to elevation indicated on the plans. Alignment and grade shall not vary from plan elevation by more than 0.10 feet. Cast-in-place units are to be constructed per Specification Section 3300, Concrete Structures. Pre-cast units will be furnished and installed in accordance with applicable portions of Specification Section 2570, Manhole Construction and 3300, Concrete Structures.

I. Cast Iron Frame and Grate – Bicycle Safe

Bicycle safe, high capacity vane grate castings shall conform to ASTM designation A48. The grate shall be installed with the vanes perpendicular to the curb line for bicycle safety. Vane grates shall not

be installed in a driveway entry area of the roadway unless longitudinal bars have been added for bicycle safety. Frames shall be set accurately to the final elevations as indicated on the plans.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement

Storm drainpipe will be measured by the number of linear feet of pipe laid horizontally between centerline of structures or the end of the pipe at an outfall.

4.2 Payment

Storm drain pipe will be paid at the contract unit price bid per linear foot, to the nearest foot, for each size and type of pipe and shall be compensation in full for furnishing and installing the type of pipe as specified and as shown on the plans including removal of obstructions, excavation, bidding, backfilling, compacting, testing, joint materials, collars, and field closures.

****END OF SECTION****

SECTION 02510

ROCK RIP-RAP CONSTRUCTION

PART 1 - GENERAL

1.1 Description

A. Description of Work

The work to be performed in accordance with this section includes furnishing and installing stone, with or without grout as indicated on the plans and specified herein. The work shall include the furnishing of all labor, tools, equipment, materials and the performing of all operations required to provide with the project plans and these specifications.

B. Related Work Specified Elsewhere

Earthwork.....Section 02200
Storm Drain Construction.....Section 02500

1.2 Quality Assurance

A. Reference Test Standards and Specifications

ASTM C131, Standard Test Method for Resistance to Degradation of Small Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine

ASTM C144, Standard Specification for Masonry Mortar

ASTM C404, Standard Specification for Aggregate for Masonry Grout

1.3 Submittals

A. Materials Test Reports

1. Report on Rip-Rap Gradation and Abrasion Loss.
2. Report on Portland Cement Grout Including Mix Design and Aggregate Properties.

B. Frequency for Testing

1. One test for each source of stone and grout.

PART 2 - MATERIALS

2.1 Stone

Sound and durable, free from seams and coatings. Loss by abrasion not to exceed 10 percent by weight after 100 revolutions nor 40 percent after 500 revolutions when tested in accordance with ASTM C131.

A. Shape

Do not use rounded boulders or cobbles on slopes steeper than 2 to 1 unless grouted. The thickness of each stone shall be more than 1/3 the length.

B. Size

Stone shall be as large as can be conveniently placed in a layer of the required depth. Except for small stones used to chink interstices, stone shall not be less than 10 pounds and at least 50 percent of the stone shall not be less than 100 pounds.

C. Type

Waste concrete is not to be used unless specifically approved by the **OWNER**.

2.2 Portland Cement Grout

One part Type V portland cement, three parts aggregate by volume. The aggregate shall be two parts sand and one part 3/8 inch aggregate. The sand shall meet the requirements of ASTM C144. The aggregate shall meet the requirements of ASTM C404, Size No. 1.

PART 3 - EXECUTION

3.1 Preliminary Investigation of the Work

Verify all preliminary work has been performed in accordance with these specifications prior to placement of rock rip-rap.

3.2 Preparation of Ground Surfaces

Trim and shape bed to provide even surfaces to the plan elevation. Excavate, backfill and compact bed for rip-rap in accordance with Specification Section 2200, Earthwork.

3.3 Rock Rip-Rap

A. Depth Less Than 20 Inches

Place stone by hand to provide a minimum of voids. Place larger stone in the trench at the slope toe; as foundation course and on the perimeter. Place stones with longitudinal axis normal to the face of the embankment and arranged so that each stone has at least 3 point bearing on underlying stones. Chink interstices with small stones. The finished surface shall be even and tight and shall not vary from the planned surface by more than 3 inches per foot of depth.

B. Depth Greater Than 20 Inches

Stone may be placed by dumping and spreading in layers with suitable equipment. Arrange with equipment to produce stable and dense layer.

3.4 Grouted Rock Rip-Rap

Place rip-rap as specified above and grout with portland cement grout. Mix grout in an appropriate machine mixer. Place grout to the depth as shown on the plan but in no case less than 70 percent of the depth of rip-rap. Place and consolidate grout so as to provide a dense stone and mortar layer with all voids and interstices filled.

The stone face surface shall be exposed. If required, use water pressure to clean stone faces after the mortar has achieved sufficient strength. Cure grouted rip-rap in accordance with Specification Section 3300, Concrete.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement

The surface area of rock rip-rap construction to be paid for will be that of the completed bid item, in place, within the limits of dimensions shown on the plans. The **OWNER** will compute the quantities of rip-rap by a method which, in his opinion, is best suited to obtain an accurate determination.

4.2 Payment

Payment for rock rip-rap will be made at the contract unit price for the number of square yards of rock rip-rap in place for each depth required on the basis of unit prices stipulated in the proposal and shall include preparation of ground surfaces and trenching.

Payment will be made under Item Number:

NOT USED - "X" Rock Rip-Rap, S.Y.

****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 Line Construction	Section 2550
Sewer Line Construction	Section 2560
Protective Coatings.....	Section 9900
Electrical	Division 16

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 in Section 2560 and for the following:
 - a.** Check valves.
 - b.** Butterfly valves.
 - c.** Plug valves.
 - d.** Gate valves.

- e. Ball valves.
- f. Air and air/vacuum valves.
- g. Surge relief valves.
- h. Gauges.

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.
- 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 Eccentric Plug Valves

A. Acceptable Manufacturers

1. DeZurik, a unit of General Signal Corporation.
2. Keystone Valve USA, Inc.
3. Milliken Valve Company, Inc.
4. Val-Matic Valve and Manufacturing Corporation.
5. Victaulic Company of America.
6. Or approved equal

B. Design

1. Quarter-turn nonlubricated eccentric type with resilient faced plug. Valves with vane type seat rings are not acceptable. Shutoff up to scheduled rating with pressure in reverse direction where scheduled.
2. Suitable for 250 psi operating pressure.
3. Port areas for valves through 16-inch shall be at least 80% of full pipe area and 24-inch and larger shall be at least 70% full pipe area.
4. Plugs shall be eccentric type with no backing ring or frame.
5. Valve body cavity shall be smooth without protrusions or baffles.

C. Materials and Construction

1. Bodies shall be of ASTM A126, Class B cast iron.
2. Valve plug shall be ASTM A126, Class B cast iron or ASTM A536 ductile iron. Resilient plug facing or replaceable style body seats shall be synthetic rubber, neoprene, or Buna N compound suitable for use with wastewater applications.
3. Seat rings shall be threaded, or welded of corrosion-resistant 18-8 stainless steel, nickel, or Monel conforming to AWWA C504. Sprayed or plated mating seat surfaces are not acceptable.
4. Bearings shall be replaceable. Sleeve type and thrust bearings in the upper and lower journals shall be corrosion-resistant stainless steel.
5. Shaft seals shall be multiple O-ring or self-adjusting U-cup or chevron type packing conforming to AWWA C504. Pull-down packing is not acceptable.
6. Shaft seals shall be field adjustable or replaceable under pressure and without valve disassembly.
7. All exposed fastening hardware shall be zinc plated or stainless steel. Provide stainless steel for buried service.

D. Connections

1. Valve connections to be flanged for valves within the wet well, valve vault and flowmeter vault and mechanical joint for all buried valves.
2. Flanged valve ends shall be faced and drilled to conform to ANSI B16.1, Class 125 for thickness and drilling.

E. Actuators

1. Manual Actuators

- a. All valves shall open counterclockwise.
- b. Provide indicators to show position of plug.

- c. Worm gear actuators shall be totally enclosed, grease sealed, gear type furnished with AWWA nut, crank, handwheel, or chainwheel. All buried valves shall be provided with worm gear actuators, AWWA nut, and enclosed cover plate. All valves with reverse pressure capacity requirement shall be provided with worm gear actuators. Worm gear actuators shall be self-locking at all variable opening positions and sized to meet the torque ratings of AWWA C504. The shaft in a worm gear actuator shall have a nonmetallic sleeve type bearing. Submit manufacturer's parts and materials drawings.
- d. Handwheels shall be located in positions indicated or as otherwise determined when manufacturer's drawings are submitted.

D. Shop Painting: Apply interior coating conforming to AWWA C550 to exposed ferrous metal surfaces. Provide affidavit or certificate of compliance per AWWA C550.

2.2 Cushioned Swing Check Valves

A. Acceptable Manufacturers

1. APCO, Valve and Primer Corporation.
2. GA Industries, Inc.

B. Operational Requirements

1. Prevent reverse flow without shock or hammer.
2. Seat tightly 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 Automatic Air/Vacuum Release Valves

A. Acceptable Manufacturers

1. APCO, Valve and Primer Corporation.
2. Crispin Valves, Multiplex Manufacturing Company.
3. G.A. Industries, Inc.
4. Val-Matic Valve and Manufacturing Corporation.

B. Design: Conform to AWWA C512 and as specified.

1. Valve shall be heavy-duty air and vacuum valve; sewer style.
2. Body and cover shall be ASTM 126 cast iron.
3. Float shall be ASTM A276 Type 316 stainless steel. Valve seats shall be Teflon or Buna-N.
4. All internal parts shall be stainless steel.
5. Single body construction built for 300 psi service.
6. Provide valves 3 inches and smaller with internal deflector and external adjustable discharge orifice to control leakage or blow-by of liquid.
7. Provide valves 4 inches and larger with internal surge check unit ahead of air/vacuum valve to ensure gentle closing upon.

C. Operation

1. Release air when filling line.

2. Admit air when emptying line.
3. Release accumulated air while pipeline is full and operating under pressure.

D. Connection

1. Connect air valves 2 inches and smaller to pipeline through ductile iron pipe service saddles with 304 SS straps. Corporation stops may be used of Mueller Company Style H-10003, H-10013, H-10045 or Engineer approved equal.
2. Connect air valves 3 inches and larger through tapped bosses or flanged outlets as indicated on drawings. Air vacuum valve inlet and outlet shall be provided with ANSI B16.1 125 psi flanged connections. Locate valve and vault either directly over pipeline or off to one side as indicated.
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.
6. Blowoff valves and shutoff valves with backflushing attachments shall be provided for all air valves.

E. Valve Schedule

As indicated on Drawings.

2.4 Surge Relief Valves

A. Acceptable Manufactures

1. G.A. Industries, Inc.
2. Or approved equal.

B. Operational Requirements

1. Valve shall be normally closed and shall open when the system pressure exceeds 135 psi.

2. Valve shall close at a slow speed to prevent hammer or pipeline shock.

C. Design

1. Valve shall be wye body configuration.
2. Flanges shall be ANSI B16.1, Class 125.

D. Materials and Construction

1. Valve body shall be ASTM A126 cast iron.
2. Valve seats and seat rings shall be renewable. Seats shall be resilient. Seat rings shall be bronze or stainless steel.
3. Disc movement shall be guided for proper alignment throughout its stroke and shall provide for full opening.
4. External springs shall be enclosed in protective casings and shall be in compression.
5. Provide two coats of the manufacturer's standard coating.

E. Valve Schedule

As indicated on Drawings.

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 Hangers and Supports

- A. Pipe hangers and 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, Spring and Rigid Hangers:** Bergen, Blaw Knox, Fee and Mason, Grinnell, or NAVCO.

- C. Pipe hanger and 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.
- D. All hangers shall be stainless steel.
- E. All hanger rods shall be stainless steel.
- F. **Concrete Inserts and Expansion Shields**
 - 1. Inserts shall be 316 stainless steel and have a recommended load capacity of 2,000 pounds per foot of length in average good concrete with a safety factor of 3.
 - 2. Inserts shall be continuous and located as required.
 - 3. Provide end caps at each end. End caps shall have attached anchor if spacing from end of insert to next anchor is greater than 2 inches.

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.

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 2560, Sewer Line Construction and 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 hangers, supports, and anchors 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.
2. Hanger class and selection of components shall be in accordance with those specified.
3. Furnish and install all rigid and spring supports, whether or not they are shown and detailed, but are required to adequately support the piping systems.
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 reaction and forces on Equipment on the Shop Drawings. Calculate expansion and movement of all pipe installed under this Contract and select hanger type and components to allow for pipe expansion and movement.
 2. Submit detail Shop Drawings of each hanger assembly for review and comments.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement

- A.** No measurement will be made for this item.

4.2 Payment

- A.** Payment for Utility Valves and Accessories will be made at the contract lump sum price and shall be considered full payment for providing labor and materials to perform this work.
- B.** Progress payments for valves will be based on the Schedule of Values per valve for each size and type of valve and shall be considered as full payment for the valve in place including any fittings, flexible couplings, anchor and thrust blocks, hydrostatic testing, disinfection, plastic pipe wrap, trench excavation, bedding and backfill. No payment will be made until the hydrostatic testing and disinfection is satisfactorily completed.

**** END OF SECTION 2515 ****

SECTION 02520

CULVERT CONSTRUCTION

PART 1 - GENERAL

1.1 Description

A. Description of Work

The work to be performed in accordance with this section includes furnishing and installing concrete pipe or concrete box culverts for the conveyance of storm drainage through roadway embankments.

The 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 these specifications.

B. Related Work Specified Elsewhere

Trench Excavation and Backfill.....Section 02300
Rock Rip-Rap Construction Section 02510
Concrete StructuresSection 03300

1.2 Quality Assurance

A. Reference Test Standards and Specifications

ASTM B209, Specification for Aluminum and Aluminum-Alloy Sheet and Plate

ASTM B316, Specification for Aluminum-Alloy Rivet and Cold Heading Wire and Rods

ASTM C76, Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe

ASTM C150, Specification for Portland Cement

ASTM C361, Specification for Low-Load Pressure Pipe.

ASTM C850, Specification for Precast Reinforced Concrete Box

Sections with less than 2-feet of Cover Subjected to Highway Loadings.

ASTM D1784, Specification for Rigid Polyvinyl Chloride (PVC) Compounds and Chlorinated Polyvinyl Chloride (PVC) Compounds.

ASTM F794, Specification for Polyvinyl Chloride (PVC) Large Diameter Ribbed Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.

ASTM M198, Joints for Circular Concrete Sewer and Culvert Pipe Using Flexible Watertight Gaskets.

B. Bedding, Backfill and Compaction

Test methods, frequencies and tolerances per Specification Section 2300, Trench Excavation and Backfill.

1.3 Submittals

A. Certificate of Compliance

1. Reinforced Concrete Pipe

- a. Compliance with ASTM C76
- b. Cement Mill Certificate
- c. Cement Content
- d. Concrete Admixture
- e. Reinforcing Steel
- f. Manufacturer Qualifications

2. Precast Reinforced Concrete Box Culvert

- a. Compliance with ASTM C850
- b. Cement Mill Certificate
- c. Cement Content

- d. Concrete Admixture
- e. Reinforcing Steel
- f. Manufacturer Qualifications

3. Corrugated Aluminum Pipe

Compliance with ASTM B209.

4. Corrugated Steel Pipe

Compliance with AASHTO M36.

5. PVC Ribbed Pipe

Compliance with ASTM F794.

6. Concrete Pipe Gaskets

Compliance with ASTM C361.

7. Precast Concrete Joint Material

Compliance with AASHTO M198.

B. Shop Drawings

1. Pipe Culvert

- a. Layout drawing including size, class, D-load of pipe and number, length and type of pipe sections.
- b. Pipe sections including joint with gasket.

2. Precast reinforced concrete box culvert

Box plan and sections

1.4 Product Delivery, Storage and Handling

A. Precast Concrete Components

Take all precautions in unloading, storing and placing precast concrete components to prevent damaging the component. All components with visible damage are subject to rejection by the **OWNER**.

B. Precast Concrete Box Culvert Sections

Individual box culvert sections are subject to rejection due to any of the following imperfections;

1. Fractures or cracks passing through the wall,
2. Defects that indicate non-compliance with mixing and molding requirements of ASTM C850,
3. Honeycombed or open texture,
4. Damaged ends where such damage would prevent making a satisfactory joint.

1.5 Reinforced Concrete Box Culverts

A. Reinforced Concrete Box Culverts

The **CONTRACTOR** may elect to use precast reinforced concrete or cast-in-place concrete for the concrete box culvert construction. In either case, the box culvert shall meet the specifications as indicated herein and as shown on the plans. Provide certificates of compliance and shop drawings as required. Perform cast-in-place construction in accordance with Specification Section 3300, Concrete Structures; except that the walls of all cast-in-place reinforced concrete boxes shall meet the 28-day minimum compressive strength requirements within a 14-day period.

PART 2 - MATERIALS

2.1 Reinforced Concrete Pipe

ASTM C76, except as modified herein.

- A.** Size, class and D-load as indicated
- B.** ASTM C150, Type V cement
- C.** Pipe that has a diameter of 36 inches or less shall be supplied with an area of reinforcing steel in the bell not less than the area required for the circumferential reinforcement in the wall of the pipe.
- D.** Minimum cement content of 564 lbs. per cubic yard of concrete.
- E.** No calcium chloride or calcium chloride admixture will be allowed.
- F.** Cure pipe by steam or water techniques to produce a pipe with the specified physical properties.
 - 1.** The manufacturer shall be competent to manufacture the type, size, and quality of pipe required.

2.2 Precast Reinforced Concrete Box Culverts

ASTM C850, except as modified herein and as shown on the plans.

- A.** **HS20-44 design load**
- B.** **ASTM C150, Type V cement**
- C.** **Minimum 28-day concrete compressive strength of 5000 psi.**
- D.** **Surface Repairs**

Patch surface imperfections which the **OWNER** has determined is not cause for rejection. Remove imperfections such as honeycombing or surface cracking, and patch with a grout specifically made for such repairs. Patches shall match the concrete surface appearance and integrity. Materials and patch techniques shall be in accordance with Specification Section 3300 and as approved by the **OWNER**.

2.3 Joint Materials

A. Concrete Pipe

O-ring rubber gasket joints conforming to ASTM C361.

B. Precast Reinforced Concrete Box Culverts and Precast Manhole Sections

AASHTO M198, Type B performed joint material.

2.4 Corrugated Aluminum Pipe and Pipe Arches

Corrugated aluminum pipe, pipe arches, and connectors shall be manufactured and inspected in conformance with the requirements of AASHTO M196, M197, and as specified herein. The size, type, and gage of the pipe to be furnished shall be shown on the Plans.

Corrugated aluminum sheets covered by this Section shall be fabricated from alloy Alchad 3004 with Temper H-34 and shall conform to ASTM B209.

2.5 Corrugated Steel Pipe and Pipe Arches

Corrugated steel pipe, pipe arches, slotted pipe, and coupling bands shall be manufactured and inspected in conformance with AASHTO M36 and as specified herein. The size, type and metal thickness of the pipe to be furnished shall be as shown on the Plans.

Corrugated steel pipe arches shall consist of corrugated steel pipe other than spiral rib pipe which has been re-formed to multi-centered pipe, having an arch-shape top with a slightly curved integral bottom. Nominal diameter shall be the minimum inside dimensions of the round pipe.

The material for corrugated steel pipe and pipe arches shall be zinc coated (galvanized) or aluminum coated (AL-T-2) iron or steel conforming to AASHTO M36 and M218 or M274.

2.6 PVC Ribbed Pipe

Pipe and fittings shall be made from PVC compounds as defined and described in ASTM D1784. The sewer pipe shall meet the performance requirements of ASTM F794 for sanitary sewers with minimum pipe stiffness of 46.

PVC sewer pipe and fittings shall be made of PVC material having a cell classification of 12454B, 12454C or 13364B as defined by ASTM D1784.

PART 3 - EXECUTION

3.1 Preliminary Investigation of the Work

Verify that all preliminary work has been performed in accordance with the plans and specifications prior to performing storm drain construction.

3.2 Trench Excavation and Backfill

Accomplish excavation, bedding, backfilling, compaction, and surface replacement as specified in Section 2300 and as indicated on the Plans.

3.3 Precast Concrete Pipe Culvert

A. Pipe Placement

Carefully inspect each pipe section before and after installation. Remove those pipe sections found defective and replace with sections which comply with the specification. Place pipe with bell end in the upgrade position. Adjust spigots in bells to produce satisfactory joint. Blocking or wedging between the bell and spigot will not be permitted. Continually monitor pipe end elevations and locations to ensure proper grade and alignment.

B. Jointing

Thoroughly clean all surfaces to receive gaskets. Install gasket and stab pipe per manufacturer's recommendations. Check each joint to ensure the spigot end is home.

C. Allowable Variation from Plan Line and Grade

The final position of the pipe shall be to the plan line and grade. Variation shall not exceed "0.05 feet vertically. The horizontal alignment shall not vary from plan alignment by more than 0.1 feet.

3.4 Precast Concrete Box Culvert

A. Placement

Carefully inspect each section before and after installation with reference to the ASTM specification. Remove defective sections and replace with sections that comply with the specification. Place sections with bell end in the upgrade direction. Adjust spigots in bells to produce satisfactory joint. Continually monitor box end elevations and locations to ensure proper grade and alignment.

B. Jointing

Thoroughly clean all surfaces to receive gasket material. Overlap gasket material as recommended by the manufacturer but no less than 6 inches. Check each joint to ensure the spigot end is correctly inserted. The maximum tolerable gap in the joint will be 3/4 inch. The maximum tolerable difference in invert elevation between the sections will be 1/4 inch.

Multiple precast concrete barrel box sections are to be placed with the longitudinal spacing as shown on the plans but in no case less than 3 inches. Fill the gap with grout. The grout shall have a maximum aggregate size of 3/8 inch and achieve a 28-day compressive strength of 2500 psi. Place grout by pumping or pouring and consolidate in lifts not to exceed six (6) feet.

C. Allowable Variation from Plan Line and Grade

The final position of the pipe shall be to the plan line and grade. Variation shall not exceed "0.05 feet vertically. The horizontal alignment shall not vary from plan alignment by more than 0.1 feet.

D. Headwalls, Wingwalls, Cutoff Wall and End Sections

Construct cast-in-place members in accordance with Specification Section 3300, Concrete Structures.

E. Jointing of Corrugated Metal Pipe

The pipe shall be laid so that the seams are not on the bottom. The inside circumferential seams shall be placed pointing downstream. Care shall be taken to ensure that dirt or other particles do not get

between the outside of pipe and the pipe coupling. Paved inverts shall be placed and centered on the bottom of the trench. Any damage to the protecting lining and coating shall be repaired prior to the backfilling around the pipe.

F. Jointing of Solvent Cemented PVC Pipe

Solvent welded jointing of PVC pipe shall be in accordance with the approved manufacturer's printed instructions which shall be furnished to the **ENGINEER**.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement

Precast concrete culvert pipe and concrete box culverts shall be measured by the number of linear feet of culvert laid horizontally.

Headwalls and end sections shall be paid per each.

4.2 Payment

A. Culvert

Culverts will be paid at the unit price bid per linear foot, to the nearest foot, for each size and type of culvert and shall be compensation in full for furnishing and installing the type of culvert as specified and as shown on the plans including removal of obstructions, excavation, bedding, backfilling, compacting, and joint materials.

B. Headwalls

Headwalls shall include the wingwalls, the attached cut-off wall and headwall. Headwalls and end sections will be paid at the contract unit price per each and shall be full compensation for furnishing and installing the item as specified and shown on the plans.

See Section 00310 Bid Schedule for Bid Items.

****END OF SECTION****

SECTION 02532
UTILITY STRUCTURES

PART 1 – GENERAL

1.1 Summary

A. Description of the Work

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. This Section includes the following structures and related appurtenances:

Precast concrete manholes
Pump Station wet well and valve vault.
Accessory vault.
Concrete anchor and thrust blocks.

C. Related Work Specified Elsewhere:

Trench Excavation and Backfill.....Section 02300
Sewer Line Construction.....Section 02560
ConcreteSection 03300

1.2 Quality Assurance

A. Applicable Test Standards and Specifications

1. American Society for Testing and Materials (ASTM)

ASTM A48 - Gray Iron Castings

ASTM C76 - Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe

ASTM C270 - Mortar for Unit Masonry

ASTM C443 - Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets

ASTM C478 - Precast Reinforced Concrete Manhole Sections

ASTM C1107 –Packaged Dry, Hydraulic-Cement Grout, Nonshrink

2. Federal Specification (FS)

FS FF-H-106 - General Hardware, Builder's, Locks and Door Trim

FS SS-S-00210 - Sealing Compound, Preformed Plastic, for Expansion Joints and Pipe Joints

3. American Association of State Highway Transportation Officials (ASSHTO)

AASHTO H20 – Axial Loading

4. American Concrete Institute (ACI)

ACI 350 – Code Requirements for Environmental Engineering Concrete Structures and Commentary

B. Leakage Test

Test all manholes installed under this contract using the vacuum method described below. Provide all equipment necessary to perform the test. Coordinate test schedule with the Owner. Test will not be accepted unless witnessed by the Owner.

1. Plug all pipes entering the manhole, taking care to securely brace the plug from being drawn into the manhole.
2. Place the test head inside of the top of the cone section and inflate seal in accordance with the manufacturer's recommendations.
3. Draw a vacuum of 10 inches of mercury and shut off the vacuum pump. With the valves closed, measure the time for the vacuum to drop to 9 inches. The manhole shall pass if the time for the vacuum to drop is greater than 60 seconds for 48" diameter manhole, 75 seconds for 60" diameter manhole and 90 seconds for 72" diameter manholes. In lieu of vacuum testing, a water tightness test may be performed by filling the manhole with water. The manhole shall pass if

the drop in water level does not exceed 0.001% of the manhole volume in one hour.

4. If the manhole fails the initial test, make necessary repairs with a non-shrink grout while the vacuum is still being drawn. Retest until a satisfactory test is obtained.

1.3 Submittals

- A. Certificates of Compliance and Descriptions required for Frames and Covers.
- B. Provide submittal for precast reinforced manholes per Section 01330, Submittals. The minimum information required for each manhole includes:
 1. Top Elevation.
 2. Base Elevation.
 3. All pipe inverts entering and leaving the manhole.
 4. All angles between lines leaving and entering the manhole.

1.4 Product Delivery, Storage And Handling

Take all necessary precautions in handling, storage and placement of manhole components and appurtenances. Replace defective materials.

PART 2 – PRODUCTS

2.1 Precast Manholes

- A. Precast concrete manholes shall conform to ASTM C478 with ASTM C443 two-fin serrated flat gasket to concrete joint or with FS SS-S-00210 preformed plastic concrete joint.
- B. Precast manholes shall be 48-inchs in diameter unless otherwise indicated.
- C. Provide precast concrete manhole bases for all concrete precast manholes.
- D. Manhole cone section shall conform to ASTM C478, 24 inch minimum inside diameter of similar quality as manhole riser sections.

- E. Manhole penetrations for pipes entering the manhole shall be provided with A-lock gaskets or approved equal and shall be included in the precast base section.

2.2 Manhole Frames And Covers

- A. Shall conform to ASTM A48, Class 30B.
- B. The word "sewer" shall be cast into the top of the lid and the lid shall contain the City's Logo.
- C. The cover and frame shall be a locking, nonventilated type for all locations in nonpaved areas, and nonlocking, nonventilated type in paved areas.
- D. Provide a concrete collar around the frame. (Minimum 1' wide and 8" thick)
- E. Provide one ("T" Handle Type) for 24-inch manhole frame and cover for locking units required for non-paved installations.
- F. Acceptable Manufacturers:
 - 1. Neenah Foundry Company Model R-1772 Cast Iron Manhole Frame & Cover with special lid containing the City Logo.
 - 2. Model REXUS D 400 or PAMREX as manufactured by SAINT GOBAIN. (This manufacturer can provide a Ductile Iron Locking Lid as specified to be installed in easements.)
 - 3. East Jordan Iron Works – Product no. 00102214 Catalog No. 1022Z3 with special lid containing the Logo.
 - 4. Engineer approved equal.
- G. Machine-bearing surfaces to provide even seating.

2.3 Non Shrink Grout

ASTM C1107, prepackaged.

2.4 Preformed Joint Material For Precast Concrete Manholes

Plastic or mastic as recommended by the barrel section manufacturer. Resistant to sewer environment to provide water tight seal between

concrete sections. Preformed joint material shall be Ram-Nek, Kent Seal, or equal.

PART 3 - EXECUTION

3.1 Excavation, Backfill And Compaction

A. Manholes

Prepare subgrade and bedding in accordance with Section 02300, Trench Excavation and Backfill. Provide bedding to depth and density indicated. Place and compact bedding and backfill with the same material and to the same density indicated for the adjacent trench.

1. Extensions

Place each extension plumb. Join sections with a full bed of preformed joint material. Cut off excess joint material to provide space for at least 1/4 inch depth of grout. Grout smooth the interior and exterior of the joint after the mastic has set.

2. Final Adjustment to Grade

Adjust frame and cover to required elevation with manhole extensions. Do not exceed maximum dimensions of 18 inches between the top of the frame and the top of the cone. Use preformed joint material to provide water tight seal between extension sections. Grout smooth the interior surface of sections and extensions.

3. Frame and Cover

Place frame and cover level to the elevation indicated or required to match surface conditions on full bed of mortar. Construct concrete collar as indicated.

4. Connections for precast concrete manholes

Grout around pipes with nonmetallic non-shrink grout. Install all piping using a flexible-rubber, entrance-hole gasket joint of pattern approved by the Engineer. Place pipe stub in manhole wall with bell or coupling outside manhole wall to provide flexible joints as indicated. Make provisions for future connections where indicated. Include plug or stopper capable

of withstanding 4.3 psi of internal or external pressure without leakage for future connections.

- 5. Manhole Installation:** All manholes shall be installed in accordance with manufacturers instructions. A representative of the manufacturer must be present for the installation of all manholes until the manufacturer is satisfied that the Contractor is proficient in the installation of the manhole.
- 6. Invert Channels:** Form invert channel with 4,000 psi Type II portland cement concrete. Make changes in direction of flow with smooth curves of as large a radius as size of manhole permits. Make changes in size and grade smoothly and uniformly. Slope floor of manhole adjacent to channels as indicated. Finish channel bottom smoothly without roughness, irregularity, or pockets.

B. Accessory Vault

- 1. Design:** Construct to conform to Drawings of reinforced concrete pipe conforming to ASTM C76, Class II
- 2. Installation:**
 - a. Install vaults where indicated.
 - b. Extend from centerline of pipe to ground surface.
 - c. Notch lower section 2 inches greater than pipe OD and include fiberglass batt to prevent transmission of loads to pipe barrel.
- 3. Manhole Frame and Cover:**
 - a. Pattern as shown on drawings. Set frame level and to grade in mortar.

C. Air Valve Vault

- 1. Design:**
 - a. Precast and masonry construction as indicated.
 - b. Precast concrete footings.
 - c. Riser of ASTM C76, Class II pipe.

- d. Top slab shall be precast as indicated.

2. Manhole Frame and Cover:

- a. Pattern as shown on attached detail.
- b. Set frame level and to grade in mortar.

D. CONCRETE ANCHOR AND THRUST BLOCKS

1. Install at tees, elbows, bends, and dead ends where indicated.
2. Place against undisturbed earth or rock.
3. Of design indicated or specified.

PART 4 – MEASUREMENT AND PAYMENT

4.1 Measurement And Payment

- A. Measurement and payment for manholes shall be as specified in Section 01210 – Measurement and Payment.

**** END OF SECTION 02532 ****



SECTION 02535
PIPE INSTALLATION

PART 1 - GENERAL

1.1 Summary

A. Description of Work

This Section includes handling, installation and testing of pipe, fittings, specials, and appurtenances as indicated or specified.

B. Related Work Specified Elsewhere

Excavation, Filling, and Backfilling for Structures.....Section 02321
Utility StructuresSection 02532
Sewer Line ConstructionSection 02560

1.2 Quality Assurance

A. Applicable Standards and Specifications

1. American Society for Testing and Materials (ASTM):

ASTM D2321 - Underground Installation of Flexible Thermoplastic Sewer Pipe.

ASTM F1417 - Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.

2. Federal Specifications (FS):

SS-S-00210 - Sealing Compound, Preformed Plastic, For Expansion Joints and Pipe Joints.

1.3 Delivery, Storage and Handling

A. Handle in a manner to ensure installation in sound and undamaged condition.

1. Do not drop or bump.

2. Use slings, lifting lugs, hooks, and other devices designed to protect pipe, joint elements, linings, and coatings.
- B. Ship, move, and store with provisions to prevent movement or shock contact with adjacent units.
 - C. Handle with equipment capable of work with adequate factor of safety against overturning or other unsafe procedures.

PART 2 - MATERIALS

Specified in Section 02560.

PART 3 - EXECUTION

3.1 Installation

- A. Verify all preliminary work has been completed prior to any sewer line construction.
- B. Use equipment, methods, and materials ensuring installation to lines and grades indicated.
 1. Maintain within tolerances specified or acceptable laying schedule.
 - a. **Alignment:** +1 inch per 100 feet in open cut or tunnel.
 - b. **Grade:** +1 inch per 100 feet.
 2. Do not lay on blocks unless pipe is to receive total concrete encasement.
 3. Obtain acceptance of method proposed for transfer of line and grade from control to the Work.
- C. Install pipe of size, materials, strength class, and joint type with embedment indicated.
- D. Install pipe with spigot or tongue ends in direction of flow. Obtain Engineer approval for deviations there from.

- E.** Clean interior of all pipe, fittings, and joints prior to installation. Exclude entrance of foreign matter during installation and at discontinuance of installation.
 - 1.** Close open ends of pipe with snug-fitting closures.
 - 2.** Do not let water fill trench. Include provisions to prevent flotation should water control measures prove inadequate.
 - 3.** Remove water, sand, mud, and other undesirable materials from trench before removal of end cap.
- F.** Brace or anchor as required to prevent displacement after establishing final position.
- G.** Perform only when weather and trench conditions are suitable. Do not lay in water.
- H.** Observe extra precaution when hazardous atmospheres might be encountered.

3.2 Jointing

A. General Requirements

- 1.** Locate joint to provide for differential movement at changes in type of pipe embedment, impervious trench checks, and structures.
 - a.** Not more than 8 inches from structure wall, or
 - b.** Support pipe from wall to first joint with concrete cradle structurally continuous with base slab or pipe bedding material.
 - c.** As indicated.
- 2.** Perform conforming to manufacturer's recommendations.
- 3.** Clean and lubricate all joint and gasket surfaces with lubricant recommended.

4. Use methods and equipment capable of fully seating or making up joints without damage.
5. Check joint opening and deflection for specification limits.

3.3 Temporary Plugs:

- A. Furnish and install temporary plugs. Temporary plugs are to be installed
In the pipe at the end of each workday and the trench is to be completely backfilled.

3.4 Field Testing:

1. Acceptance Tests for Gravity and Low-Pressure Pipelines:

a. Alignment:

- (1) Sewer shall be inspected by flashing a light between manholes or by physical passage where space permits.
- (2) Sewer shall be inspected by videotaping entire line, from first to last manhole. During entire video recording, water must be flowing in the invert at a rate of at least one gallon per minute. The footage from the starting manhole must be recorded on the video screen, as well as the pipe run identification.
- (3) Contractor shall clean pipe of excess mortar, joint sealant, and other dirt and debris prior to inspection.
- (4) Determine from Videotaping or Physical Inspection:
Presence of any misaligned, displaced, or broken pipe.
Presence of visible infiltration or other defects.
- (5) Correct defects as required prior to conducting leakage tests.

b. Air Testing: Perform air tests per ASTM C828 for clay or F1417 for plastic pipe at Contractor's option in lieu of exfiltration test for pipe sizes up to and including 42 inches in diameter and will include all lateral pipes to the property lines where applicable.

(1) Furnish all facilities required including:

Necessary piping connections.
Test pumping equipment.
Pressure gauges or manometers.
Bulkheads.
All miscellaneous items required.

(2) Obtain approval of equipment and acceptance of methods proposed for use.

(3) Conduct initial test on first run of pipe laid by each crew.

(a) Include a minimum of 10 lengths of pipe but not to exceed 500 feet.

(b) Perform before backfilling.

(c) Satisfactorily complete test before crew is permitted to continue pipe installation.

(4) Test remaining pipe in sections determined by Contractor and approved by Engineer.

(5) A wetted interior pipe surface on clay pipe is desirable and will produce more consistent test results.

(6) Plug ends of line and cap or plug all connections to withstand internal test pressures. Test plugs must be securely braced within the manholes.

(7) Introduce low-pressure air until internal air pressure is 4.0 psi greater than the average back pressure of ground water above the pipe invert.

- (8) Allow two to five minutes for internal air pressure and temperature to stabilize. Adjust pressure to 3.5 psi and start test.
- (9) Time required for pressure to decrease 1.0 psi from 3.5 to 2.5 psig greater than the average back pressure of any ground water above the pipe invert shall not be less than the minimum test time in the following table for the given diameters:

Minimum Test Times (Minutes) in Plastic Pipe			
<u>Nominal Pipe Diameter</u>	<u>Minimum Time (min.)*</u>	<u>Length for Min. Time</u>	<u>Time for Longer Length(s)*</u>
4 in.	3:46	597 ft.	0.380 L
6 in.	5:40	398 ft.	0.854 L
8 in.	7:34	298 ft.	1.520 L
10 in.	9:26	239 ft.	2.374 L
12 in.	11:20	199 ft.	3.418 L
15 in.	14:10	159 ft.	5.342 L
18 in.	17:00	133 ft.	7.692 L
21 in.	19:50	114 ft.	10.470 L
24 in.	22:40	99 ft.	13.674 L
27 in.	25:30	88 ft.	17.306 L
30 in.	28:20	80 ft.	21.366 L
33 in.	31:10	72 ft.	25.852 L
36 in.	34:00	66 ft.	30.768 L

* For 3.5 kPa (0.5 psi) pressure test drop, required test times shall be exactly one-half the values shown.

- (10) If the section of line to be tested includes more than one pipe size, calculate the test duration for the length of each size and add the test durations to arrive at the total duration of the testing period for the section.
- (11) Repeat test as necessary after all leaks and defects have been repaired.

2. Acceptance Tests for Pressure Pipelines:

- a. Perform hydrostatic pressure and leakage tests.
 - (1) Conform to AWWA C600 procedures. As modified herein.
 - (2) Perform after backfilling.
- b. Test separately in segments between sectionalizing valves, between a sectionalizing valve and a test plug, or between test plugs.
 - (1) Select test segments such that adjustable seated valves are isolated for individual checking.
 - (2) Contractor shall furnish and install test plugs.
 - (a) Including all anchors, braces, and other devices to withstand hydrostatic pressure on plugs.
 - (b) Be responsible for any damage to public or private property caused by failure of plugs
- c. Limit fill rate of line to available venting capacity. Fill rate shall be regulated to limit velocity in lines when flowing full to not more than 0.05 to 1 fps.
- d. Owner shall make water for testing available to Contractor at nearest source.
- e. Pressure and Leakage Test:
 - (1) Test pressure shall not exceed 1.25 times the working pressure at the highest point along the test section.
 - (2) Test shall be at least 2-hour duration. Maintain pressure throughout test within 5 PSI of the test pressure.
 - (3) Leakage test shall be conducted concurrently with the pressure test.
 - (4) Acceptable when leakage does not exceed that determined by the following formula (in English Units):
 - L = 0.0000075SD(P)^{1/2}, in which
 - L = allowable leakage, in gallons per hour
 - S = length of pipe tested, in feet
 - D = nominal diameter of the pipe, in inches
 - P = average actual leakage test pressure in psig.

- (5) These formulas are based on an allowable leakage of 11.65 gpd/mile/in of nominal diameter at a pressure of 150 psi.
- (6) When testing against a closed metal-seated valve, an additional leakage per closed valve of 0.0078 gal/hr/in of nominal valve size shall be allowed.
- (7) Repeat test as necessary.
 - (a) After location of leaks and repair or replacement of defective joints, pipe, fittings, valves or hydrants. All visible leaks are to be repaired regardless of the amount of leakage.
 - (b) Until satisfactory performance of test.
- (8) Engineer will witness pressure and leakage test.

PART 4 - MEASUREMENT AND PAYMENT

4.1 Measurement

Measurement and payment will be made in accordance with Section 01210 - Measurement and Payment.

**** END OF SECTION 02535 ****

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 02560	-	Sewer Line Construction
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:

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:

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.

Resubmittals shall be made in the same manner as submittals, with changes clearly shown.

PART 2 MATERIALS

2.0 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.

2.1 Fittings:

1. Water main fittings:

General:

All bolts and nuts shall be low-alloy, corrosion-resistant, high-strength steel in conformance with AWWA C111.

Fitting types applicable to this specification consist of bends, crosses, tees, reducers/increasers, plugs, caps, couplings, and sleeves.

Unless specified otherwise on the plans or Detailed Specifications the following fitting joint shall be provided:

- Fittings 8 inches and smaller shall be push-on joint.
- 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.
- Fittings 14 inches and larger shall be mechanical joint.

Push-on joint fittings shall be furnished with restraining lugs. The lug pattern for all sizes shall accommodate gripper-type restrainers.

- a. Ductile Iron water main fittings: 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.

- b. PVC water main fittings: 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.
- c. Couplings: 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.
- d. Tapping Sleeves: 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:

1. Gate Valves and Butterfly Valves:

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.

2. Valve Box Adaptor:

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.

3. 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.

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 Pota-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.

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.

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.

In cases where a Fire Hydrant Extension will be installed, the Contractor shall furnish the appropriate extension.

2.5 Service Lines, Valves and Fittings:

General: 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 C83600-85-5-5-5) 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.

1. 1 inch services

1 inch services shall be assembled as shown on the "1 Inch Service Connection Details".

- a. 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.
- b. 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.

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.

2. 1 ½ and 2 inch services

1 ½ inch & 2" 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.

- a. 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".
- b. 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.

3. Meter boxes

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.

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For 1 ½ inch service lines the meter box shall be a Christy Fiberlite box # FL-36T Box 12 w/ lid # FL-36D01.

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

4. Tapping sleeves and valves shall be used for service lines larger than 2 inches.

2.6 Concrete Thrust Blocks:

Thrust blocks shall be 4000 psi concrete as specified in Section 03300 of these specifications.

2.7 Joint Restraining Devices

1. Joint Restraint Devices at Fittings shall meet the following requirements:

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.

- a. For DI pipe to DI push-on fittings:

Fitting Joint Restraints shall be EBAA Series 1100HD, or equal.

- b. For DI pipe to DI MJ fittings:

Fitting Joint Restraints shall be EBAA MEGALUG Series 1100, Series 1100SD, or equal.

- c. For PVC pipe to DI push-on fittings:

Fitting Joint Restraints shall be EBAA Series 15PF00, or equal.

- d. For PVC pipe to DI MJ fittings:

Fitting Joint Restraints shall be EBAA Series 2000PV, Series 2000SV, Series 15PF00, or equal.

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- e. For PVC pipe to PVC push-on fittings:

Fitting Joint Restraints shall be EBAA Series 2500, or equal.

- 2. Joint Restraint Devices at pipe bells shall meet the following requirements:

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.

- a. For ductile iron pipe:

The bell restraint shall be EBAA Series 1700, or equal.

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.

- b. For PVC C-900 pipe:

The bell restraint shall be EBAA Series 1600, or equal.

- c. For PVC C-905 pipe:

The bell restraint shall be EBAA Series 2800, or equal.

2.8 Polyethylene Encasement:

Polyethylene Encasement (poly-wrap) shall meet AWWA C-105.

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.

2.9 Combination Air Release Valves:

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.

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2.10 Tracer Wire System:

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

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Updated 2/4/2019

3.1 Materials Handling and Storage:

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.

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.

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.

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.

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:

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:

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:

1. Vertical Separation at Crossings:

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.

At all other crossings the sewer shall be encased in concrete a minimum of 6 inches thick per LHC standard details.

2. Water Main and Sewer Main/Storm Sewer Horizontal Separation:

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.

3. Unusual Conditions:

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.

4. Sewer Manholes:

No water pipe shall pass through, or come in contact with any part of the sewer manhole.

3.5 Installation:

1. Trenching shall comply with the requirements of Section 02300 Trench Excavation and Backfill.
2. Minimum Cover depth from top of pipe to finished grade shall be 3 ft.
3. 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.
4. 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.
5. 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.

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.

During construction, prior to filling and testing, no water shall be allowed to run into or through the pipe.

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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.

- a. 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.
 - b. 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.
6. 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.
 7. 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**.
 8. 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.
 9. 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.
 10. 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.

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.

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.

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.

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.

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.

11. 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.
 - a. All Valves 12 inches and larger and pipe joints within their corresponding "L" lengths shall be restrained.
 - b. All High Pressure Valves (working pressures greater than 110 psi) and pipe joints within their corresponding "L" lengths shall be restrained.
 - c. All Reducers/Increasesers and their corresponding "L" lengths shall be restrained.

- d. All Vertical Bends and pipe joints within their corresponding "L" lengths shall be restrained.
- e. 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.

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.

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.

12. Tracer Wire: Tracer wire shall be installed along with all water pipes as described below:

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.

Tracer wire shall not be installed with copper water service lines.

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.

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.

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.

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 versa. Service line tracer wire shall not be connected to the main line tracer wire.

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.

The Engineer shall inspect all underground splices and "pig tails" prior to backfilling.

13. Fire Hydrants and Auxiliary Valves: 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.

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.

The hydrant barrel shall be poly wrapped to the ground surface and the poly wrap shall not cover up the weep holes.

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.

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.

Tracer wire shall be attached to the fire hydrant barrel section prior to backfill per LHC Standard Details.

14. Valves: 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.

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".

15. Valve Boxes: 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.

A Valve Box Adaptor shall be installed on the valve bonnet prior to installing the valve box.

When shown on the drawings or specified, tracer wire shall be secured to the valve box section prior to backfill.

16. Tapping Tees for taps 4 inches and larger: 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.
17. Polyethylene Encasement: 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.

Polyethylene encasement shall NOT be used when the metallic piping is cathodically protected by the use of an anode.

18. Dewatering: If necessary, dewatering shall be accomplished as identified in the special provisions.

3.6 Disinfection:

1. General:

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.

2. Preventative Methods:

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.

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.

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.

3. Disinfectant:

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.

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.

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.

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.

4. 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.

5. Placing Tablets:

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.

6. Filling and Contact:

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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.

7. Flushing:

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.

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.

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.

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 Number of Fire Hydrants	Outlet Size (In.)	Minimum Flushing Duration (minutes per 100 feet of pipe)
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.

8. Bacteria Testing:

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.

9. Disposal of Chlorinated Water:

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:

1. General:

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.

2. Test Restrictions:

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.

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.

3. Pressurization:

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.

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.

4. 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.
5. 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

6. 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.

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:

1. 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.

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.

2. Operation of Valves: 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.
3. Temporary water service for 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.

3.9 Abandonment and/or Salvage of Water Main and Appurtenances:

1. 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.

2. 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.

3. 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.

4. 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.

5. 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.

3.10 Service Lines and Fittings:

1. 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.
2. 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.
3. 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.
4. 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.
5. 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.

6. 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.

7. 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.
8. 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.

3.11 Acceptance of Meter Valves and Main Valves:

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 & Payment

A. Water Main and Service Line Pipe:

Installed pipe quantities shall be determined by measuring from centerline to centerline of all pipe and fittings. Measurements shall be to the nearest whole linear foot.

B. Water Main Fittings and Couplings:

Fittings furnished and installed shall be counted on a per each basis unless otherwise specified by contract. Measurement for concrete thrust blocks, cable and rods, and other thrust restraint will not be made; such work shall be incidental to the respective work item.

C. Valves:

LHC 02550-032

Updated 2/4/2019

Valves shall be counted on a per each basis. Valve boxes shall be included with the valves as a complete unit.

D. Fire Hydrant Assembly:

Fire Hydrant Assemblies will be counted on a per each basis. Hydrant, auxiliary valve, valve box and pipe between the auxiliary valve and hydrant shall be included with the assembly as a complete unit; no separate measurement and payment will be made for pipe between the auxiliary valve and the hydrant or for auxiliary valves and boxes.

E. Fire Hydrant Lead:

The water main pipe for the hydrant lead (branch) from the main to the Auxiliary Valve shall be paid for at the unit price bid for the appropriate size pipe.

F. Fire Hydrant Extensions:

Fire hydrant extensions are not allowed. Contractor shall verify grade prior to installation.

G. Water Service Reconnection:

Water service reconnections and new water service connections will be counted on a per each basis.

H. New Water Service Connections:

Water service consists of service saddle, corp stop, copper tubing, ball valve and meter box, counted on a per each basis.

I. Meter Boxes & Service Termination Fittings Installed, Adjusted or Abandoned:

Meter Boxes & Service Termination fittings furnished and installed, adjusted, or abandoned will be counted on a per each basis.

J. Water Main Encasement:

LHC 02550-033

Measurement for water main encasement will be made on a per each basis, furnished and installed, for each encased crossing with lengths as noted on the Drawings.

K. Polyethylene Encasement:

No separate measurement will be made for polyethylene encasement such work will be incidental to the pipe and fittings.

L. Water Air Release or Blow Off Valves:

Valve assembly per standard detail, furnished and installed, will be counted on a per each basis.

M. Tapping Tee (Includes sleeve and valve):

Tapping tees furnished and installed will be counted on a per each basis unless otherwise specified.

N. Tracer Wire

Tracer wire access boxes and all accessory items necessary for the installation of tracer wire shall be considered as incidental to the pipe installed.

O. Water Main Lowering:

Water main lowerings including, all materials, restraints, and Flowable Fill for the complete installation shall be included in the bid item for water main lowering. Water main lowerings shall be counted on a per each basis.

P. Abandon valve:

Abandon valve shall be incidental.

Q. Adjust Valve Box:

Adjust valve box shall be incidental.

R. New Water Main Connections:

New water main connections shall be counted on a per each basis. The bid item, New Water Main Connections, is intended for use where a tapping tee cannot be used and where an in-line tee must be cut into an existing main or where a cap/plug with thrust block must be removed prior to connecting.

S. Measurement and payment will be made in accordance with Section 01210 - Measurement and Payment.

END OF SECTION

SECTION 2600

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

No measurement will be made for this item.

4.2 Payment

No payment will be made for subgrade preparation. This item shall be considered incidental to Section 2630, Asphalt Concrete Pavement.

SECTION 2610

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

The quantity of aggregate base course to be paid for will be determined by measurement of the number of square yards of each thickness placed and accepted by the **OWNER** as complying with the drawings and specifications. The quantity shall be based on plan dimensions.

4.2 Payment

Payment will be made at the contract unit price per square yard for each thickness of aggregate base course. This price shall be full compensation for furnishing all materials, for preparing and placing these materials, and for all the labor, equipment, tools and incidentals necessary to complete the item.

See Section 00310 Bid Schedule for Bid Items.

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 tack 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

No measurement will be made for this item.

4.2 Payment

Payment will be made at the contract lump sum price bid for traffic control and shall be considered full payment for providing the labor and materials to perform this work.

See Section 00310 Bid Schedule for Bid Items.

****END OF SECTION****

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

Permanent signs will be measured per each type of sign and post provided.

4.2 Payment

Payment for permanent signs will be made at the contract unit price bid for each type of sign and shall be considered as full payment for providing each type of sign as specified. Sign posts shall be considered as incidental to each permanent sign provided.

See Section 00310 Bid Schedule for Bid Items.

****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 – Not Applicable

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 1330.

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 – Not Applicable

****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- μ m) 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:

<u>Capacity of Mixer Cubic Yards</u>	<u>Minimum Time 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.

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 – Not Applicable

**** 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 05120

MISCELLANEOUS STEEL

PART 1 - GENERAL

1.1 Summary

A. This Section includes fabrication and erection of the structural steel and other steel or metal items as defined in AISC Manual, Code of Standard Practice.

B. Structural Steel Repair and Improvement Requirements

1. Interior Structural Steel Repair Work

a. Replace a total of one column and top cap plate. The replacement column and cap plate shall be equal or greater in size and material properties to those being replaced. The existing column base plates shall remain in place. Grind the top of the existing column base plate surfaces smooth for column to fully bear against the top of the plate. Install the columns plumb. At the Contractor's option the columns may be repaired by welding new cover plates of sufficient cross sectional area to restore the load carrying capacity of the existing members to their original condition. Prior to the start of work, the Contractor shall submit a detailed report with recommendations and drawings for the replacement or repair of the structural steel columns to the Engineer for approval. The Contractor shall submit the report and drawings sealed by a registered professional Engineer licensed in the state of Arizona.

b. Replace roof purlins at locations directed by the Engineer. Inspect all structural steel surfaces following abrasive blasting operations. Notify the Engineer in writing where the loss of material exceeds fifteen (15) percent of the original material thickness. At the Contractor's option the roof beams may be repaired by welding new cover plates of sufficient cross sectional area to restore the load carrying

capacity of the existing members to their original condition. Prior to the start of work, the Contractor shall submit a detailed report with recommendations and drawings for the replacement of repair of the structural steel roof beams to the Engineer for approval. The Contractor shall submit the report and drawings sealed by a registered professional Engineer licensed in the state of Arizona.

- c. Perform Ultra Sonic Floor Thickness Survey and vacuum test on all floor seams prior to application of the new protective coating system. Locate any leaks in the floor plate or welded joint using vacuum testing in accordance with AWWA D100, Section 11.12. Leaks observed in welds shall be repaired by gouging-out the defective area and rewelding. Leaks observed at surfaces of plates shall be repaired by seal welding a ¼ inch thick plate (minimum) to the existing floor plate. Prior to the start of the repair work, the Contractor shall submit a detailed report with recommendations and drawings for the repair of the floor, to the Engineer for approval. The Contractor shall submit the report and drawings and sealed by a registered professional engineer licensed in the State of Arizona.

2. Exterior Structural Steel Modifications:

- a. Install new safety handrail and chain as indicated in Sketches SK-1 and SK-3.
- b. Install new gauge board numbers, float and target per Sketch SK-7.
- c. Remove and replace the existing roof vent located at the center of the roof per Sketch SK-4. Install new side vents through the shell wall of reservoir per Sketch SK-5 and SK-6. Eight side vents shall be equally spaced around the perimeter of the shell wall of each 1.0 mg tank above maximum overflow inlet pipe elevation and shall avoid interference with existing ladders, piping, level indicators, etc.

- d. Furnish and install 30" access door on shell at location determined by the Engineer. Access door to be installed per AWWA D100- *Welded Steel Tanks for Water Storage* and shall be constructed with a side hinge assemble. Shop drawings to be submitted with a structural engineer stamp prior to installation.

C. Related Work Specified Elsewhere

Protective CoatingsSection 09900

1.2 References

A. Applicable Standards

1. American Institute of Steel Construction (AISC)

Manual of Steel Construction – Allowable Stress Design.
Quality Criteria and Inspection Standards.

2. American Welding Society (AWS)

A5.4 – Stainless Steel Electrodes for Shielded Metal Arc Welding.

D1.1 – Structural Welding Code – Steel.

QC1 – Standard for AWS Certification of Welding Inspectors.

QC3 – Standard for AWS Certified Welders.

3. American Society for Testing and Materials (ASTM)

A6 – General Requirements for Rolled Steel Plates, Shapes Sheet Piling, and Bars for Structural Use.

A36 – Structural Steel.

A53 – Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

A106 – Seamless Carbon Steel Pipe for High-Temperature

Service.

A108 – Steel Bars, Carbon, Cold-Finished, Standard Quality.

A307 – Carbon Steel Bolts and Studs, 60,000 psi Tensile.

A563 – Carbon and Alloy Steel Nuts.

A569 – Steel, Carbon (0.15 Maximum, Percent) Hot-Rolled Sheet and Strip Commercial Quality.

F436 – Hardened Steel Washers.

4. American Water Works Association (AWWA)

D100 – Welded Steel Tanks for Water Storage

1.3 Submittals

- A.** Submit as specified in DIVISION 1.
- B.** Includes, but not limited to, the following:
 - 1.** Fabrication and erection drawings for all Work. The Contractor may use a reproduction of the Engineer prepared Contract Drawings for erection drawings such as to indicate information on erection or to identify detail drawing references. Where the drawings are revised to show this additional Contractor information, the Engineer's title block is to be replaced with a Contractor's title block and the Engineer's professional seal will be removed from the drawing. The Contractor shall revise these erection drawings for subsequent Engineer revisions to the Contract Drawings.
 - 2.** All necessary information for the fabrication, including filler metal for welds, of the component part of the structure, presented on drawings to conform to recognized standard practice, AISC Manual Part 5, and AWS Code.
 - 3.** Drawings showing each piece marked for identification to correspond to erection drawings.

4. Manufacturer's literature on products including, but not limited to hardware and protective coatings.

1.4 Quality Assurance

A. Welder Qualifications

1. Welders shall be previously qualified by passing the tests prescribed in the AWS Standard Qualification Procedure.
2. Welders shall have been tested within the past 12 months and their qualification shall be considered as remaining in effect unless the welder is not engaged in a given process of welding for a period exceeding 6 months.

- B. Inspection:** Material or workmanship may be subject to inspection in the shop and field.

1.5 Delivery, Storage and Handling

- A.** Handle and store all steel and appurtenances as specified in DIVISION 1.
- B.** Store all steel and appurtenances blocked-up off the ground and in orderly stacks.
- C.** Protect all items with shop applied protective coatings from corrosion. Store in an environment and manner consistent with type of coating.

PART 2 – MATERIALS

2.1 Basic Materials

- A. Steel:** Conform to ASTM A36, as designated in the AISC Manual, Part 1, unless otherwise indicated or specified.
- B. Connection Bolts, Nuts, and Washers**
1. Conform to ASTM A307.
 2. Be galvanized when connecting galvanized steel.

- C. **Handrail:** Conform to ASTM A53, Type E or S, Grade B or ASTM A106, Grade B.
- D. **Pipe for Structural Uses:** Conform to ASTM A53, Type E or S, Grade B, or ASTM A106, Grade B.
- E. **Welding**
 - 1. For ASTM A36 steel, use E70 electrodes for shielded metal arc welding, F7 series electrodes for submerged arc, E70T series electrodes for flux-cored arc welding, and ER70S series electrodes for gas metal arc welding.
 - 2. Select "matching" filler metal in accordance with Table 4.1, AWS D1.1.
 - 3. Select "matching" electrodes in accordance with AWS A5.4 for welding of stainless steel.

2.2 Steel Fabrication

- A. Fabricate all steel to conform to AISC specifications, codes, and standards.
- B. Permissible variations for sweep, camber, length, and cross section of all steel members shall conform to ASTM A6, AISC "Manual of Steel Construction, Part 1", AISI "Code of Standard Practice", and AISC "Quality Criteria and Inspection Standards" unless indicated otherwise.
- C. **Welding**
 - 1. All welding shall be shielded metal arc, submerged arc, or flux cored arc, or gas metal arc. For gas metal arc welding, the short-circuiting mode of filler metal transfer is not permitted.
 - 2. Conform to AWS Code, AISC Manual, Part 4, and the AISC Quality Criteria and Inspection Standards.
 - 3. The Contractor shall perform fabrication welding inspection in accordance with AWS D1.1. This welding inspection shall

be performed by AWS Certified Welding Inspector(s) (CWI).
Defective welds shall be corrected.

D. Shop Connections

1. Weld or bolt as indicated or specified.

E. Provisions for Field Connections

1. Provide with bolted connections as indicated or specified.

2.3 Shop-Protective Coating

A. Prepare surface and apply primer (first coat) as specified in SECTION 9900.

B. Apply primer in shop to all steel including connections, except for the following surfaces:

1. Within 3 inches adjacent to field welds.
2. On faying surfaces of bolted connections when using alkyd primer.

2.6 Handrail

A. 1-1/2-inch nominal (1.9-inch od) round, black standard-weight pipe.

B. Post spacing shall not exceed 5 feet from center-to-center.

C. Form and weld all handrail. Grind all welds smooth and even with the surface of the pipe, including field welds required for erection.

D. Carefully form all handrail where change of direction or elevation occurs.

E. Handrail posts shall be vertical (plumb) unless otherwise indicated.

PART 3 - EXECUTION

3.1 Preparation

- A.** Contractor shall submit the method and sequence of erection for acceptance.

3.2 Steel Erection

- A.** Erect all steel to conform to AISC specifications, codes, and standards; AISC Quality Criteria and Inspection Standard; or any local, state or federal codes which may exceed such requirements.

B. Erection Shoring and Bracing

- 1.** Contractor shall be responsible for structural adequacy, design, engineering, and construction of all erection shoring and bracing.
- 2.** Provide all necessary temporary struts, ties, cables, temporary flooring, planking, and scaffolding in connection with the erection of the structural steel or support of erection machinery.
- 3.** Locate shoring and bracing as required to maintain proper position against loads from erection equipment, construction material, and wind.
- 4.** Leave bracing in place until sufficient steel connections to ensure stability of the structure.

C. Connections

- 1.** Make bolted connections as indicated.
- 2.** Where required for connection fit-up, bolt holes may be adjusted in one of the following manners (flame cutting or flame enlargement of holes is not allowed):
 - a.** Reamed to AISC allowable maximum size for oversized holes.

- b. Holes may be filled with weld metal, ground smooth, and field-drilled.

3. Welded Connections

- a. Make welded connections as indicated and leave all erection bolts in place after completion of welding unless otherwise indicated.
- b. Reinforce connections when members requiring fillet welds are not in contact.
- c. Use backup bars or spacer bars on all butt welds where root opening exceeds 3/16-inch.
- d. Remove all run-out tabs.

D. Welding and Welders

- 1. The requirements for erection welding and welders shall be the same as specified for steel fabrication.
- 2. The Contractor shall perform erection-welding inspection in accordance with AWS D1.1. This welding inspection shall be performed by AWS Certified Welding Inspector(s) (CWI). Defective welds shall be corrected.

- E. Protect pipe sleeves and other anchorage members from deleterious materials at all times.

F. Handrail

- 1. Form and weld all handrail. Grind all welds smooth and even with the surface of the pipe.
- 2. Carefully fit all handrail where change of direction or elevation occurs.
- 3. Install all rails and posts plumb, level, straight and true, and in alignment.

4. Top rail shall clear all fixed objects by at least 3 inches vertically and horizontally.
5. Furnish and install plates, bolts, and additional items as indicated or required for fastening to supporting members.

3.3 Field-Protective Coatings

- A. Surface preparation, priming, and finish coating are specified in Section 9900.

PART 4 – MEASUREMENT AND PAYMENT

- 4.1 **Measurement:** No measurement will be made for this item, Miscellaneous Steel.
- 4.2 **Payment:** Payment will be made at the Contract Lump Sum Price Bid and the "Schedule of Adjustment Unit Prices" and shall be considered full payment for providing all labor, equipment, tools and materials to perform this Work.

****END OF SECTION****

DIVISION III

SPECIAL PROVISIONS

SECTION 1110

SUMMARY OF WORK

PART 1 - GENERAL

1.1 Summary

This Section summarizes the Work for the **Wash Crossing Improvements EL Dorado Avenue N., Project No. B24-PW-105007-500392** as covered in detail in the complete Contract Documents.

1.2 Project Description

A. Description of Project:

The project is located at the crossing of El Dorado Wash and El Dorado Ave North. Improvements consist of a six barrel reinforced concrete box culvert, inlet/outlet channels, inlet/outlet cutoff walls, safety railing, catch basins, drainage piping, roadway, curb, gutter, sidewalk, and water line relocation.

B. Work Covered by Contract Documents:

Includes all construction and coordination activities associated with the construction of the drainage improvements, roadway improvements, and water line relocation.

1.3 Contractor's Use of Premises

A. Limited Use

- 1.** Limit use of the premises for storage and execution of the Work to allow for Owner occupancy. Confine operations to areas within Contract limits indicated. Portions of the Site outside the Contract limits shall not be disturbed.
- 2.** Coordinate with other separate contractors and Owner to avoid interference of operations.
- 3.** Conduct operations so as to ensure the least inconvenience to Owner and the general public.

1.4 Owner's Use of Premises

- A. Partial Owner Occupancy:** The Owner reserves the right to occupy and to use the area outside of the Contract limits.

1.5 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 per Section 01325.

PART 2 – MATERIALS – Not Applicable.

PART 3 – EXECUTION – Not Applicable.

****END OF SECTION****

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. 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 set forth in this section govern.

The Contractor shall 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. Changes to quantities shall be approved by OWNER.

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

2.21 Construction Staking

Measurement for "Construction Staking" shall be per lump sum.

Payment for "Construction Staking" shall be per lump sum and shall constitute full compensation for furnishing all materials, labor, equipment and tools for the staking of the project. This item also includes all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 00800 – Special Provisions

2.22 Mobilization

Measurement for "Mobilization" shall be per lump sum.

Payment for "Mobilization" shall be per lump sum and 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 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. The bid item price for mobilization shall not exceed 8% of the overall contract price.

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

2.23 Quality Control

Measurement for "Quality Control" shall be per lump sum.

Payment for "Quality Control" shall be per lump sum and includes all labor, material, equipment, and mobilization to complete sampling and testing of materials and provide the required documentation necessary to complete the work as described in the Plans and Specifications.

2.24 Environmental Control

Measurement for "Environmental Control" shall be per lump sum.

Payment for "Environmental Control" shall be per lump sum and includes all work and materials necessary to complete the work as described in the Plans and Specifications.

2.25 Traffic Control

Measurement for "Traffic Control" shall be per lump sum.

Payment for "Traffic Control" shall be per lump sum and shall include 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. It 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.

Refer to Section 02650 – Traffic Control.

2.26 Stormwater Pollution Prevention Plan (SWPPP)

Measurement for "SWPPP" shall be per lump sum.

Payment for "SWPPP" shall be per lump sum and shall include the SWPPP preparation, submittals (NOI, COI, NOT, etc.), and furnishing, installing, maintaining, removing and disposing of temporary erosion control measures such as silt fences, check dams, straw barriers, and other erosion control devices or methods as shown in the SWPPP. The work shall also include furnishing, installing, and maintaining permanent erosion control measures such as pipe inlet and outlet protection, cut and fill slope transitions, headwall and wingwall treatments, and other permanent erosion control devices or methods as shown in the SWPPP.

2.27 Remove Existing Improvements

Measurement for "Remove Existing Improvements" shall be per lump sum.

Payment for "Remove Existing Improvements" shall be per lump sum and shall include the saw cutting, removal, loading, hauling, and disposal of existing asphalt, curb, concrete, walls, cut-off walls, and signs within the City right-of-way and wash area. It shall also include the furnishing of all labor, tools, equipment, materials, and performance of all operations required to complete the work as described in the Plans and Specifications.

Refer to Section 02110 – Removal of Existing Improvements.

2.28 Remove Fire Hydrant, Water Main, Water Service

Measurement for "Remove Fire Hydrant, Water Main, Water Service" shall be per lump sum.

Payment for "Remove Fire Hydrant, Water Main, Water Service" shall be per lump sum and shall include excavating, shoring, cutting, loading, hauling, and disposal of existing piping and appurtenances as shown in the Plans. It shall also include all labor, tools, equipment, materials, and performance of all operations required to complete the work as described in the Plans and Specifications.

Refer to Section 02550 – Water Piping Systems, Section 02110 – Removal of Existing Improvements, and Section 02050 – Demolition and Removals.

2.29 Six Barrel 10'X5' RCBC (ADOT SD 6.06)

Measurement for "Six Barrel 10'X5' RCBC (ADOT SD 6.06)" shall be per lump sum.

Payment for "Six Barrel 10'X5' RCBC (ADOT SD 6.06)" shall be per lump sum and includes excavation, slope stabilization, subgrade preparation, base preparation, bedding material, form materials, and placement of steel and concrete materials. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02520 – Culvert Construction.

2.2.10 Inlet Concrete Headwall

Measurement for "Inlet Concrete Headwall" shall be per each.

Payment for "Inlet Concrete Headwall" shall be per each and includes form materials, and placement of steel and concrete materials. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 03300 – Concrete Structures.

2.2.11 Inlet Concrete Wingwalls (ADOT SD 6.10)

Measurement for "Inlet Concrete Wingwalls (ADOT SD 6.10)" shall be per each.

Payment for "Inlet Concrete Wingwalls (ADOT SD 6.10)" shall be per each and includes excavation, slope stabilization, subgrade preparation, base preparation, bedding material, form materials, and placement of steel and concrete materials. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02321 – Excavation, Filling, and Backfilling for Structures, Section 03100 – Concrete Formwork, Section 03200 – Concrete Reinforcement, Section 03300 – Concrete Structures.

2.2.12 Inlet Reinforced Shotcrete Channel w/ Cutoff Wall

Measurement for "Inlet Reinforced Shotcrete Channel w/ Cutoff Wall" shall be per each.

Payment for "Inlet Reinforced Shotcrete Channel w/ Cutoff Wall" shall be per each and includes excavation, slope stabilization, subgrade preparation, base preparation, bedding material, form materials, cut-off walls, and placement of steel, shotcrete, and concrete materials. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02321 – Excavation, Filling, and Backfilling for Structures, Section 03100 – Concrete Formwork, Section 03200 – Concrete Reinforcement, Section 03300 – Concrete Structures, SP 033713 – Shotcrete.

2.2.13 Outlet Concrete Headwall

Measurement for "Outlet Concrete Headwall" shall be per each.

Payment for "Outlet Concrete Headwall" shall be per each and includes form materials, and placement of steel and concrete materials. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 03300 – Concrete Structures.

2.2.14 Outlet Concrete Wingwalls (ADOT SD 6.10)

Measurement for "Outlet Concrete Wingwall (ADOT SD 6.10)" shall be per each.

Payment for "Outlet Concrete Wingwall (ADOT SD 6.10)" shall be per each and includes excavation, slope stabilization, subgrade preparation, base preparation, bedding material, form materials, and placement of steel and concrete materials. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02321 – Excavation, Filling, and Backfilling for Structures, Section 03100 – Concrete Formwork, Section 03200 – Concrete Reinforcement, Section 03300 – Concrete Structures.

2.2.15 Outlet Reinforced Shotcrete Channel w/ Cutoff Wall

Measurement for "Outlet Reinforced Shotcrete Channel w/ Cutoff Wall" shall be per each.

Payment for "Outlet Reinforced Shotcrete Channel w/ Cutoff Wall" shall be per each and includes excavation, slope stabilization, subgrade preparation, base preparation, bedding material, form materials, cut-off walls, and placement of steel, shotcrete, and concrete materials. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02321 – Excavation, Filling, and Backfilling for

Structures, Section 03100 – Concrete Formwork, Section 03200 – Concrete Reinforcement, Section 03300 – Concrete Structures, SP 033713 – Shotcrete.

2.2.16 Safety Rail (MAG 145)

Measurement for "Safety Rail (MAG 145)" shall be per linear foot.

Payment for "Safety Rail (MAG 145)" shall be per linear foot and include all work and materials necessary to complete the work as described in the Plans and Specifications.

2.2.17 Earthwork (Cut to Fill)

Measurement for "Earthwork (Cut to Fill)" shall be per cubic yard.

Payment for "Earthwork (Cut to Fill)" shall be per cubic yard of excavation to the new subgrade elevation (bottom of riprap, shotcrete, or concrete) and shall include excavating, preparing subgrade, sloping, rounding tops and ends of excavations, loading, hauling, depositing, conditioning, spreading, and compacting the material complete in place. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

No measurement or payment will be made for overexcavation. The payment for "Earthwork (Cut to Fill)" shall be full compensation for excavating the existing material to the depth and section required, hauling and wasting the overexcavated material and backfilling with suitable material.

Refer to Section 02200 – Earthwork.

2.2.18 Earthwork (Export)

Measurement for "Earthwork (Export)" shall be per cubic yard.

Payment for "Earthwork (Export)" shall be per cubic yard of exported (surplus) material and shall include excavating, loading, hauling, and depositing the material outside of the project right-of-way. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02200 – Earthwork.

2.2.19 Riprap (D50=18") (T=36") & Geosynthetic Fabric

Measurement for "Riprap (D50=18") (T=36") & Geosynthetic Fabric" shall be per cubic yard.

Payment for "Riprap (D50=18") (T=36") & Geosynthetic Fabric" shall be per cubic yard and shall include excavation, ground surface preparation, erosion control geosynthetic fabric, bedding material, riprap stone, and backfilling. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02510 – Rock Rip-Rap Construction, SP 310519 – Geosynthetics.

2.2.20 Riprap (D50=6") (T=12") & Geosynthetic Fabric

Measurement for "Riprap (D50=6") (T=12") & Geosynthetic Fabric" shall be per cubic yard.

Payment for "Riprap (D50=6") (T=12") & Geosynthetic Fabric" shall be per cubic yard and shall include excavation, ground surface preparation, erosion control geosynthetic fabric, bedding material, riprap stone, and backfilling. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02510 – Rock Rip-Rap Construction, SP 310519 – Geosynthetics.

2.2.21 Asphaltic Concrete Pavement (4" Thick)

Measurement for "Asphaltic Concrete Pavement (4" Thick)" shall be per ton.

Payment for "Asphaltic Concrete Pavement (4" Thick)" shall be per ton and include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02630 – Asphalt Concrete Pavement

2.2.22 Aggregate Base Course (4" Thick)

Measurement for "Aggregate Base Course (4" Thick)" shall be per cubic yard.

Payment for "Aggregate Base Course (4" Thick)" shall be per cubic

yard and shall include furnishing all materials for preparing and placing these materials, and for all the labor, equipment, tools and incidentals necessary to complete the item. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02610 – Aggregate Base Course

2.2.23 Vertical Curb & Gutter Type A (MAG 220-1)

Measurement for "Vertical Curb & Gutter Type A (MAG 220-1)" shall be per linear foot.

Payment for "Vertical Curb & Gutter Type A (MAG 220-1)" shall be per linear foot and shall include, but not be limited to subgrade preparation, base preparation, base course, form materials and placement of steel and concrete materials. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 03310 – Concrete Curb, Gutter, Sidewalk and Driveways

2.2.24 Sidewalk (MAG 230)

Measurement for "Sidewalk (MAG 230)" shall be per square foot.

Payment for "Sidewalk (MAG 230)" shall be per square foot and shall include, but not be limited to subgrade preparation, base preparation, base course, form materials and placement of steel and concrete materials. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 03310 – Concrete Curb, Gutter, Sidewalk and Driveways

2.2.25 3/4" Landscape Rock (2" Thick)

Measurement for "3/4" Landscape Rock (2" Thick)" shall be per square yard.

Payment for "3/4" Landscape Rock (2" Thick)" shall be per square yard and shall include loading, hauling, depositing, conditioning, sloping, spreading, and compacting the material complete in place. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

2.2.26 24" CMP

Measurement for "24" CMP" shall be per linear foot.

Payment for "24" CMP" shall be per linear foot and shall include excavation, bedding, backfilling, compacting, testing, joint materials, collars, wall penetrations and field closures. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02500 – Storm Drain Construction, Section 02300 Trench Excavation and Backfill.

2.2.27 Scupper (MAG 203)

Measurement for "Scupper (MAG 203)" shall be per each.

Payment for "Scupper (MAG 203)" shall be per each and shall include subgrade preparation, base preparation, base course, form materials, grate material, and placement of steel and concrete materials. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02500 – Storm Drain Construction, Section 03310 – Concrete Curb, Gutter, Sidewalk and Driveways, Section 03300 – Concrete Structures.

2.2.28 Catch Basin (MAG 535) (L=17')

Measurement for "Catch Basin (MAG 535) (L=17'" shall be per each.

Payment for "Catch Basin (MAG 535) (L=17'" shall be per each and shall include subgrade preparation, base preparation, base course, form materials, grate material, and placement of steel and concrete materials. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02500 – Storm Drain Construction, Section 03310 – Concrete Curb, Gutter, Sidewalk and Driveways, Section 03300 – Concrete Structures.

2.2.29 Catch Basin (MAG 535) (L=6')

Measurement for "Catch Basin (MAG 535) (L=6'" shall be per each.

Payment for "Catch Basin (MAG 535) (L=6'" shall be per each and shall include subgrade preparation, base preparation, base course,

form materials, grate material, and placement of steel and concrete materials. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02500 – Storm Drain Construction, Section 03310 – Concrete Curb, Gutter, Sidewalk and Driveways, Section 03300 – Concrete Structures.

2230 8" C-900 DR-14 PVC Water Main w/ Restrained Joints

Measurement for "8" C-900 DR-14 PVC Water Main w/ Restrained Joints" shall be per linear foot.

Payment for "8" C-900 DR-14 PVC Water Main w/ Restrained Joints" shall be per linear foot and shall include furnishing and installing the pipe and fittings, specials, adapters, etc., complete in place, as called for on the plans and/or on the standard details, and shall include all costs of excavation, shoring and bracing, bedding, backfilling, compaction, testing, disinfecting, connections to existing lines or works, and all work not specifically covered in other pay items. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02550 – Water Piping Systems.

2231 1" Air/Vacuum Valve (LHC 310)

Measurement for "1" Air/Vacuum Valve (LHC 310)" shall be per each.

Payment for "1" Air/Vacuum Valve (LHC 310)" shall be per each and include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02515 – Utility Valves and Accessories.

2232 6" Fire Hydrant Assembly (LHC 320)

Measurement for "6" Fire Hydrant Assembly (LHC 320)" shall be per each.

Payment for "6" Fire Hydrant Assembly (LHC 320)" shall be per each and include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02550 – Water Piping Systems.

2.233 8" Gate Valve (MJXMJ) (LHC 300)

Measurement for "8" Gate Valve (MJXMJ) (LHC 300)" shall be per each.

Payment for "8" Gate Valve (MJXMJ) (LHC 300)" shall be per each and include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02515 – Utility Valves and Accessories.

2.234 24" Steel Casing (LHC 403) Modified

Measurement for "24" Steel Casing (LHC 403) Modified" shall be per linear foot.

Payment for "24" Steel Casing (LHC 403) Modified" shall be per linear foot and shall include steel casing, skids, end seals, excavation, trenching, dewatering, testing, cleaning, backfill, and compaction. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02445 – Utility Casings, Section 02550 – Water Piping Systems.

2.235 1" Water Service (LHC 301)

Measurement for "1" Water Service (LHC 301)" shall be per each.

Payment for "1" Water Service (LHC 301)" shall be per each and include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02550 – Water Piping Systems.

2.236 Valve Box, Lid, & Concrete Collar (LHC 300)

Measurement for "Valve Box, Lid, & Concrete Collar (LHC 300)" shall be per each.

Payment for "Valve Box, Lid, & Concrete Collar (LHC 300)" shall be per each and include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02550 – Water Piping Systems.

2.237 Permanent Striping and Signage

Measurement for "Permanent Striping and Signage" shall be per lump sum.

Payment for "Permanent Striping and Signage" shall be per lump sum and shall include the application of permanent striping, removal, salvage, and installation of all signs, posts, and related hardware as shown on the Plans. It shall also include all work and materials necessary to complete the work as described in the Plans and Specifications.

Refer to Section 02660 – Permanent Signs.

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

SP 033713

SHOTCRETE

PART 1 - GENERAL

1.1 Summary

- A. The work under this section shall consist of furnishing all materials and applying shotcrete on prepared surfaces at the locations and in accordance with the details shown on the plans and the requirements of the specifications.

Shotcrete shall be mortar or concrete conveyed through a hose and pneumatically applied using either the dry mix process or the wet mix process.

The dry mix process shall consist of thoroughly mixing a proportional combination of dry fine aggregate and Portland cement; conveying the mixture through a delivery hose to a special nozzle where water is added and mixed with the other materials immediately prior to its discharge from the nozzle.

The wet mix process shall consist of premixing by mechanical methods a proportional combination of Portland cement, supplementary cementitious material, aggregate, and water required to produce mortar or concrete; conveying the mortar or concrete through the delivery hose to the special nozzle where additional compressed air is added at the nozzle prior to its discharge.

B. Related Work Specified Elsewhere

Earthwork.....Section 02200
Rock Rip-Rap Construction.....Section 02510

1.2 Quality Assurance

A. Reference Test Standards and Specifications

1. Arizona Department of Transportation (ADOT)

Standard Specifications for Road and Bridge Construction

2. Arizona Test Methods (ARIZ)

ARIZ 317a – Obtaining and Testing Drilled Cores and Sawed Beams of Concrete

3. American Society for Testing and Materials (ASTM)

ASTM C94 – Standard Specification for Ready-Mix Concrete

ASTM C171 – Standard Specification for Sheet Materials for Curing Concrete

ASTM C309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete

4. American Society of State Highway and Transportation Official (AASHTO)

T 152 – Standard Method of Test for Air Content of Freshly Mixed Concrete by the Pressure Method

1.3 Submittals

Submit as specified in Section 1330.

PART 2 – MATERIALS

2.1 Portland Cement and Water

Portland cement and mixing water shall conform to the requirements of Subsection 1006-2.01 and 1006-2.02 of the ADOT Standard Specifications, respectively.

2.2 Aggregate

A. Fine Aggregate

Fine aggregate shall conform to the requirements of Subsection 1006-2.03(B) of the ADOT Standard Specifications.

B. Coarse Aggregate

Coarse aggregate shall conform to the requirements of Subsection 1006-2.03(C) of the ADOT Standard Specifications, except that it shall conform to the following gradation in Table 037313-1.

TABLE 037313-1

Sieve Size	Sieve Size
1/2 inch	100
3/8 inch	85 - 100
No. 4	0 - 30
No. 8	0 - 10
No. 16	0 - 5

2.3 Admixtures

Admixtures shall conform to the requirements of Subsection 1006-2.04 of the ADOT Standard Specifications.

Air-entraining admixtures will be required for shotcrete placed at an elevation of 3,000 feet or above. Air content will be measured in accordance with AASHTO T 152.

When the wet-mix process is used, the air content will be measured just

prior to pumping, and shall not be less than 7 percent nor more than 10 percent.

When the dry-mix process is used, the air content will be measured from the in-place material that has been shot, and shall not be less than 4 percent nor more than 7 percent.

2.4 Reinforcing Steel

Reinforcing steel bars or welded wire fabric shall conform to the requirements of Section 1003 of the ADOT Standard Specifications.

2.5 Equipment

Equipment for use with the dry mix process shall be capable of metering the aggregate-cement mixture into the delivery hose under close control and delivering a continuous smooth stream of uniformly mixed material at the proper velocity to the discharge nozzle. The nozzle shall be equipped with a manually operated water ring for directing an even distribution of water through the fine aggregate-cement mixture. The water ring shall be capable of ready adjustment to vary the quantity of water.

Equipment for use with the wet mix process shall be the pneumatic feed type; however, a positive displacement type may be used if permitted in writing by the Engineer. The pneumatic feed type shall be capable of discharging the concrete or premixed mortar accurately, uniformly, and continuously through the delivery hose and to the gunning nozzle. The nozzle shall be fitted with an air ring for injecting additional compressed air into the flow of material. The size of the delivery hose shall be within the range of 1-1/4 to 2-1/2 inches.

2.6 Air Supply

The air compressor shall have ample capacity to furnish an adequate supply of clean dry air for maintaining sufficient nozzle velocity for all phases of the work while simultaneously operating a blow pipe for clearing away the rebound. The air hose shall be equipped with a filter to prevent any oil or grease from contaminating the shotcrete.

A constant air pressure of not less than 80 pounds per square inch shall be maintained in the placing machine when using the dry mix process or at the nozzle when using the wet mix process and when the delivery hose length is 100 feet or less. The pressure shall be increased at least 5 pounds per square inch for each additional 50 feet of hose or fraction thereof.

PART 3 – CONSTRUCTION REQUIREMENTS

3.1 Proportion Mixing

A. Dry Mix Process

Dry mix material shall consist of one part Portland cement to not more than four parts fine aggregate, measured either by weight or by volume. The fine aggregate shall contain not less than 3 percent nor more than 6 percent moisture by weight.

The cement and fine aggregate shall be thoroughly mixed before being charged into the delivery equipment. If the contractor uses a drum-type mixer, the mixing time shall be not less than one minute. The mixed material shall be utilized promptly after mixing. Any unused material that stands more than 45 minutes will be rejected and removed from the work site.

B. Wet Mix Process

1. Premixed Mortar

Premixed mortar shall consist of not less than 564 pounds of combined Portland cement and supplementary cementitious material per cubic yard, fine aggregate, chemical and/or air-entraining admixtures, and water mixed to a desired consistency, generally to a slump in the range of 1-1/4 to 4 inches.

The material may be mixed at a central mixing plant or at the project site. If mixing is done at the project site, the mixer shall be capable of thoroughly mixing the specified materials in sufficient quantity to maintain continuous placing of the mortar.

2. Concrete

The contractor shall determine the mix proportions and shall furnish concrete for pneumatic placement which contains a minimum of 658 pounds of combined Portland cement and supplementary cementitious material per cubic yard of concrete and which attains a minimum 28-day compressive strength of 3,000 pounds per square inch, unless otherwise specified. Fine aggregate and coarse aggregate shall conform to the requirements of Subsection 2.2 of this specification. The total mix shall contain 15 to 20 percent coarse aggregate, by weight. The water/cementitious material ratio shall not exceed 0.50. In no case shall the slump be greater than 4 inches.

If ready-mixed concrete is used, it shall conform to the requirements

of ASTM C94.

3.2 Preparation of Surface

The surfaces on which shotcrete is to be placed shall be finely graded to the lines and grades shown on the project plans or established by the Engineer. The surfaces shall be thoroughly compacted and shall be uniformly moistened so that water will not be drawn from the freshly placed shotcrete.

3.3 Forms and Ground Wires

Forms shall be of plywood sheathing or other suitable material and shall be true to line and grade and sufficiently rigid to resist deflection during placement of the shotcrete. Forms shall be constructed to permit the escape of air and rebound during the gunning operation.

Ground or gauging wires shall be installed where necessary to establish the thicknesses, surface planes and finish lines of the shotcrete.

3.4 Steel Reinforcement

Steel reinforcement shall be as shown on the project plans and shall conform to the requirements of Section 605 of the ADOT Standard Specifications.

3.5 Placement of Shotcrete

The velocity of the shotcrete as it leaves the nozzle shall be maintained uniform and at a rate approved by the Engineer for the given job conditions. The nozzle shall be held perpendicular to the working surface and at a proper distance, generally between 2 and 5 feet, to ensure maximum compaction with minimum rebound of the shotcrete.

Rebound or previously expended material in the shotcrete mix shall not be used in any portion of the work. All rebound shall be removed prior to final set and before placement of the shotcrete on adjacent surfaces.

Shotcrete shall not be applied during any precipitation which is of sufficient intensity to cause the in-place shotcrete to run. Shotcrete shall not be applied during wind conditions that cause separation of the nozzle flow.

Shotcrete shall not be applied when a descending ambient air temperature falls below 40 degrees F nor until an ascending air temperature rises above 35 degrees F. Temperature shall be taken in the shade away from artificial heat.

3.6 Testing

Tests to determine the physical quality of the shotcrete will be performed by the Engineer during the work as required. The contractor shall prepare test panels and obtain cores as specified herein.

Test panels at least 12 inches square and as thick as the structure being constructed, but not less than 3 inches thick, shall be prepared by gunning shotcrete mix into a frame which has been placed on a flat piece of plywood. Test panels shall be cured in the same manner as the production work, as specified in Subsection 912-3.09 of the specifications.

The contractor shall obtain three cores from each test panel in accordance with Arizona Test Method 317. The cores shall have a minimum diameter of 3 inches and a length to a diameter ratio (L/D) of at least 1.00. The cores must be obtained under the observation of an ADOT representative.

The cut surfaces of the cores will be carefully examined for soundness and uniformity of the material and shall be free from laminations and sand pockets.

The three cores will be tested by the Engineer for 28-day compressive strength in accordance with Arizona Test Method 317. Unless otherwise specified, the cores shall have an average compressive strength of at least 3,000 pounds per square inch.

3.7 Construction Joints

Construction joints shall be tapered to a shallow edge of 1 inch thick over a width of 1 foot, except where the joint will be subjected to compressive loading. If such is the case, or if joints are at slab intersections, full depth vertical joints shall be constructed and special care taken to avoid or remove trapped rebound at the joint. The entire joint shall be thoroughly cleaned and wetted prior to the application of additional shotcrete.

3.8 Finishing

After the shotcrete has been placed as nearly as practicable to the required thickness and shape outlined by forms and ground wires, the surface shall be checked with a straightedge and any low spots or depression shall be brought up to proper grade by placing additional shotcrete in such a manner that the finished surface shall be smooth and uniform.

Unless otherwise specified, the surface of the shotcrete shall have a natural gun finish.

3.9 Curing

The shotcrete surfaces shall be kept continuously moist for at least seven

days, beginning immediately after finishing, by means of either a water spray or fog system capable of being applied continuously or by liquid membrane-forming compound or by polyethylene sheeting conforming to the requirements specified in ASTM C171.

If polyethylene sheeting is used, it shall be white opaque and adjoining sheets shall overlap at least 12 inches and the laps secured to provide an airtight and windproof joint. If liquid membrane-forming compound is used it shall be Type I conforming to the requirements of ASTM C309 and the application rate shall be 1 gallon per 100 square feet.

PART 4 – UNITS AND METHODS OF MEASUREMENT

4.1 Units and Method of Measurement

See Section 01210 – Measurement and Payment.

****END OF SECTION 033713****

SP 310519

GEOSYNTHETICS

PART 1 - GENERAL

1.1 Summary

A. This section defines the requirements for geosynthetic fabrics, grids and membranes typically used as pavement fabric beneath asphalt concrete overlays, filtration/drainage separation between soil/aggregate layers, erosion control filter/separators for riprap protection, and soil or base reinforcement to improve the stability of weak soils or reinforce aggregate bases.

B. Related Work Specified Elsewhere

Earthwork.....Section 02200
Rock Rip-Rap Construction.....Section 02510

1.2 Quality Assurance

A. Reference Test Standards and Specifications

1. Arizona Department of Transportation (ARIZ)

ARIZ-730

2. American Society for Testing and Materials (ASTM)

ASTM D1388 – Standard Test Method for Stiffness of Fabrics

ASTM D3786 – Standard Test Method for Bursting Strength of Textile Fabrics—Diaphragm Bursting Strength Tester Method

ASTM D4354 – Standard Practice for Sampling of Geosynthetics and Rolled Erosion Control Products (RECPs) for Testing

ASTM D4355 – Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus

ASTM D4533 – Standard Test Method for Trapezoid Tearing Strength of Geotextiles

ASTM D4632 – Standard Test Method for Grab Breaking Load and Elongation of Geotextiles

ASTM D4751 – Standard Test Methods for Determining Apparent Opening Size of a Geotextile

ASTM D4833 – Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products

ASTM D4873 – Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples

ASTM D4945 – Standard Test Method for High-Strain Dynamic Testing of Deep Foundations

ASTM D6637 – Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method

ASTM D7737 – Standard Test Method for Individual Geogrid Junction Strength

3. Geosynthetic Research Institute

GRI-GG2 – Test Method for Geogrid Junction Strength

1.3 Submittals

A. Certificate of Compliance

1. Submit as specified in Section 01330.
2. Upon request, a Certificate of Compliance shall be submitted to the Engineer for material to be used. Samples of materials shall be submitted for testing. Each geosynthetic material lot or shipment is to be approved by the Engineer before the material is incorporated into the work.

Testing methods and results shown in the Certificate of Compliance shall conform to the listed specifications for the proposed geosynthetic. Manufacturer's supporting documentation including, but not limited to, product information sheets, installation procedures and recommendations, recommended use, and project references shall be submitted to the Engineer for product evaluation and approval.

PART 2 – MATERIALS

2.1 General

Identification, packaging, delivery, storage and handling of geosynthetic materials shall be in accordance with manufacturer's recommendations and ASTM D4873. Each roll shall be labeled or tagged to provide product identification sufficient to determine the product type, manufacturer, quantity, lot number, roll number date of manufacture, and shipping date. Geosynthetic materials shall be inert to commonly encountered chemicals, resistant to rot and mildew, and shall have no tears or defects which adversely affect or alter its physical properties.

Geosynthetic materials shall be packaged with material that will protect the geosynthetic (including ends of rolls) from damage due to shipment, water, sunlight and contaminants. During storage, geosynthetic materials shall be elevated off the ground and protected from the following: site construction damage, precipitation, extended ultraviolet radiation, strong acid or strong base chemicals, flames (including welding sparks), temperatures in excess of 160°F, and any other environmental condition that may damage geosynthetic material property values. Protection shall be in accordance with manufacturer's specifications and shall be maintained during periods of shipment and storage.

Materials required for complete and proper installation of geosynthetic materials that are not specifically described herein (such as pins, nails, washers, etc.) shall conform to the manufacturer's recommendations and be as selected and supplied by Contractor subject to final approval by the Engineer.

Requirements represent minimum average roll values in the weaker principal direction. Average of test results from any sampled roll in a lot shall meet or exceed the minimum values noted herein. Lot sampling shall be in accordance with ASTM D4354.

2.2 Pavement

Pavement fabric geosynthetics are non-woven polyester or polypropylene fabrics that are field saturated with an asphalt binder and placed as an interlayer beneath a pavement overlay or between pavement layers. When placed, the fabric becomes an integral part of the roadway section, forming a barrier to water infiltration and absorbing stresses to reduce reflective and fatigue cracking of the new pavement surface layer.

Pavement fabric shall be constructed of at least 95 percent (by weight) nonwoven synthetic fibers of polyester or polypropylene, thermally bonded on one side. The fabric material shall additionally conform to the physical

properties shown in Table 310519-1.

TABLE 310519-1

PAVEMENT GEOSYNTHETIC PROPERTIES			
Property	Class A	Class B	Test Method
Weight: oz./yd ²	4.1 min.	4.0 min.	ASTM D3776
Grab tensile strength: lbs.	100 min.	90 min.	ASTM D4632
Elongation at break: %	50 min.	50 min.	ASTM D4632
Melting point: degree F	300 min.	300 min.	ASTM D276
Asphalt retention: gal/yd ²	0.25 min.(1)	0.20 min.	ASTM D6140

(1) May be reduced within street intersections, on steep grades or in other zones where vehicle braking is common, but not less than 0.20 gal/yd², when approved by the Engineer.

2.3 Filtration (Drainage) Separation

Filtration and separation fabrics are nonwoven or woven polypropylene or polyester fabrics with specified strength characteristics used as permeable separators to restrain soil or other particles subjected to hydrodynamic forces while allowing the passage of fluids into or across a geotextile and to prevent inter-migration of adjacent soil layers of vastly different particle sizes and particle distributions.

Filtration and separation fabrics shall be nonwoven or woven fabric consisting only of long chain polymeric filaments such as polypropylene or polyester formed or woven into a stable network such that the filaments retain their relative position to each other. The fabric material shall additionally conform to the physical properties shown in Table 310519-2.

TABLE 310519-2

FILTRATION & DRAINAGE GEOSYNTHETIC PROPERTIES			
Property	Class A ⁽¹⁾	Class B ⁽²⁾	Test Method
Grab tensile strength: lbs.	180 min.	80 min.	ASTM D4632
Seam strength: lbs.	160 min.	70 min.	ASTM D4632

Puncture strength: lbs.	80 min.	25 min.	ASTM D4833
Trapezoidal tear: lbs.	50 min.	25 min.	ASTM D4533
Apparent opening size: US Standard sieve size	>50	>50	ASTM D4751
Ultraviolet Stability: %	50 min.	50 min.	ASTM D4355

(1) Class A - Use where installation stresses are more severe than for Class B application

(i.e. very coarse sharp angular aggregate or high compaction requirements).

(2) Class B – Use with smooth graded surface having no sharp angular projections and sharp angular aggregate.

2.4 Erosion Control

Erosion control fabrics are used below areas to receive aggregate or riprap slope protection and act as filter/separators to provide sustained permeability while maintaining structural stability.

Erosion control fabrics shall be a woven monofilament fabric or a nonwoven fabric consisting only of long chain polymeric filaments such as polypropylene or polyester formed into a stable network that the filaments retain their relative position to each other. The fabric material shall additionally conform to the physical properties shown in Table 310519-3.

TABLE 310519-3

EROSION CONTROL GEOSYNTHETIC PROPERTIES			
Property	Class A	Class B	Test Method
Grab tensile strength: lbs.	270 min.	200 min.	ASTM D4632
Elongation at break: %	45min., 115 max.	15 min., 115 max.	ASTM D4632
Puncture strength: lbs.	110 min	75 min.	ASTM D4833
Burst strength: psi	430 min.	320 min.	ASTM D3786
Trapezoidal tear: lbs.	75 min.	50 min.	ASTM D4533
Permittivity: second-1	0.07 min.	0.07 min.	ARIZ-730 ⁽¹⁾
Apparent opening size: US Standard sieve size	30 – 140	30 - 140	ASTM D4751

Ultraviolet Stability: %	70 min.	70 min.	ASTM D4355
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(1) Arizona Department of Transportation test method.

2.5 Soil for Base Reinforcement

Geogrid geosynthetic materials are used for improving the stability of weak soils or reinforcing aggregate bases. Geogrids are defined as biaxial or triaxial polymeric grids formed by a regular network of integrally connected polymer tensile elements with apertures of sufficient size to permit significant mechanical interlock with the surrounding soil, aggregate, or other fill materials to function primarily as reinforcement.

The geogrid structure shall be dimensionally stable and able to retain its geometry under manufacture, transport and installation. Geogrids shall be integrally formed and deployed as a single layer; comprised of 100 percent polypropylene or high-density polyethylene. Geogrids shall additionally conform to the physical properties shown in Table 310519-4.

TABLE 310519-4

REINFORCEMENT GEOGRID PROPERTIES			
Property	Type 1	Type 2	Test Method
Aperture size: inches	1 min.	1-3/8 min.	ID callipered
Ultimate Tensile Strength: lb./ft.	850 min.	1300 min.	ASTM D4945
Flexural Rigidity: Mg-cm	250,000 min.	750,000 min.	ASTM D1388
Tensile Strength @ 2% Strain: lb./ft. MD ⁽¹⁾	270 min.	410 min.	ASTM D6637
Tensile Strength @ 2% Strain: lb./ft. CMD ⁽²⁾	380 min.	620 min.	ASTM D6637
Tensile Strength @ 5% Strain: lb./ft. MD ⁽¹⁾	550 min.	810 min.	ASTM D6637
Tensile Strength @ 5% Strain: lb./ft. CMD ⁽²⁾	720 min.	1340 min.	ASTM D6637
Junction Efficiency: % Ultimate Tensile Strength		75 min.	GRI-GG2 (3)
Ultraviolet Stability: % Retained Strength		70 min.	ASTM D4355

(1) MD = Test in the machine direction along roll length

(2) CMD = Test in the cross-machine (transverse) direction across roll width

(3) Geosynthetic Research Institute test method

PART 3 – MEASUREMENT AND PAYMENT

3.1 Measurement

No measurement will be made for this item.

3.2 Payment

No payment will be made for Geosynthetics. Geosynthetics shall be considered incidental to other items.

****END OF SECTION 310519****

DIVISION IV

CONSTRUCTION DRAWINGS AND DETAILS

DIVISION V

APPENDICES

APPENDIX A – GEOTECHNICAL REPORT

Geotechnical Evaluation El Dorado Wash Improvements El Dorado Avenue and El Dorado Wash Lake Havasu City, Arizona

Holistic Engineering and Land Management
14040 North Cave Creek Road, Suite 104 | Phoenix, Arizona 85022

December 1, 2022 | Project No. 607314001



Geotechnical | Environmental | Construction Inspection & Testing | Forensic Engineering & Expert Witness

Geophysics | Engineering Geology | Laboratory Testing | Industrial Hygiene | Occupational Safety | Air Quality | GIS

Ninyo & Moore
Geotechnical & Environmental Sciences Consultants



December 1, 2022
Project No. 607314001

Mr. Charlie Joy, PE
Holistic Engineering and Land Management
14040 North Cave Creek Road, Suite 104
Phoenix, Arizona 85022

Subject: Geotechnical Evaluation
El Dorado Wash Improvements
El Dorado Avenue and El Dorado Wash
Lake Havasu City, Arizona

Dear Mr. Joy:

In accordance with our proposal dated June 2, 2022, and your authorization, Ninyo & Moore has performed a geotechnical evaluation for the above-referenced site. The attached report presents our methodology, findings, conclusions, and recommendations regarding the geotechnical conditions at the project site.

Ninyo & Moore appreciates the opportunity to be of service to you on this project.

Sincerely,
NINYO & MOORE

Stephen V. Hargus
Stephen V. Hargus, PE
Senior Engineer



SVH/SDN/tlp

Steven D. Nowaczyk
Steven D. Nowaczyk, PE
Managing Principal Engineer

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1. INTRODUCTION

In accordance with our proposal dated June 2, 2022, and your authorization, we have performed a geotechnical evaluation for the proposed El Dorado Wash Improvements in Lake Havasu City, Arizona. The purpose of our evaluation was to assess the subsurface conditions at the project site in order to provide geotechnical recommendations for design and construction. This report presents the results of our evaluation, and our geotechnical considerations and recommendations regarding the proposed construction.

2. SCOPE OF SERVICES

Our scope of services included the following:

- Reviewing readily available geotechnical data, aerial photographs, and published geologic literature, including maps and reports pertaining to the project site and vicinity.
- Conducting a geologic reconnaissance of the site.
- Obtaining a permit from Lake Havasu City and coordinating traffic control to conduct the field work.
- Marking out the boring locations at the project site and notifying Arizona 811 of the boring locations prior to drilling.
- Drilling, logging, and sampling three exploratory borings to depths between approximately 13.7 and 20 feet below ground surface (bgs). The boring logs are presented in Appendix A.
- Collecting soil samples in the borings at approximately 2.5 and 5.0-foot intervals using ASTM International (ASTM) Methods D1586 (standard penetration test with split-spoon barrel sampling of soils) and D3550 (ring-lined barrel sampling of soils) for laboratory testing and analysis.
- Collecting near surface soil samples immediately upstream and downstream of the intersection at two locations using hand-operated equipment. The soil samples were transported to our laboratory for testing and analysis.
- Performing laboratory tests on selected samples obtained from the boring to evaluate in-situ moisture content and dry density, gradation, Atterberg limits, maximum density, and corrosivity characteristics (including pH, minimum electrical resistivity, and soluble sulfate and chloride contents). The in-situ moisture content and dry density results are presented on the boring logs in Appendix A. The remainder of the laboratory test results are presented in Appendix B.
- Preparing this report presenting our findings, conclusions, and recommendations regarding the design and construction of the project.

Our scope of services did not include environmental consulting services such as hazardous waste sampling or analytical testing at the site. A detailed scope of services and estimated fee for such services can be provided upon request.

3. SITE DESCRIPTION

The project site is located at the intersection of El Dorado Avenue and El Dorado Wash in Lake Havasu City, Arizona (Figure 1). The El Dorado Wash is a sandy bottom wash generally running from the east to the west. El Dorado Avenue is two-lane asphaltic concrete (AC) road with bike lanes on both sides. The intersection of the roadway and wash is currently configured as a low-flow crossing with a concrete cutoff wall and riprap mat on the downstream side of the roadway. The area is surrounded by residential homes.

According to the Lake Havasu City South, Arizona 7.5-Minute United States Geological Survey (USGS) Topographic Quadrangle Map (2021) the site slopes from the northeast to the southwest. The roadway at the north bank of El Dorado Wash is at approximately 1,064 feet relative to mean sea level (MSL). The center of wash is at approximately elevation 1,056 feet MSL, and the south bank is at approximately elevation 1,058 feet MSL.

4. AERIAL PHOTOGRAPH REVIEW

Aerial photographs of the project site from a Historical Aerials website (2022) dated between 1947 and 2019 were reviewed for this project. As of 1947, the site was a native desert wash. By 1969 channel improvements had been made to support residential development in the surrounding area. The channel improvement included defined side slopes, berm construction, and low flow crossings. Some scattered homes were constructed around the El Dorado Avenue crossing which was still a dirt road at the time. By 1981, El Dorado Avenue was paved and some additional homes had been constructed. Residential development continued over the next two decades, and by 2005, the residential development around the site had been fully built out, similar to its current condition.

5. PROJECT DESCRIPTION

The project includes the design and construction of a multi-cell box culvert to replace the existing low flow crossing configuration at the intersection of the El Dorado Avenue and the El Dorado Wash. The construction of the box culvert will call for the roadway to be raised with the construction of new roadway embankment and placement of new AC pavement. It is anticipated that some utilities may be relocated as part of the construction. Other improvements, such as

scour protection, grade-control structures, and bank restoration, may be done as part of this project.

6. FIELD EXPLORATION AND LABORATORY TESTING

The following sections summarize our field exploration and laboratory testing activities.

6.1. Soil Borings

Ninyo & Moore conducted a subsurface exploration of the site on August 16th, 2022. The site exploration was needed to evaluate the subsurface conditions and to collect soil samples for laboratory testing. Our exploration consisted of drilling, logging, and sampling three exploratory soil borings denoted as B-1 through B-3. The approximate boring locations are shown on Figure 2. The borings were drilled using a CME-55 truck-mounted drill rig equipped with hollow-stem augers (HSA). Our borings were drilled to depths between 13.7 and 20 feet bgs. Borings B-2 experienced auger refusal at 13.7 feet on cobbles and possible boulders. Logs of the borings are included in Appendix A.

Soil samples were collected at selected intervals and were logged in general accordance with the ASTM D2488. Disturbed soil samples were collected during standard penetration testing using a split-spoon sampler. Relatively undisturbed soil samples were collected at regular intervals by using modified ring-lined split tube samplers. Bulk samples were also collected from the HSA cuttings and placed in large plastic bags. The selected intervals at which the bulk soil samples were collected are provided on the boring logs. Descriptions of the soils encountered in our borings are presented on the boring logs.

6.2. Hand Sampling

Ninyo & Moore collected near surface hand samples upstream and downstream of the proposed box culvert site during our geologic reconnaissance on July 25th, 2022. Bulk samples were collected using hand tools and placed in large plastic bags. These samples were transported to our laboratory for testing to aide in sediment transport and scour analysis. The results of the laboratory tests are included in Appendix B.

6.3. Laboratory Testing

Selected samples were visually classified and tested in our laboratory to evaluate their engineering properties as a basis for providing geotechnical recommendations for design and construction considerations. Our geotechnical laboratory testing included in-situ moisture content and dry density, gradation, Atterberg limits, maximum density, and chemical testing to evaluate corrosivity

(including soil pH, resistivity, sulfate, and chloride). Laboratory test results for in-situ moisture content and dry density are shown on the boring logs, the results of the geotechnical laboratory tests are included in Appendix B.

7. GEOLOGY AND SUBSURFACE CONDITIONS

The geology and subsurface conditions at the site are described in the following sections.

7.1. Geologic Setting

The project site is located in the Sonoran Desert Section of the Basin and Range physiographic province, which is typified by broad alluvial valleys separated by steep, discontinuous, subparallel mountain ranges. The mountain ranges generally trend north-south and northwest-southeast. The basin floors consist of alluvium with thickness extending to several thousands of feet.

The basins and surrounding mountains were formed approximately 10 to 18 million years ago during the mid- to late-Tertiary. Extensional tectonics resulted in the formation of horsts (mountains) and grabens (basins) with vertical displacement along high-angle normal faults. Intermittent volcanic activity also occurred during this time. The surrounding basins filled with alluvium from the erosion of the surrounding mountains as well as from deposition from rivers. Coarser-grained alluvial material was deposited at the margins of the basins near the mountains.

The surficial geology at the site consists of unconsolidated to strongly consolidated alluvial and eolian deposits. This unit includes: coarse, poorly sorted alluvial fan and terrace deposits on middle and upper piedmonts and along large drainages; sand, silt and clay on alluvial plains and playas; and wind-blown sand deposits. (Richard, SM, et al., 2000).

7.2. Subsurface Conditions

Our knowledge of the subsurface conditions at the project site is based on the results of our exploratory boring and our understanding of the general geology of the area. The boring logs contain our field test results, as well as our interpretation of the conditions likely to exist between actual samples retrieved. Therefore, the boring logs contain both factual and interpretive information. Lines delineating subsurface strata on the boring logs are intended to group soils having similar engineering properties and characteristics. They should be considered approximate, as the actual transition between soil types may be gradual. Detailed stratigraphic information as well as a key to the soil symbols and terms used on the boring logs are provided in Appendix A.

7.2.1. Asphaltic Concrete

An AC pavement overlaying native alluvium was encountered at the surface of each of the borings. Based on measurements taken from our borings the AC thickness ranged between 4 and 4.5 inches along the roadway.

7.2.2. Alluvium

Alluvial soils were encountered below the AC layer and extended to the boring termination depth. In our borings, as well as the hand samples, the alluvium generally consisted of medium dense to very dense coarse-grained soils. The alluvial soil were mixtures of sand and gravel characterized as poorly graded sand with gravel (SP), poorly graded sand with silt and gravel (SP-SM), well-graded sand with silt and gravel (SW-SM), silty clayey sand (SC-SM), poorly graded gravel with sand (GP) and silty clayey gravel with sand (GC-GM). Cobbles were scattered across the surface near our borings. Cobbles and possibly boulders were encountered in boring B-2.

7.2.3. Groundwater

Groundwater was not encountered in our borings at the time of drilling. The site is located approximately three and a half miles from the Colorado River. Well data from the Arizona Department of Water Resources (ADWR) Groundwater Site Inventory database (2022) indicates that regional groundwater has been historically encountered as shallow as 30 feet with one-quarter mile from the Colorado River. Given the elevation change (approximately 1,200 feet) and distance (approximately 3.0 miles) between the river and the site, groundwater is not anticipated to be encountered. Seasonal variations could cause fluctuations in the surrounding groundwater depths. Perched water tables may be encountered, especially after flood events.

8. GEOLOGIC HAZARDS

The following sections describe regional geologic hazards, including land subsidence, earth fissures, faults, and liquefaction.

8.1. Land Subsidence and Earth Fissures

Based on our field reconnaissance and information accessed at Arizona Geologic Survey website (2022), the site is not located in area with documented earth fissures. The project site is not in an area with a measured land subsidence based on information accessed at the ADWR e-Library (2022).

8.2. Faulting and Seismicity

The site lies within the Sonoran zone, which is a relatively stable tectonic region located in southwestern Arizona, southeastern California, southern Nevada, and northern Mexico (Euge et al., 1992). This zone is characterized by sparse seismicity and few Quaternary faults. Based on our field observations, review of pertinent geologic data, and analysis of aerial photographs, Quaternary faults are not located on or adjacent to the property.

The closest known Quaternary faults to the site are the Needles-Graben Faults, located approximately 22 miles to the north of the site (Pearthree, 1998). Approximately 2 meters of displacement has occurred along this fault within middle to upper Pleistocene deposits (<750,000 years), but the upper Pleistocene and Holocene deposits (<250,000 years) are not displaced.

9. GEOTECHNICAL CONSIDERATIONS

Based on the results of our subsurface evaluation, laboratory testing, and data analysis, it is our opinion that the proposed construction is feasible from a geotechnical standpoint, provided that the recommendations of this report are incorporated into the design and construction of the proposed project, as appropriate. Geotechnical considerations include the following:

- The near surface site soils can generally be excavated or ripped using heavy-duty earthmoving or excavation equipment. However, very dense soils, varying amounts of gravel, cobbles, and possibly boulders were encountered in our borings and may be more difficult to excavate and/or slow the rate of excavation during construction.
- The new structure may be supported on a mat foundation or spread footings proportioned for moderate bearing pressures on a zone of engineered fill.
- Imported soils and soils generated from on-site excavation activities that exhibit relatively low plasticity can generally be used as engineered fill. Many of the on-site soils will be suitable for re-use as engineered fill, but some screening of material may be needed.
- Groundwater was not observed in our borings. Based on ADWR well data, the regional groundwater table has been historically measured at depths on the order of 30 feet bgs within one-half mile from the Colorado River. However, the site is more than three miles from the river with an elevation change of over 1,200 feet. In general, groundwater is not expected to be a constraint to the design and construction of this project.
- No documented geologic hazards are present underlying or immediately adjacent to the site.

10. RECOMMENDATIONS

The following sections present our geotechnical recommendations and were developed based on our understanding of the proposed construction (Section 4), the observed subsurface conditions (Section 7), and our experience. Given the project location, recommendations and guidelines outlined by the Maricopa Association of Governments (MAG), and/or any Lake Havasu City (LHC) Engineering Specifications should be used unless recommended differently herein. If the proposed construction is changed from that discussed herein or subsurface conditions other than those shown on the boring logs (Appendix A) are observed at the time of construction, Ninyo & Moore should be retained to conduct a review of the new information and to evaluate the need for additional recommendations.

10.1. Earthwork

The following sections provide our earthwork recommendations for this project.

10.1.1. Site Preparation

Vegetation, unsuitable materials, or debris from the clearing operation should be removed from the site and disposed of or placed in non-structural areas (e.g., landscaping). Obstructions that extend below finish grade, if present, should be removed and the resulting voids filled with moisture-conditioned and compacted fill.

The geotechnical consultant should carefully evaluate any areas of loose, soft, or wet soils prior to placement of fill or other construction. Drying or over-excavation of some materials may be appropriate.

10.1.2. Wet Weather Conditions

Earthwork contractors should be made aware of the moisture sensitivity of the near surface clayey soils and potential compaction difficulties. If construction is undertaken during wet weather conditions, the surficial soils may become saturated, soft, and unworkable. Therefore, we recommend that consideration be given to construction during the dryer months and positive drainage be established and maintained during construction.

10.1.3. Subgrade Improvement

Based on our testing, the near surface alluvial soils are not considered suitable to provide support to the new improvements in their in-situ condition. We recommend that near surface foundations associated with the box culvert structure be supported on 2 feet of moisture-conditioned and compacted engineered fill measured from the bottom of the footing

or mat. This overexcavation zone should extend 2 feet horizontally beyond the edges of the foundations and should be moisture conditioned and compacted in accordance with this report.

New pavements, concrete flatwork and any roadway fill constructed over native soils should be supported on 12 inches of moisture conditioned and compacted engineered fill. The improvements in these areas should extend 12 inches beyond the edges of the pavements and flatwork. New pavements and concrete flatwork constructed over the concrete box culvert should be supported on a minimum of 12 inches of moisture conditioned and compacted engineered fill. The box culvert should be structurally designed to withstand traffic loading.

Once the above-mentioned overexcavation is achieved, and the underlying soils are exposed, further evaluation should be made by the on-site geotechnical representative for the presence of loose, soft, yielding, or unacceptable soils. Based on this evaluation, additional remediation may be needed. This could include further improvement of the exposed surface. This additional remediation, if needed, should be addressed by the geotechnical consultant during earthwork operations.

10.1.4. Excavations

Our evaluation of the excavation characteristics of the on-site materials is based on the results of our exploratory borings, site observations, and experience with similar materials. Excavation of the materials can generally be accomplished with heavy-duty earthmoving equipment. However; very dense soils, varying amounts of gravel varying amounts of gravel, cobbles, and possibly boulders were encounter in our borings and may be more difficult to excavate and/or slow the rate of excavation depending on the degree of cementation encountered during construction.

Sidewalls for temporary excavations should not be anticipated to stand near-vertical without sloughing. Therefore, the sides of excavations and trenches for this project should be stabilized in order to reduce damage to adjacent facilities resulting from vertical or lateral movement of the soil. The sides of the excavation may be stabilized by sloping back the sides and/or by using bracing. However, the trench sidewalls may be difficult to stabilize due to the presence of low cohesion soils, which could have a potential to caving and sloughing during excavation, especially if the soils are wet or saturated. Additionally, vibrations caused by nearby traffic or construction equipment could accelerate sloughing.

10.1.5. Temporary Slopes

The contractor should provide safely sloped excavations or an adequately constructed and braced shoring system in compliance with OSHA Regulations for employees working in an excavation that may expose them to the danger of moving ground. Based on the soil conditions at the site, we recommend that OSHA Soil “Type C” classification be used for excavations at the site. This corresponds to temporary slopes of 1.5:1 (horizontal: vertical). This side slope is for excavations that are less than 20 feet deep. If material is stored or equipment is operated near an excavation, stronger shoring should be used to resist the extra pressure due to superimposed loads. Excavations over 20 feet should be designed by the contractor’s engineer based on alignment-specific geotechnical analysis.

Upon making the excavations, soil and/or rock classifications and excavation performance should be evaluated in the field by the geotechnical consultant in accordance with OSHA standards.

10.1.6. Permanent Slopes

Permanent cut slopes and constructed embankment fill slopes should be no steeper than 2:1 (horizontal to vertical). New embankment fills should be benched into existing embankments, where appropriate. Benches should be level and wide enough to allow operation of and compaction by, construction equipment. Fill slopes should be constructed in a manner (e.g., overfilling and cutting to grade) such that the recommended degree of compaction is achieved to the finished slope face. Cut and fill slopes should be protected from erosion. This should promote re-vegetation and a stable slope. Periodic maintenance of exposed slopes should be anticipated.

Unprotected slopes may rill and erode if exposed to running water. Silty soils and soils containing fine sand are more susceptible in this regard. While 2:1 (horizontal to vertical) slopes are acceptable from a stability standpoint, laying slopes back to 3:1 (horizontal to vertical) will decrease runoff velocity and decrease the likelihood of serious erosion. Steeper slopes will need additional maintenance. Adequate drainage and temporary erosion protection covering could minimize erosion problems and promote post-construction vegetation. Plating the slopes with gravelly material or riprap will reduce the impacts of precipitation and slow the rate of erosion. If riprap is placed in the channel it should be adequately sized to prevent erosion of the embankment. Along longer slopes, brow ditches should be considered to reduce the amount of surface flow on the slope face. Where feasible, the existing vegetation should be salvaged and replaced.

10.1.7. Trench Widths

Project related trench widths should be in accordance with LHC Standard Detail 200A. The trench width should be taken as the clear distance between trench walls or the inside face-to-face distance between the ground support systems.

10.1.8. Temporary Shoring

In some instances, it may be preferable to temporarily brace or shore the excavations rather than using open cuts to the base of the excavations. Temporary earth retaining systems will be subjected to lateral loads resulting from earth pressures. Shored excavations may be designed using the parameters on Figure 3.

The earth pressure values presented on Figure 3 assume that spoils from the excavation or other surcharge loads will not be placed above the excavation within a 1:1 (H:V) plane extending up and back from the base of the excavation. If spoil piles are placed closer than this to the braced or shored excavation, the resulting surcharge loads should be considered in the bracing or shoring design. We recommend that an experienced structural engineer design the bracing or shoring system. The bracing and shoring parameters presented in this report should be considered as guidelines.

Trench boxes may also be a suitable alternative to laying back the side walls; however, due to the presence of granular soils, the excavations may not stand open long enough to install the trench boxes. The contractor should be prepared to deal with these soil conditions and plan accordingly. Once installed, some sloughing is possible at the ends of the trench box; therefore, any loose material should be removed prior to backfilling of the trench.

10.1.9. Bottom Stability

The surface exposed at the bottom of an excavation should be stable for the purpose of the planned construction. However, if excavations are open during a heavy rain event, the bottom of the excavation may become saturated and unstable. Excavations that encounter seepage or surface run-off could be dewatered by pumping the water out and away from the excavation. However, heavily saturated soils or perched groundwater zones, if encountered, may call for more aggressive means of dewatering and consultation with a qualified expert may be needed. Discharge of water from the excavations to natural drainage channels, if needed, may entail securing a special permit.

10.1.10. Fill Materials

On-site and imported soils that exhibit relatively low plasticity indices are generally suitable for re-use as engineered fill or trench backfill material. Relatively low plasticity indices, as evaluated by ASTM D4318, are defined as a plasticity index (PI) of 15 or less for this project.

In addition, suitable fill should not include construction debris, organic material, or other non-soil fill materials. Clay lumps and rock particles should not be larger than 4 inches in dimension. Unsuitable fill material should be disposed of off-site or in non-structural areas.

Imported fill, if used, should consist of soils with a relatively low PI (15 or less). Import material in contact with ferrous metals should preferably have low corrosion potential (minimum resistivity more than 2,000 ohm-cm, chloride content less than 25 parts per million [ppm]). In lieu of this, corrosion protection techniques (e.g., cathodic protection, pipe wrapping, etc.) can be implemented. A corrosion specialist should be consulted for recommendations of an appropriate corrosion protection technique. Imported material in contact with concrete should have a soluble sulfate content of less than 0.1 percent. The geotechnical consultant should evaluate such materials and details of their placement prior to importation.

10.1.11. Re-use of On-Site Soils

The Atterberg limits tests performed on soil samples obtained from our borings resulted in a PI value ranging between zero (non-plastic) and 7. Based on our test results, many of the on-site soils are generally suitable for re-use as engineered fill or trench backfill for this project. Some screening may be needed to remove oversized material. Additional field sampling and laboratory testing should be conducted by the contractor either prior to or during construction to better screen for any unsuitable materials.

10.1.12. Flowable Fill

As an alternative to using soil backfill, some backfill zones may be filled with Flowable fill. Flowable fill consists of a fluid, workable mixture of aggregate, Portland cement, and water. The use of flowable fill has some advantages:

- A narrower backfill zone can be used, thereby minimizing the quantity of soil to be excavated and possibly reducing disturbance to the near-by structures.
- Relatively higher modulus of soil reactions values may be used.
- The support given to the connecting pipes is generally better.

- Because little compaction is needed to place flowable fill, there is less risk of damaging the connecting pipes.
- Flowable fill can be batched to flow into irregularities in the trench bottom and walls.

The flowable fill design mix should be in accordance with the Section 02310 of the LHC Engineering Specification. Additional mix design information can be provided upon request.

Buoyant or uplift forces on the piping should be considered when using flowable fill and prudent construction techniques may result in multiple pours to avoid inducing excessive uplift forces. Sufficient time should be provided to allow the flowable fill to cure before placing additional lifts of flowable fill or trench backfill.

10.1.13. Pipe Bedding

We recommend standard utility pipelines be supported on a minimum of 6 inches or more of granular bedding material such as sand and gravel, or crushed rock meeting Section 02300 of the LHC Engineering Specifications (pea gravel or crushed chips are not acceptable). Care should be taken not to allow voids to form beneath the pipe (i.e., the pipe haunches should be continuously supported) to avoid damaging the pipeline. Bedding material and compaction requirements should be in accordance with the recommendations in this report, as well as the LHC Engineering Specifications.

10.1.14. Trench Backfill

Backfilling should generally be accomplished in a manner consistent with LHC Section 02300. The onsite soils are generally suitable for reuse as trench backfill provided, they are free of organic material, clay lumps, debris, and rocks greater than 4 inches in diameter. Some screening of larger particles may be needed, to meet the LHC Engineering Specifications. Imported fill, if utilized, should meet the requirements for fill material presenting in this report.

10.1.15. Modulus of Soil Reaction (E')

The modulus of soil reaction (E') is used to characterize the stiffness of soil backfill placed on the sides of buried pipelines for the purpose of evaluating deflection caused by the weight of the backfill over the pipe. We anticipate that the invert depth of the new piping will generally be less than 15 feet bgs. For granular backfill bedding soils for pipes, we recommend using an E' value of 1,500 pounds per square inch (psi). For a flowable fill, an E' value of 2,500 psi may be used. For trench backfill materials an E' value of 1,000 psi may be used.

10.1.16. Fill Placement and Compaction

Special care should be exercised to avoid damaging pipes or other structures during the compaction of the backfill. Compaction should be accomplished in a manner that inhibits surface water infiltration as well as conveyance of subsurface moisture due to the intersection of natural drainages along the alignment.

Trench backfill and engineered fill material should be placed in horizontal lifts approximately 8 inches in loose thickness when compacted by mechanical methods. If non-conventional, hand operated, compaction equipment is employed horizontal lifts shall not exceed 4 inches in loose thickness. It is recommended that soil be compacted by appropriate mechanical methods at moisture content as outlined in Table 1.

Engineered Fill Description	Percent Compaction per ASTM D698	Moisture Content
Below foundations and exterior flatwork	95 percent	±2 percent of optimum
Pavement subgrade and roadway fill	95 percent	±2 percent of optimum
AB beneath pavement	100 percent	±3 percent of optimum
Final Backfill Upper Zone – Within 2 feet below pavement	100 percent	±2 percent of optimum
Final Backfill Trench Zone – Deeper than 2 feet below pavement or in unpaved areas	95 percent	±2 percent of optimum
Pipe Bedding	95 percent	±3 percent of optimum

An earthwork (shrinkage) factor of 10 to 20 percent is estimated. This shrinkage factor range represents an average of the material tested and assumes that materials excavated from the site will be placed as fill. Potential bidders should consider this in preparing estimates and should review the available data to make their own conclusions regarding excavation conditions.

10.1.17. Site Drainage

The long-term performance of the foundation system depends, in part, on maintaining positive surface drainage during the life of the structure. Adequate drainage should be provided to reduce variations in the moisture content of foundation soils. The invert of the box culvert should be positioned to allow water to flow through culvert and not pond on the upstream side.

Finished grade within 5 feet of the structure along the downstream side should be adjusted to slope away from the structure at a slope of 2 percent, or more.

An upstream cutoff trench may be needed to prevent moisture infiltration beneath the box culvert. The depth of this cutoff trench should extend below the anticipated scour depth. The trench should be backfilled with concrete or a flowable fill.

10.2. Seismic Design Parameters

The current International Building Code (IBC) specifies that the Risk-Targeted, Maximum Considered Earthquake (MCE_R) ground motion response accelerations be used to evaluate seismic loads for design of buildings and other structures. The MCE_R ground motion response accelerations are based on the spectral response accelerations for 5 percent damping in the direction of maximum horizontal response and incorporate a target risk for structural collapse equivalent to 1 percent in 50 years with deterministic limits for near-source effects. The horizontal PGA that corresponds to the MCE_R for the site was calculated as 0.085g. The MCE_G PGA, based on the geometric mean PGA with a 2 percent probability of exceedance in 50 years, with adjustment for site class effects (PGA_M) was calculated as 0.124g. Seismic design parameters were calculated using the ATC Hazards by Location website (2022) seismic design tool.

Design of the proposed improvements should be performed in accordance with the requirements of the governing jurisdictions and applicable building codes. Table 2 presents the seismic design parameters for the site in accordance with International Building Code (IBC) guidelines and adjusted maximum considered earthquake spectral response acceleration parameters evaluated using the ATC Hazards by Location website (2022) seismic design tool. The soil properties in the upper 100 feet of the site are not known in sufficient detail to justify selecting a Site Class C or better. Therefore, the default Site Class D should be used for this site. For structural design, the following seismic parameters should be used:

Table 2 – IBC Seismic Design Criteria	
Seismic Design Factors	Value
Site Class	D
Site Coefficient, F_a	1.6
Site Coefficient, F_v	2.355
Mapped Spectral Response Acceleration at 0.2-second Period, S_s	0.213g
Mapped Spectral Response Acceleration at 1.0-second Period, S_1	0.111g

Table 2 – IBC Seismic Design Criteria

Seismic Design Factors	Value
Spectral Response Acceleration at 0.2-second Period Adjusted for Site Class, S_{MS}	0.341g
Spectral Response Acceleration at 1.0-second Period Adjusted for Site Class, S_{M1}	0.262g
Design Spectral Response Acceleration at 0.2-second Period, S_{DS}	0.227g
Design Spectral Response Acceleration at 1.0-second Period, S_{D1}	0.175g

10.3. Foundations

Based on the results of the field and laboratory evaluations, it is our opinion that the proposed box culvert structure can be founded a mat foundation with thickened sections. Small retaining walls, wing walls, or other small structures can be founded on shallow spread or continuous footings. Recommendations for these foundation systems are presented in the following sections of this report.

10.3.1. Mat Foundations

A mat foundation may be utilized for the box culvert and should bear at a depth of 24 inches or more below the adjacent finished grade, on a minimum of 24 inches of compacted engineered fill, as described in this report. Mat foundations should be reinforced in accordance with the recommendations of the structural engineer.

Mat foundations founded on engineered fill may be designed using a net allowable bearing capacity of 2,000 pounds per square foot (psf) for static conditions. The allowable bearing capacity may be increased by one-third when considering loads of short duration such as wind or seismic forces.

Total and differential settlements beneath mat slab foundations will vary depending on slab configuration and applied load. A modulus of subgrade reaction of 350 kips per cubic foot (kcf) may be used for design of mats supported on compacted engineered fill to estimate the settlement. This value is an estimate based on published typical ranges, results of laboratory testing performed on samples taken from our borings, and our experience with similar materials. If more refined estimates are needed, field plate load testing should be performed in the areas proposed for the new mats.

Mat foundations bearing on compacted engineered fill and subject to lateral loadings may be designed using an ultimate coefficient of friction of 0.40 (total frictional resistance equivalent to the coefficient of friction multiplied by the dead load).

10.3.2. Shallow Foundations

Spread or continuous footings, if utilized, should be supported at a depth of 18 inches or more below the adjacent finished grade. The footings should be supported on engineered fill, as described in this report. Continuous footings should have a width of 18 or more inches, and isolated spread footings should have a width of 24 or more inches. Spread or continuous footings should be reinforced in accordance with the recommendations of the structural engineer.

Based on the available soil boring information, spread footings associated with the perimeter walls, and light structures supported on engineered fill may be designed using a net allowable bearing capacity of 2,500 psf for static conditions.

Total and differential settlement of up to about 1 inch and ½ inch respectively, may occur.

These settlement estimates are based on the assumption that the foundations act as isolated foundations, that is, the clear spacing between the foundation elements are the width of the largest adjacent foundation or more, and the settlement associated with fill soils has already occurred.

Foundations bearing on moisture-conditioned, compacted engineered fill that are subject to lateral loadings may be designed using an ultimate coefficient of friction of 0.40 (total frictional resistance equivalent to the coefficient of friction multiplied by the dead load). A passive resistance value of 400 psf per foot of depth for drained conditions. The lateral resistance can be taken as the sum of the frictional resistance and passive resistance, provided that the passive resistance does not exceed one-half of the total allowable resistance. The passive resistance may be increased by one-third when considering loads of short duration such as wind or seismic forces. The foundations should preferably be proportioned such that the resultant force from lateral loadings falls within the kern (i.e., middle one-third).

10.4. Retaining Walls

Retaining walls should be supported on shallow spread footings as discussed in this report. Drainage should consist of free-draining granular material and could be accompanied by weepholes through the wall or corrugated, perforated pipe placed parallel to the wall or abutment bottom, wrapped in a filter fabric, and surrounded by 6 inches or more of granular filter material (e.g., pea gravel). In lieu of the wrapped open-graded gravel, a geocomposite drainage mat attached to the wall and discharging to a drain pipe or weepholes may be considered. Retaining

wall should be designed using the applicable lateral earth pressures. The earth pressures provided assume level backfill at the top of the wall.

10.4.1. Active Conditions

Active earth pressure occurs when the wall moves away from the soils and the soil mass stretches horizontally, sufficient to mobilize its shear strength, and a condition of plastic equilibrium is reached. For a drained granular backfill, an equivalent fluid active earth pressure of 40 psf per foot (psf/ft) of wall height should be used for design of cantilevered, yielding walls. An outward lateral movement of about $0.001H$ (where H is the height of the wall) at the top of the wall is generally needed to mobilized the active earth pressure condition.

Unrestrained retaining walls should also be designed to resist a horizontal earth pressure of $0.33q$. The value for “ q ” represents the vertical surcharge pressure induced by adjacent light loads, slab, or traffic loads plus any adjacent footing loads.

10.4.2. At Rest Conditions

A soil mass that is neither stretched nor compressed is said to be in an at-rest state. If the wall is rigidly restrained, so that it does not rotate sufficiently to reach the active earth pressure condition, at-rest earth pressure condition will exist. An equivalent fluid at-rest earth pressure of 60 psf/ft for drained conditions should be used. Restrained retaining walls should also be designed to resist a horizontal earth pressure of $0.50q$. The value for “ q ” represents the vertical surcharge pressure induced by adjacent light loads, slab, or traffic loads plus any adjacent footing loads.

10.4.3. Passive Conditions

Passive earth pressure occurs when the wall or foundation moves into the soil and the soil mass is compressed horizontally, mobilizing its shear strength. For below-grade portions of the walls with granular backfill (derived from on-site soils) in front of the toe of the wall, an ultimate equivalent fluid passive earth pressure of 400 psf/ft can be used for drained conditions. This value assumes that the ground is horizontal for a distance of 10 feet or more in front of the wall or three times the height generating the passive pressure, whichever is more. We recommend that the upper 12 inches of soil not protected by pavement or a concrete slab, or any soil subject to possible future scour or excavation, be neglected when calculating passive resistance.

10.5. Pavements

AC pavement is recommended for use over the top of the box culvert. The design parameters for the pavement section includes a 20-year design life and a traffic load of 400,000 or less Equivalent Single-Axle Loads. The pavement section is assumed to bear on a minimum of 36 inches of imported or on-site soils with an average soil R-value of 35 or more.

An asphalt concrete pavement section consisting of 4 inches or more of plant-mix asphalt (per LHC Section 02630) over 4 inches or more of graded AB (per LHC Section 02610) should be utilized along El Dorado Avenue. Subgrade soils and AB should be moisture-conditioned and compacted as described in this report.

10.6. Exterior Concrete Flatwork

Exterior concrete flatwork (i.e. sidewalks) should be supported on a zone of moisture-conditioned and compacted engineered fill as described in this report and compacted to reduce the potential manifestation of distress to exterior concrete flatwork due to movement of the underlying soil, we recommend that such flatwork be installed with crack-control joints at appropriate spacing as designed by the structural engineer.

10.7. Corrosion

The corrosion potential of the on-site materials was tested to evaluate its potential effect on the foundations and structures. Our corrosion evaluation of the on-site soils is based on the results of our field and laboratory testing done for this project. A corrosion specialist should perform their own analysis.

Laboratory testing consisted of pH, minimum electrical resistivity, and chloride and soluble sulfate contents. The pH and minimum electrical resistivity tests were performed in general accordance with Arizona Test 236c, while sulfate and chloride tests were performed in accordance with Arizona Test 733 and 736, respectively. The results of these corrosivity tests are presented in Appendix B.

The soil pH values of selected samples tested from our borings ranged between 8.1 and 9.2, which is considered to be alkaline. The minimum electrical resistivity of the samples tested ranged between 3,618 and 4,154 ohm-cm, which are considered to have a low corrosive potential to ferrous materials. The chloride content of the samples tested were 3 ppm, which also indicates a low corrosive environment for ferrous materials. The soluble sulfate content of the soil samples

tested ranged between 0.0003 and 0.001 percent by weight, which is considered to represent negligible sulfate exposure for concrete.

Notwithstanding the results of the laboratory testing that indicate the on-site materials are considered corrosive to ferrous materials, we recommend that to reduce the corrosion potential of buried metallic utilities, topsoil, organic soils, soils, and mixtures of sand and clay not be placed adjacent to buried metallic utilities. Rather, we suggest that sand or gravel be placed around buried metal piping. Also, buried utilities of different metallic construction or operating temperatures should be electrically isolated from each other to minimize galvanic corrosion problems. In addition, new piping should be electrically isolated from old piping, if any, so that the old metal will not increase the corrosion rate of the new metal. A corrosion specialist should be consulted for further recommendations.

10.8. Concrete

Laboratory chemical tests performed on on-site soil samples indicated sulfate contents between 0.0003 and 0.001 percent by weight, which represents a negligible sulfate exposure for concrete. Based on the following American Concrete Institute (ACI) table (Table 3), the on-site soils should be considered to have negligible sulfate exposure to concrete. Based on the sulfate test results, and based on our experience with similar soil conditions, the specific use of the facility, and nearby practice, we however recommend the use of sulfate resistant cement (Type II or similar) for construction of concrete structures at this site. Due to potential uncertainties as to the use of reclaimed irrigation water, or topsoil that may contain higher sulfate contents, pozzolan or admixtures designed to increase sulfate resistance may be considered.

Sulfate Exposure	Water-Soluble Sulfate (SO ₄) in Soil, Percentage by Weight	Cement Type	Water-Cementitious Materials Ratio, by Weight, Normal-Weight Aggregate Concrete ¹	f'c, Normal-Weight and Lightweight Aggregate Concrete, psi
				x 0.00689 for MPa
Negligible	0.00 - 0.10	--	--	--
Moderate ²	0.10 - 0.20	II, IP(MS), IS (MS)	0.50 or less	4,000 or more
Severe	0.20 - 2.00	V	0.45 or less	4,500 or more

Table 3 – ACI Requirements for Concrete Exposed to Sulfate-Containing Soil

Sulfate Exposure	Water-Soluble Sulfate (SO ₄) in Soil, Percentage by Weight	Cement Type	Water-Cementitious Materials Ratio, by Weight, Normal-Weight Aggregate Concrete ¹	f'c, Normal-Weight and Lightweight Aggregate Concrete, psi
				x 0.00689 for MPa
Very severe	Over 2.00	V plus pozzolan ³	0.45 or less	4,500 or more

Notes:

¹ A lower water-cementitious materials ratio or higher strength may be needed for low permeability or for protection against corrosion of embedded items or freezing and thawing (ACI Table 4.2.2).

² Seawater.

³ Pozzolan that has been evaluated by test or service record to improve sulfate resistance when used in concrete containing Type V cement.

We recommend that the structural concrete have a water-cementitious materials ratio no more than 0.50 by weight for normal weight aggregate concrete. The structural engineer should ultimately select the concrete design strength based on the project specific loading conditions. Higher strength concrete may be selected for increased durability and resistance to slab curling and shrinkage cracking.

10.9. Pre-Construction Conference

We recommend that a pre-construction conference be held. Representatives of the owner, civil engineer, the geotechnical consultant, and the contractor should be in attendance to discuss the project plans and schedule. Our office should be notified if the project description included herein is incorrect, or if the project characteristics are significantly changed.

10.10. Construction Observation and Testing

During construction operations, we recommend that a qualified geotechnical consultant perform observation and testing services for the project. These services should be performed to evaluate exposed subgrade conditions, including the extent and depth of overexcavation, to evaluate the suitability of the on-site materials for use as fill and to observe placement and test compaction of fill soils. If another geotechnical consultant is selected to perform observation and testing services for the project, we request that the selected consultant provide a letter to the owner, with a copy to Ninyo & Moore, indicating that they fully understand our recommendations and they are in full agreement with the recommendations contained in this report. Qualified subcontractors utilizing appropriate techniques and construction materials should perform construction of the proposed improvements.

11. LIMITATIONS

The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for design purposes only. It does not provide sufficient data to prepare an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

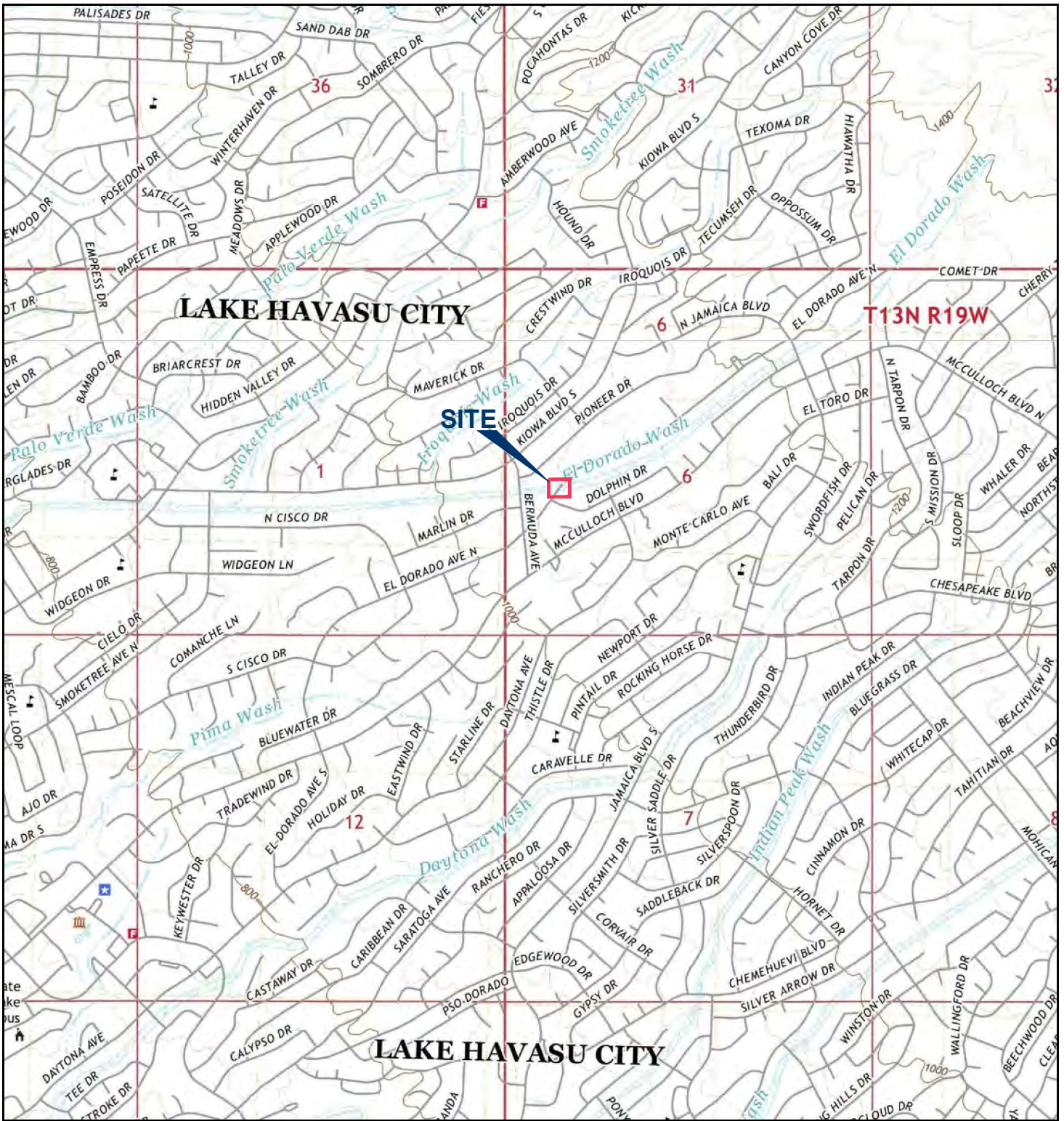
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FIGURES

607314001_SL.dwg 08/16/2022 BSM



NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE. | REFERENCE: USGS, 2018.

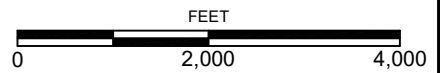
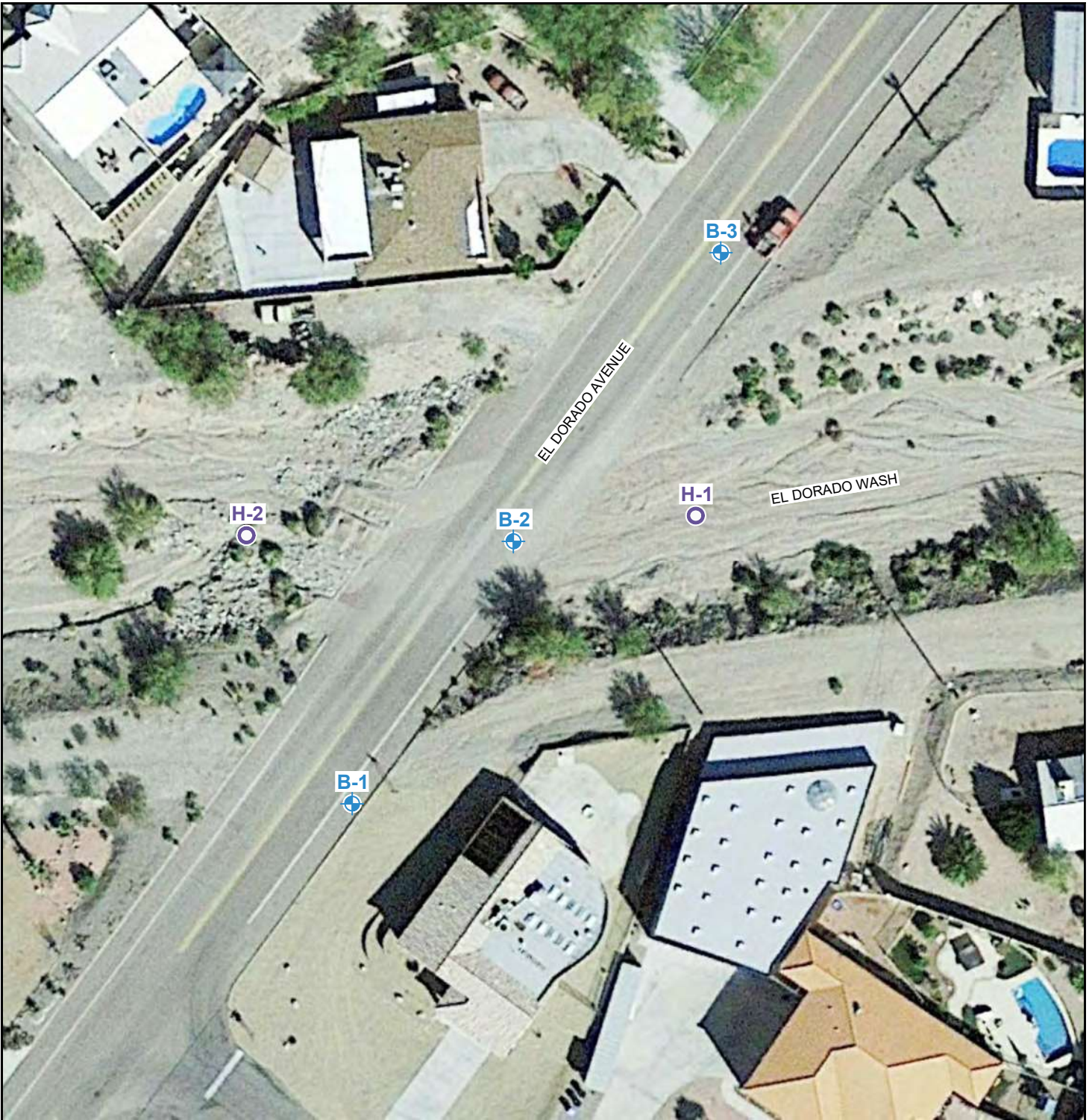


FIGURE 1

SITE LOCATION

EL DORADO WASH IMPROVEMENTS
LAKE HAVASU CITY, ARIZONA



LEGEND

- B-3**  BORING
- H-2**  HAND AUGER

NOTE: DIMENSIONS, DIRECTIONS AND LOCATIONS ARE APPROXIMATE. | REFERENCE: GOOGLE EARTH, 2020.

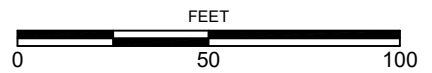
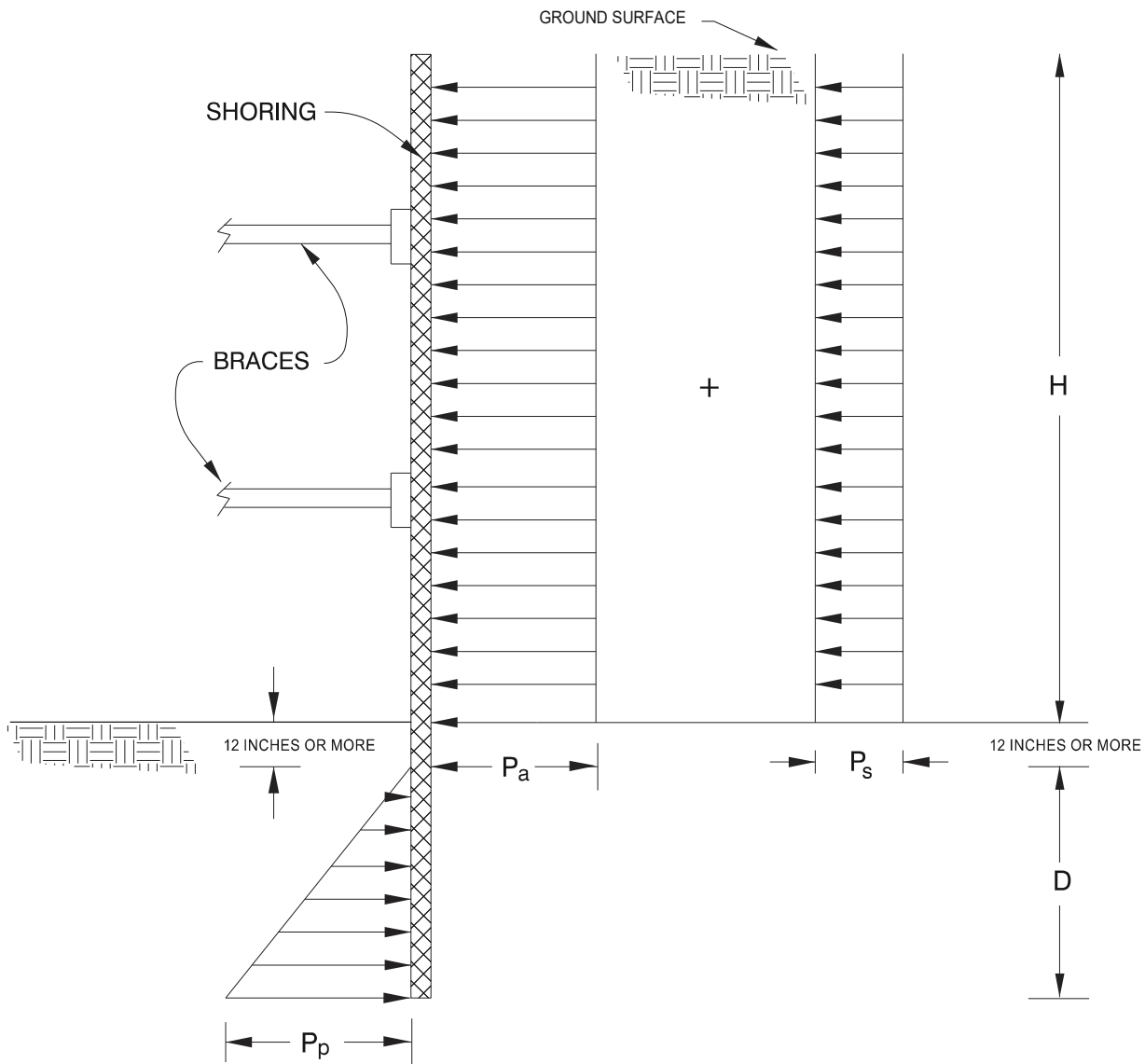


FIGURE 2

EXPLORATION LOCATIONS
 EL DORADO WASH IMPROVEMENTS
 LAKE HAVASU CITY, ARIZONA



NOTES:

1. APPARENT LATERAL EARTH PRESSURE, P_a
 $P_a = 35H$ psf
2. CONSTRUCTION TRAFFIC INDUCED SURCHARGE PRESSURE, P_s
 $P_s = 120$ psf
3. PASSIVE LATERAL EARTH PRESSURE, P_p
 $P_p = 350D$ psf
4. ASSUMES GROUNDWATER IS NOT PRESENT
5. SURCHARGES FROM EXCAVATED SOIL OR CONSTRUCTION MATERIALS ARE NOT INCLUDED
6. H AND D ARE IN FEET

NOT TO SCALE

FIGURE 3

LATERAL EARTH PRESSURES FOR BRACED EXCAVATION
(GRANULAR SOIL)

EL DORADO WASH IMPROVEMENTS
LAKE HAVASU CITY ARIZONA



APPENDIX A

Boring Logs

APPENDIX A

BORING LOGS

Field Procedure for the Collection of Disturbed Samples

Disturbed soil samples were obtained in the field using the following methods.

Bulk Samples

Bulk samples of representative earth materials were obtained from the exploratory borings. The samples were bagged and transported to the laboratory for testing.

The Standard Penetration Test (SPT) Sampler

Disturbed drive samples of earth materials were obtained by means of a SPT sampler. The sampler is composed of a split barrel with an external diameter of 2 inches and an unlined internal diameter of 1-3/8 inches. The sampler was driven up to 18 inches into the ground with a 140-pound hammer falling freely from a height of 30 inches in general accordance with ASTM D1586. The blow counts were recorded for every 6 inches of penetration; the blow counts reported on the log are those for the last 12 inches of penetration. Soil samples were observed and removed from the sampler, bagged, sealed, and transported to the laboratory for testing.

Field Procedure for the Collection of Relatively Undisturbed Samples

Relatively undisturbed soil samples were obtained in the field using the following method.

The Modified Split-Barrel Drive Sampler

The sampler, with an external diameter of 3.0 inches, was lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sample barrel was driven into the ground with a 140-pound hammer falling freely from a height of 30 inches in general accordance with ASTM D3550. The approximate length of the fall, the weight of the hammer or bar, and the number of blows per foot of driving are presented on the boring logs as an index to the relative resistance of the materials sampled. The samples were removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

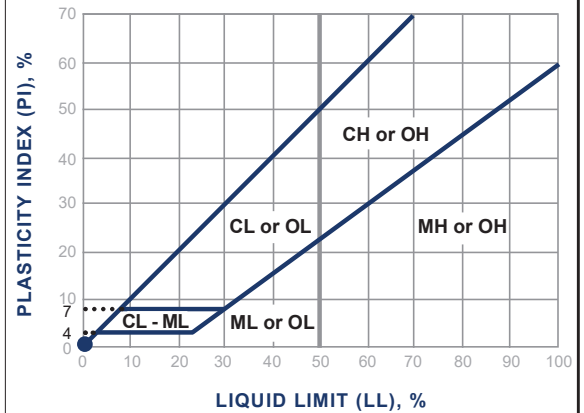
Soil Classification Chart Per ASTM D 2488

Primary Divisions		Secondary Divisions				
		Group Symbol	Group Name			
COARSE-GRAINED SOILS more than 50% retained on No. 200 sieve	GRAVEL more than 50% of coarse fraction retained on No. 4 sieve	CLEAN GRAVEL less than 5% fines	GW	well-graded GRAVEL		
			GP	poorly graded GRAVEL		
		GRAVEL with DUAL CLASSIFICATIONS 5% to 12% fines	GW-GM	well-graded GRAVEL with silt		
			GP-GM	poorly graded GRAVEL with silt		
			GW-GC	well-graded GRAVEL with clay		
			GP-GC	poorly graded GRAVEL with		
	GRAVEL with FINES more than 12% fines	GM	silty GRAVEL			
		GC	clayey GRAVEL			
	SAND 50% or more of coarse fraction passes No. 4 sieve	CLEAN SAND less than 5% fines	SW	well-graded SAND		
			SP	poorly graded SAND		
		SAND with DUAL CLASSIFICATIONS 5% to 12% fines	SW-SM	well-graded SAND with silt		
			SP-SM	poorly graded SAND with silt		
			SW-SC	well-graded SAND with clay		
			SP-SC	poorly graded SAND with clay		
		SAND with FINES more than 12% fines	SM	silty SAND		
			SC	clayey SAND		
		FINE-GRAINED SOILS 50% or more passes No. 200 sieve	SILT and CLAY liquid limit less than 50%	INORGANIC	CL	lean CLAY
					ML	SILT
CL-ML					silty CLAY	
ORGANIC				OL (PI > 4)	organic CLAY	
	OL (PI < 4)			organic SILT		
	CH			fat CLAY		
SILT and CLAY liquid limit 50% or more	INORGANIC		MH	elastic SILT		
			OH (plots on or above "A"-line)	organic CLAY		
	ORGANIC		OH (plots below "A"-line)	organic SILT		
			Highly Organic Soils		PT	Peat

Grain Size

Description	Sieve Size	Grain Size	Approximate Size
Boulders	> 12"	> 12"	Larger than basketball-sized
Cobbles	3 - 12"	3 - 12"	Fist-sized to basketball-sized
Gravel	Coarse	3/4 - 3"	Thumb-sized to fist-sized
	Fine	#4 - 3/4"	Pea-sized to thumb-sized
Sand	Coarse	#10 - #4	Rock-salt-sized to pea-sized
	Medium	#40 - #10	Sugar-sized to rock-salt-sized
	Fine	#200 - #40	Flour-sized to sugar-sized
Fines	Passing #200	< 0.0029"	Flour-sized and smaller

Plasticity Chart




Apparent Density - Coarse-Grained Soil

Apparent Density	Spooling Cable or Cathead		Automatic Trip Hammer	
	SPT (blows/foot)	Modified Split Barrel (blows/foot)	SPT (blows/foot)	Modified Split Barrel (blows/foot)
Very Loose	≤ 4	≤ 8	≤ 3	≤ 5
Loose	5 - 10	9 - 21	4 - 7	6 - 14
Medium Dense	11 - 30	22 - 63	8 - 20	15 - 42
Dense	31 - 50	64 - 105	21 - 33	43 - 70
Very Dense	> 50	> 105	> 33	> 70

Consistency - Fine-Grained Soil

Consistency	Spooling Cable or Cathead		Automatic Trip Hammer	
	SPT (blows/foot)	Modified Split Barrel (blows/foot)	SPT (blows/foot)	Modified Split Barrel (blows/foot)
Very Soft	< 2	< 3	< 1	< 2
Soft	2 - 4	3 - 5	1 - 3	2 - 3
Firm	5 - 8	6 - 10	4 - 5	4 - 6
Stiff	9 - 15	11 - 20	6 - 10	7 - 13
Very Stiff	16 - 30	21 - 39	11 - 20	14 - 26
Hard	> 30	> 39	> 20	> 26

BORING LOG EXPLANATION SHEET

DEPTH (feet)	SAMPLES		BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	
	Bulk	Driven						
0								<p>Bulk sample.</p> <p>Modified split-barrel drive sampler.</p> <p>No recovery with modified split-barrel drive sampler.</p> <p>Sample retained by others.</p> <p>Standard Penetration Test (SPT).</p> <p>No recovery with a SPT.</p> <p>Shelby tube sample. Distance pushed in inches/length of sample recovered in inches.</p> <p>No recovery with Shelby tube sampler.</p> <p>Continuous Push Sample.</p> <p>Seepage.</p> <p>Groundwater encountered during drilling.</p> <p>Groundwater measured after drilling.</p>
5								<p>XX/XX</p>
10								
15							SM	<p><u>MAJOR MATERIAL TYPE (SOIL):</u> Solid line denotes unit change.</p>
15							CL	<p>Dashed line denotes material change.</p> <p>Attitudes: Strike/Dip b: Bedding c: Contact j: Joint f: Fracture F: Fault cs: Clay Seam s: Shear bss: Basal Slide Surface sf: Shear Fracture sz: Shear Zone sbs: Shear Bedding Surface</p>
20								<p>The total depth line is a solid line that is drawn at the bottom of the boring.</p>

DEPTH (feet)	SAMPLES		BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED <u>8/16/2022</u> BORING NO. <u>B-1</u>	
	Bulk	Driven						GROUND ELEVATION <u>1,058' ± (MSL)</u>	SHEET <u>1</u> OF <u>1</u>
								METHOD OF DRILLING <u>CME-55, 8" Diameter Hollow-Stem Auger (Wildcat)</u>	
								DRIVE WEIGHT <u>35 lbs. (Manual)</u> DROP <u>N/A</u>	
								SAMPLED BY <u>DM</u> LOGGED BY <u>DM</u> REVIEWED BY <u>SDN</u>	
DESCRIPTION/INTERPRETATION									
0							GC-GM	<p>ASPHALT CONCRETE: Approximately 4 1/2 inches thick.</p> <p>ALLUVIUM: Brown, dry, medium dense, silty, clayey GRAVEL with sand.</p>	
			41	4.4	117.8			Dense.	
			34						
			56	4.0	119.7				
			24					No recovery; coarse gravel; possible cobbles.	
10									
			64						
			50/5"					Very dense.	
20								<p>Total Depth = 19 feet.</p> <p>Groundwater not encountered during drilling.</p> <p>Backfilled and asphalt concrete patched on 8/16/22 shortly after completion of drilling.</p>	
								<p><u>Notes:</u> Groundwater, though not encountered at the time of drilling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.</p>	
								<p>The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.</p>	
30									
40									

FIGURE A- 1

DEPTH (feet)	SAMPLES		BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED <u>8/16/2022</u> BORING NO. <u>B-2</u>	
	Bulk	Driven						GROUND ELEVATION <u>1,057' ± (MSL)</u>	SHEET <u>1</u> OF <u>1</u>
								METHOD OF DRILLING <u>CME-55, 8" Diameter Hollow-Stem Auger (Wildcat)</u>	
								DRIVE WEIGHT <u>35 lbs. (Manual)</u> DROP <u>N/A</u>	
								SAMPLED BY <u>DM</u> LOGGED BY <u>DM</u> REVIEWED BY <u>SDN</u>	
DESCRIPTION/INTERPRETATION									
0			65				SC-SM	<p>ASPHALT CONCRETE: Approximately 4 inches thick.</p> <p>ALLUVIUM: Brown, dry, very dense, silty, clayey SAND with gravel.</p> <p>No recovery; coarse gravel; possible cobbles.</p>	
			50/2"						
			50/4"						
			50/3"				GP	Brown, dry, very dense, poorly graded GRAVEL with sand.	
10									
			50/2"					<p>@ 13.5 feet: Total auger refusal; coarse gravel; cobbles and possible boulders. Total Depth = 13.7 feet. Groundwater not encountered during sampling. Backfilled and asphalt concrete patched on 8/16/22 shortly after completion of sampling.</p> <p>Notes: Groundwater, though not encountered at the time of sampling, may rise to a higher level due to seasonal variations in precipitation and several other factors as discussed in the report.</p> <p>The ground elevation shown above is an estimation only. It is based on our interpretations of published maps and other documents reviewed for the purposes of this evaluation. It is not sufficiently accurate for preparing construction bids and design documents.</p>	
20									
30									
40									

FIGURE A- 2

DEPTH (feet)	SAMPLES		BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED <u>8/16/2022</u> BORING NO. <u>B-3</u> GROUND ELEVATION <u>1,061' ± (MSL)</u> SHEET <u>1</u> OF <u>1</u> METHOD OF DRILLING <u>CME-55, 8" Diameter Hollow-Stem Auger (Wildcat)</u> DRIVE WEIGHT <u>35 lbs. (Manual)</u> DROP <u>N/A</u> SAMPLED BY <u>DM</u> LOGGED BY <u>DM</u> REVIEWED BY <u>SDN</u>		
	Bulk	Driven						DESCRIPTION/INTERPRETATION		
0							SW-SM	ASPHALT CONCRETE: Approximately 4 1/2 inches thick. ALLUVIUM: Brown, dry, medium dense, well graded SAND with silt and gravel; few fine to coarse gravel. Dense. Medium dense. Very dense. No recovery; coarse gravel; cobbles. Trace clay. Total Depth = 18.7 feet. Groundwater not encountered during sampling. Backfilled and asphalt concrete patched on 8/16/22 shortly after completion of sampling.		
37			2.8	116.3						
22										
34			2.3	109.1						
35										
50/2"										
50/2"										
20										
30										
40										

FIGURE A- 3



APPENDIX B

Laboratory Testing

APPENDIX B

LABORATORY TESTING

Classification

Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D2488. Soil classifications are indicated on the logs of the exploratory borings in Appendix A.

In-Place Moisture and Density Tests

The moisture content and dry density of relatively undisturbed samples obtained from the exploratory borings was evaluated in general accordance with ASTM D2937. The test results are presented on the log of the exploratory borings in Appendix A.

Gradation Analysis

Gradation analysis tests were performed on selected representative soil samples in general accordance with ASTM D422. The grain-size distribution curves are shown on Figures B-1 and B-5. These test results were utilized in evaluating the soil classifications in accordance with the USCS.

Atterberg Limits

Atterberg Limits Tests were performed on a selected representative fine-grained soil samples to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D4318. These test results were utilized to evaluate the soil classification in accordance with the USCS. The test results and classifications are shown on Figures B-6 and B-7.

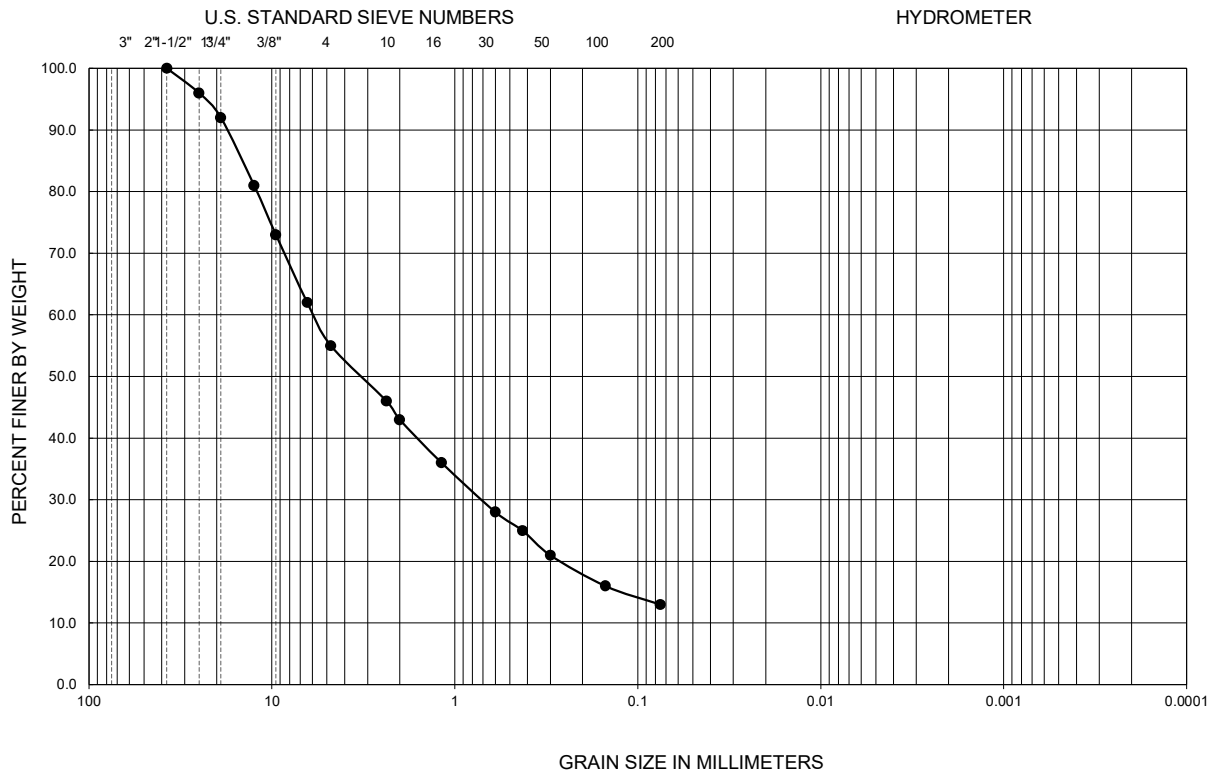
Maximum Dry Density

Tests were performed on selected representative soil samples to evaluate the laboratory compaction characteristics in general accordance with ASTM D698. These test results were utilized to evaluate the relationship between maximum dry density and optimum moisture content for soils compacted using standard effort. The test results are shown on Figures B-8 and B-9.

Soil Corrosivity Tests

Soil pH and minimum resistivity tests were performed on a representative sample in general accordance with Arizona test method, ARIZ 236c. The chloride content of the selected sample was evaluated in general accordance with ARIZ 736. The sulfate content of the selected sample was evaluated in general accordance with ARIZ 733. The test results are shown on Figure B-10.

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D ₁₀	D ₃₀	D ₆₀	C _u	C _c	Passing No. 200 (percent)	USCS
●	B-1	1.0-5.0	25	18	7	--	0.698	5.87	--	--	13.0	GC-GM

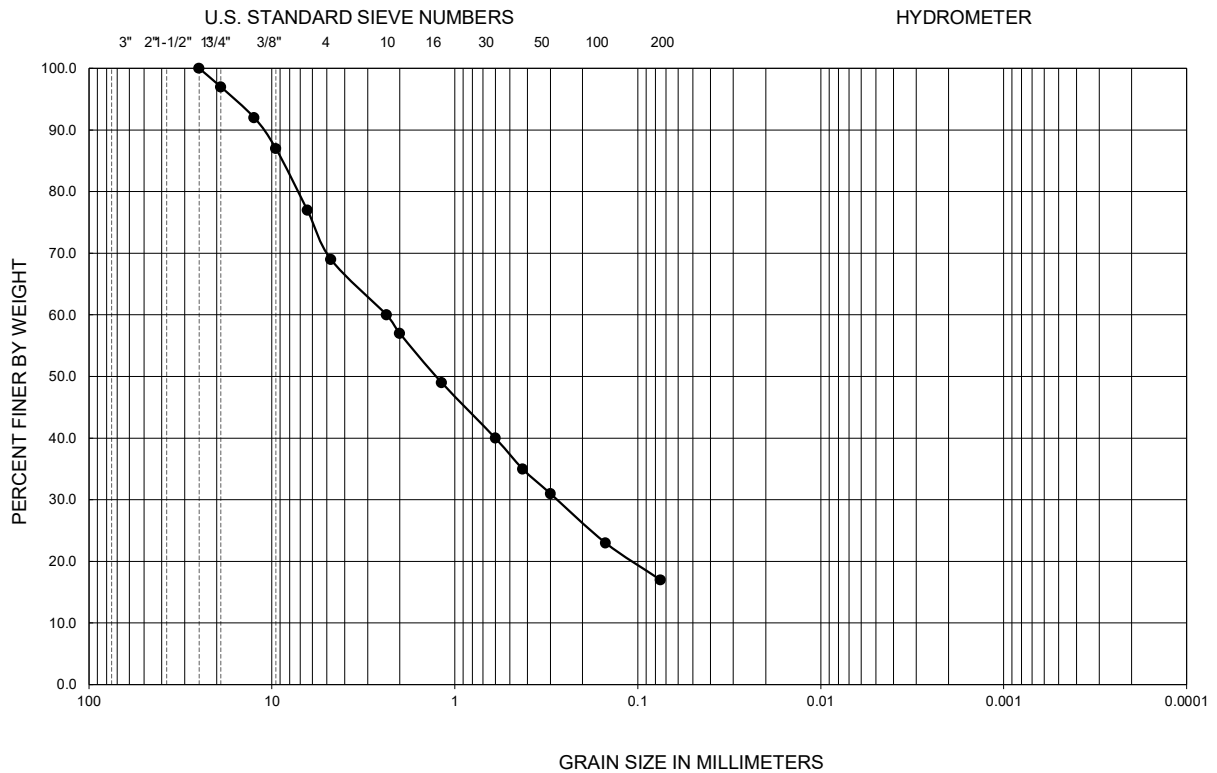
PERFORMED IN GENERAL ACCORDANCE WITH ASTM C136 / D422

FIGURE B-1

GRADATION TEST RESULTS

EL DORADO WASH IMPROVEMENTS
LAKE HAVASU CITY, ARIZONA

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D ₁₀	D ₃₀	D ₆₀	C _u	C _c	Passing No. 200 (percent)	USCS
●	B-2	1.0-5.0	25	19	6	--	0.279	2.39	--	--	17.0	SC-SM

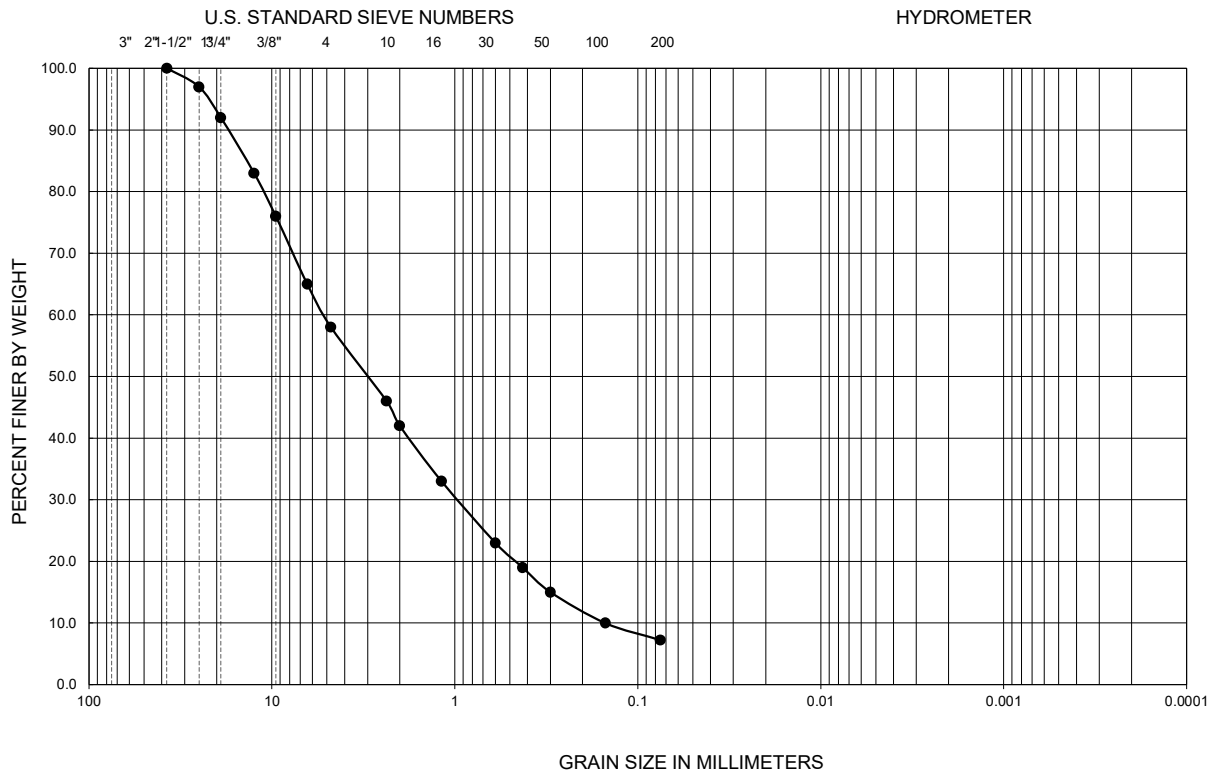
PERFORMED IN GENERAL ACCORDANCE WITH ASTM C136 / D422

FIGURE B-2

GRADATION TEST RESULTS

EL DORADO WASH IMPROVEMENTS
LAKE HAVASU CITY, ARIZONA

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D ₁₀	D ₃₀	D ₆₀	C _u	C _c	Passing No. 200 (percent)	USCS
●	B-3	1.0-5.0	--	--	NP	0.150	0.963	5.22	34.8	1.2	7.2	SW-SM

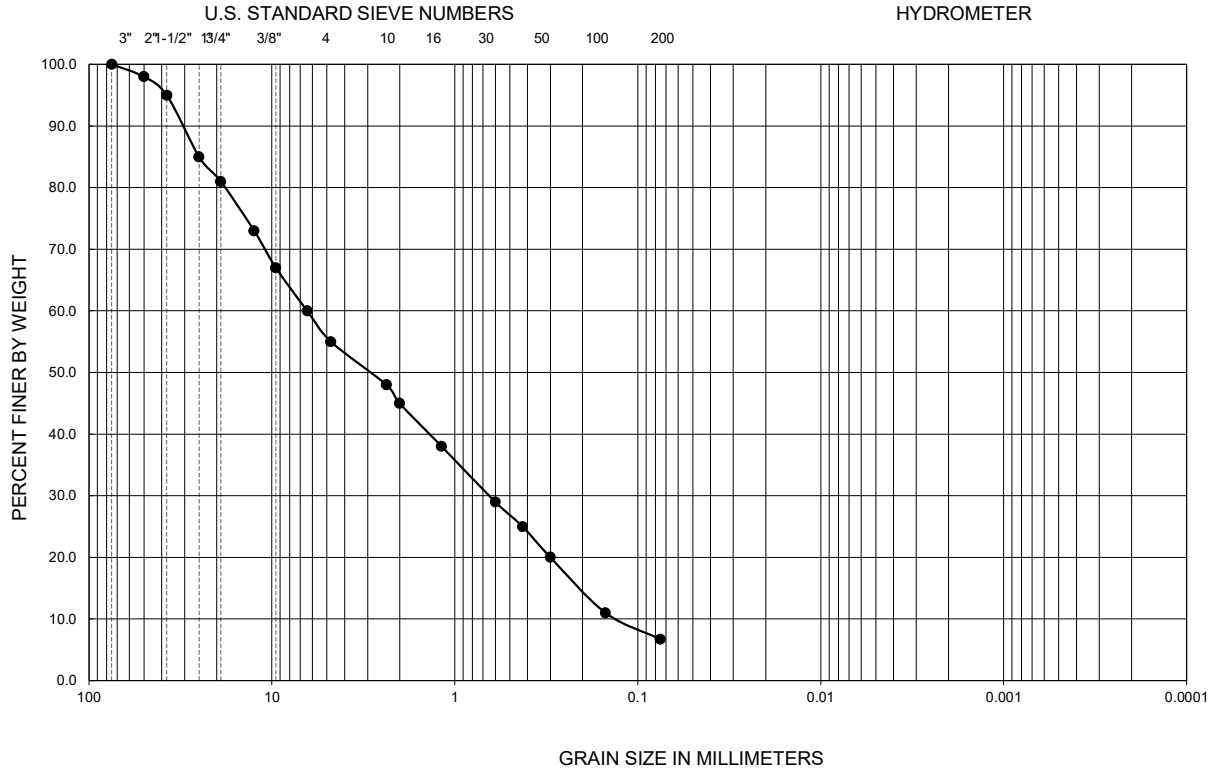
PERFORMED IN GENERAL ACCORDANCE WITH ASTM C136 / D422

FIGURE B-3

GRADATION TEST RESULTS

EL DORADO WASH IMPROVEMENTS
LAKE HAVASU CITY, ARIZONA

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	SILT	CLAY



Symbol	Sample Location	Depth (ft)	Liquid Limit	Plastic Limit	Plasticity Index	D ₁₀	D ₃₀	D ₆₀	C _u	C _c	Passing No. 200 (percent)	USCS
●	H-2	0.0-1.0	--	--	NP	0.127	0.632	6.35	50.0	0.5	6.7	SP-SM

PERFORMED IN GENERAL ACCORDANCE WITH ASTM C136 / D422

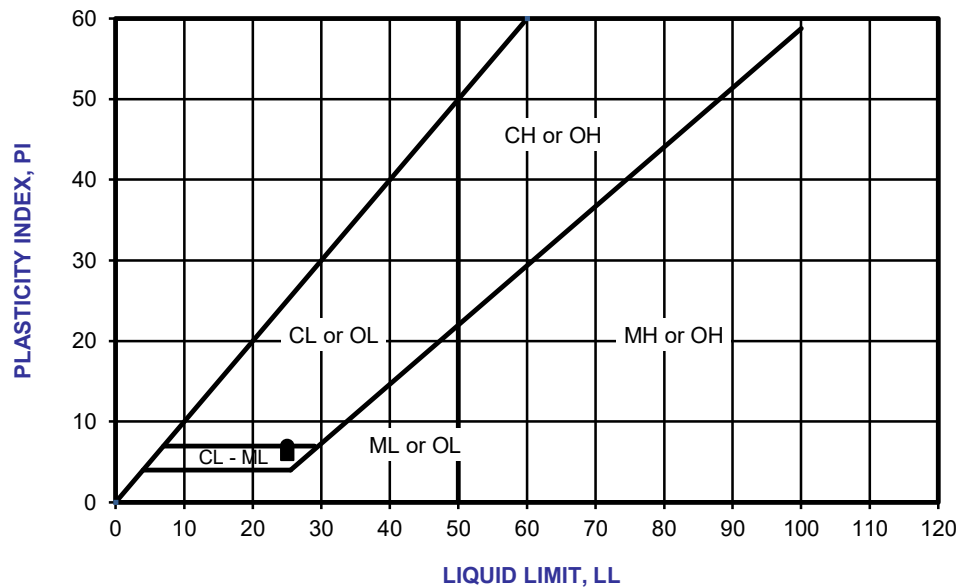
FIGURE B-5

GRADATION TEST RESULTS

EL DORADO WASH IMPROVEMENTS
LAKE HAVASU CITY, ARIZONA

SYMBOL	LOCATION	DEPTH (ft)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve)	USCS
●	B-1	1.0-5.0	25	18	7	CL-ML	GC-GM
■	B-2	1.0-5.0	25	19	6	CL-ML	SC-SM
◆	B-3	1.0-5.0	--	--	NP	ML	SW-SM

NP - INDICATES NON-PLASTIC



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318

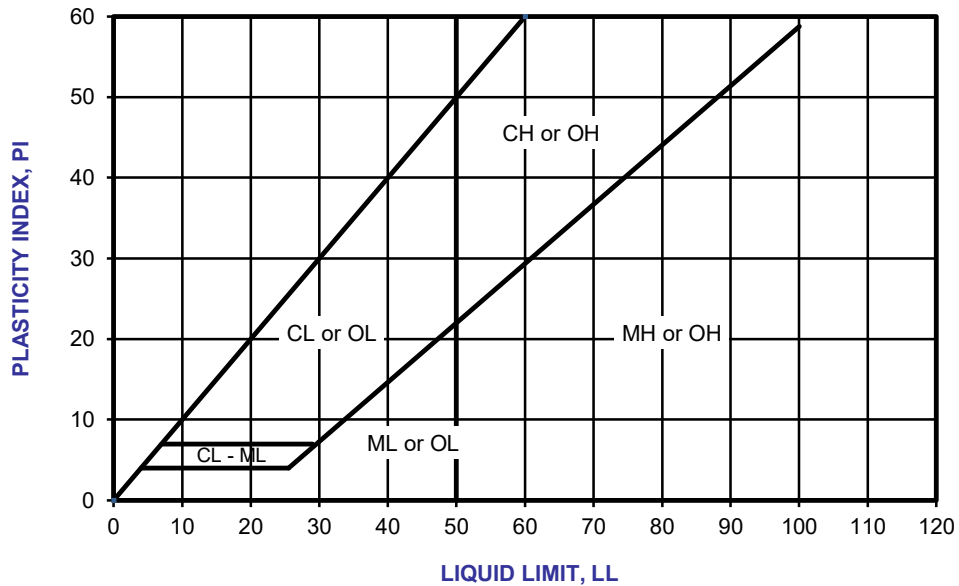
FIGURE B-6

ATTERBERG TEST RESULTS

EL DORADO WASH IMPROVEMENTS
LAKE HAVASU CITY, ARIZONA

SYMBOL	LOCATION	DEPTH (ft)	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve)	USCS
●	H-1	0.0-1.0	--	--	NP	ML	SP
■	H-2	0.0-1.0	--	--	NP	ML	SP-SM

NP - INDICATES NON-PLASTIC

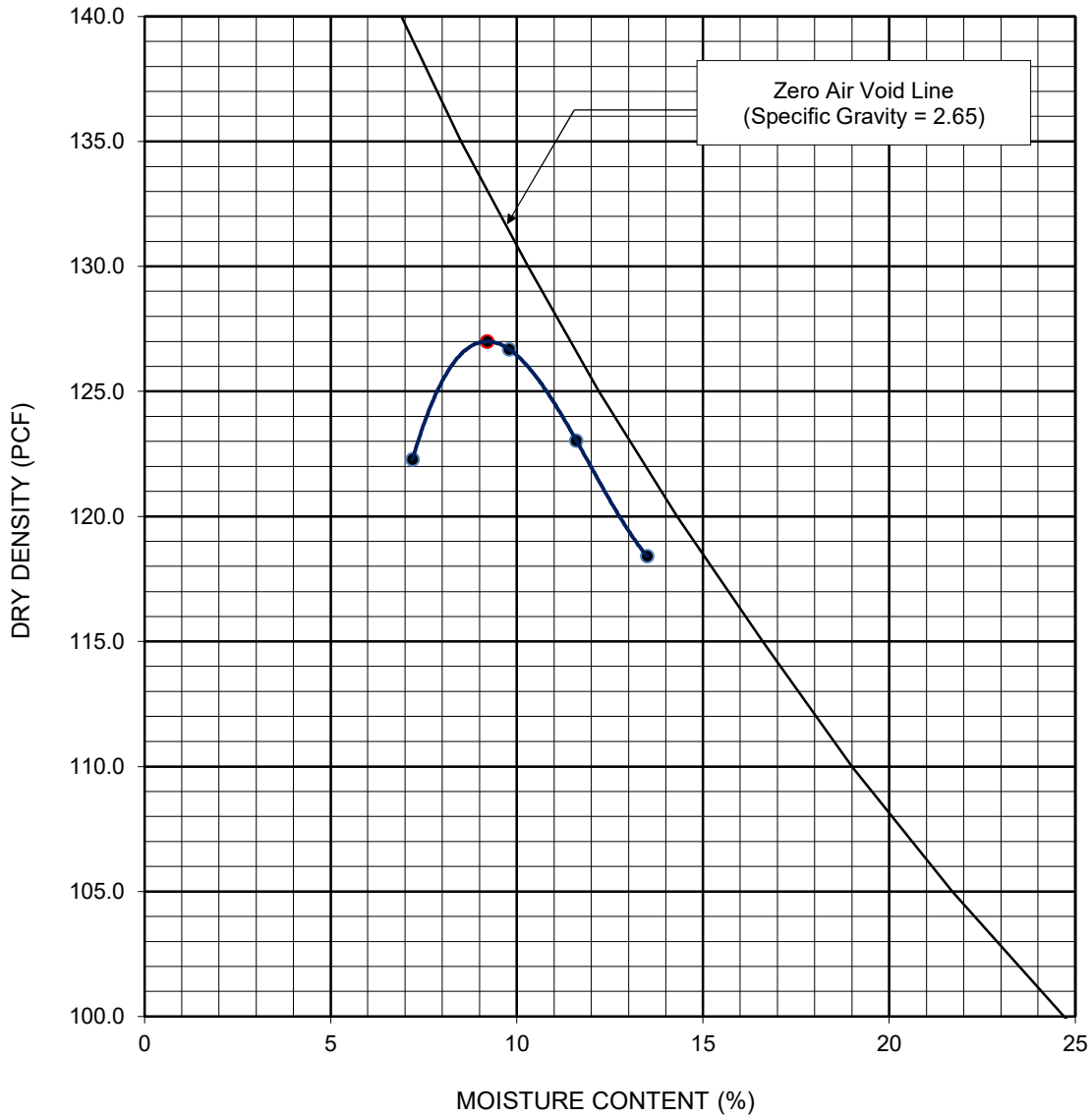


PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318

FIGURE B-7

ATTERBERG TEST RESULTS

EL DORADO WASH IMPROVEMENTS
LAKE HAVASU CITY, ARIZONA



Sample Location	Depth (ft)	Soil Description	Maximum Dry Density (pcf)	Optimum Moisture Content (percent)
B-1	1.0-5.0	GC-GM	127.0	9.2
Dry Density and Moisture Content Values Corrected for Oversize (ASTM D 4718)			142	5

PERFORMED IN GENERAL ACCORDANCE WITH

ASTM D 1557

ASTM D 698

METHOD

A

B

C

FIGURE B-8

MAXIMUM DENSITY RESULTS

EL DORADO WASH IMPROVEMENTS

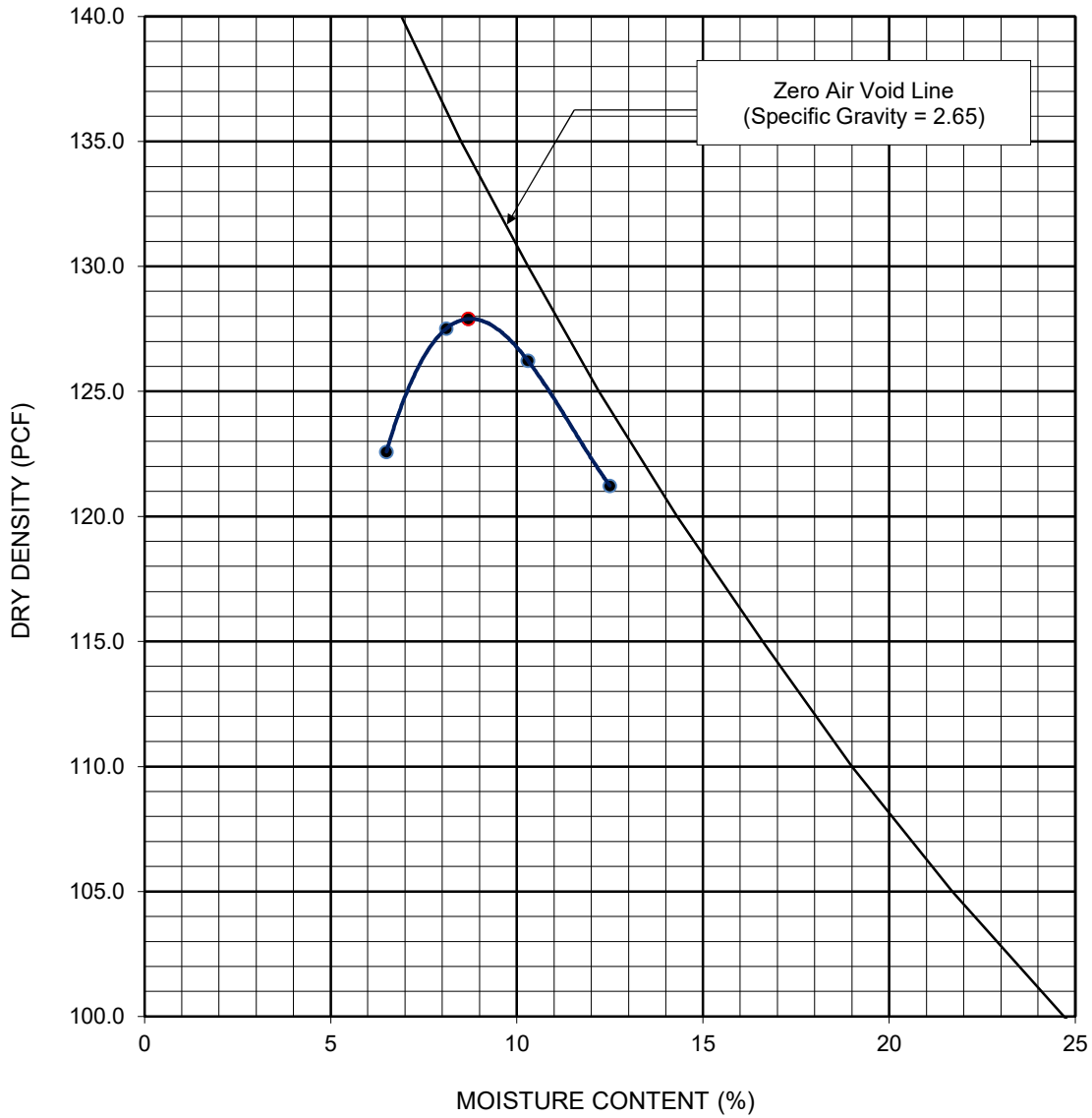
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Sample Location	Depth (ft)	Soil Description	Maximum Dry Density (pcf)	Optimum Moisture Content (percent)
B-2	1.0-5.0	SC-SM	127.9	8.7
Dry Density and Moisture Content Values Corrected for Oversize (ASTM D 4718)			151	3

PERFORMED IN GENERAL ACCORDANCE WITH

ASTM D 1557

ASTM D 698

METHOD

A

B

C

FIGURE B-9

MAXIMUM DENSITY RESULTS

EL DORADO WASH IMPROVEMENTS

LAKE HAVASU CITY, ARIZONA



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SAMPLE LOCATION	SAMPLE DEPTH (ft)	pH ¹	RESISTIVITY ¹ (Ohm-cm)	SULFATE CONTENT ²		CHLORIDE CONTENT ³ (ppm)
				(ppm)	(%)	
B-1	1.0-5.0	8.7	3,618	5	0.001	3
B-2	1.0-5.0	9.2	4,154	3	0.0003	3

¹ PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 236c

² PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 733

³ PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 736

FIGURE B-10

CORROSIVITY TEST RESULTS

EL DORADO WASH IMPROVEMENTS

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