

**CITY OF PHOENIX, ARIZONA
OFFICE OF THE CITY ENGINEER
DESIGN AND CONSTRUCTION PROCUREMENT**



PROJECT SPECIFICATIONS AND CONTRACT DOCUMENTS

**WATER SERVICES DEPARTMENT
VOLUME 1 OF 3**

**NORTHWEST WASTEWATER MASTER PLAN PACKAGE 4B - 51ST AVENUE
GRAVITY SEWER**

PROJECT NO. WS90500307

**PROCUREPHX PRODUCT CATEGORY CODE 912000000
RFx 6000001501**

AGREEMENT _____

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CALL FOR BIDS

**CITY OF PHOENIX
NORTHWEST WASTEWATER MASTER PLAN PACKAGE 4B
51ST AVENUE GRAVITY SEWER
DESIGN-BID-BUILD**

PROJECT NO. WS90500307

**PROCUREPHX PRODUCT CATEGORY CODE 912000000
RFx 6000001501**

**BIDS WILL BE DUE: TUESDAY, DECEMBER 5, 2023 AT 2:00 P.M.
SUBMITTED INTO THE DESIGN AND CONSTRUCTION PROCUREMENT BID BOX
LOCATED ON THE 1ST FLOOR LOBBY OF THE PHOENIX CITY HALL BUILDING,
200 W. WASHINGTON STREET, PHOENIX, ARIZONA, 85003**

**BIDS WILL BE READ: TUESDAY, DECEMBER 5, 2023 AT 2:00 P.M.
ON 5TH FLOOR, ROOM 5 WEST
PHOENIX CITY HALL
200 W. WASHINGTON STREET
PHOENIX, AZ 85003-1611
*All times are local Phoenix time**

SCOPE OF WORK

The City of Phoenix is seeking a qualified contractor to provide construction services for the project listed below.

This project includes the installation of approximately 17,500 feet of 36" gravity sewer pipeline and manholes along 51st Avenue, from the Central Arizona Project (CAP) Canal south to Pinnacle Peak Road and then east to 47th Avenue terminating in a new junction structure constructed on an existing 36" sewer. The project also includes a bid alternate to jack and bore 405 feet of 60" steel casing and install 458 feet of 36" sewer under the CAP Canal at 51st Avenue.

A Small Business Enterprise goal of 7% has been established for this project.

PRE-BID MEETING

A pre-bid meeting will be held on Thursday, November 9, 2023, at 11:30 a.m., at 200 W. Washington Street, City Hall Conference Room 5 West. At this meeting, staff will discuss the scope of work, general contract issues and respond to questions from the attendees. As City staff will not be available to respond to individual inquiries regarding the project scope outside of this pre-bid meeting, it is strongly recommended that interested firms send a representative to the pre-bid meeting.

REQUEST FOR BID PACKET

On Thursday, November 2, 2023, the bid packet may be downloaded from the City of Phoenix's eProcurement site at:

<https://eprocurement.phoenix.gov/irj/portal>

(OR)

the City of Phoenix’s “Solicitations” web page as. The web address is:

<https://solicitations.phoenix.gov>

Firms receiving a copy of the bid packet through any other means are strongly encouraged to download the bid packet from the City webpage.

Firms must be registered in eProcurement <https://www.phoenix.gov/finance/vendorsreg> as a vendor.

GENERAL INFORMATION

The City reserves the right to award the contract to the lowest responsible responsive bidder or all bids will be rejected, as soon as practicable after the date of opening bids.

The City of Phoenix will provide reasonable accommodations for alternate formats of the bid packet by calling Julie B. Smith at (602) 534-2418 or calling TTY 711. Requests will only be honored if made within the first week of the advertising period. Please allow a minimum of seven calendar days for production.

Questions pertaining to process or contract issues should be directed to Julie B. Smith at (602) 534-2418 or julie.b.smith@phoenix.gov (preferred).

Jeffrey Barton
City Manager

Eric J. Froberg, PE

SECTION 00100 – INSTRUCTIONS TO BIDDERS

1. Defined Terms

1.1. Terms used in these Instructions to Bidders which are defined in the General Conditions of the Construction Contract Section 00700 have the meanings assigned to them in the General Conditions. Certain additional terms used in these Instructions to Bidders have the meanings indicated below which are applicable to both the singular and plural thereof.

1.1.1. Owner - the City of Phoenix, Water Services Department.

1.1.2. Bidder - one who submits a proposal directly to Owner, as distinct from a sub-bidder who submits a Proposal directly to a Bidder.

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

1.1.4. Bid Documents - the proposed Contract Documents as advertised, and all Addenda issued before Bid opening.

2. Copies of Bid Documents

2.1. Project information is available online at:

<https://solicitations.phoenix.gov>

2.2. Complete sets of Bid Documents shall be used in preparing Bids; neither Owner nor Design Professional assume any responsibility for errors or misinterpretations resulting from the use of incomplete sets of Bid Documents.

2.3. Owner and Design Professional, in making copies of Bid Documents available on the above terms, do so only for the purpose of obtaining Bids for the Work and do not confer a license or privilege for any other use.

3. Qualifications of Bidders

3.1. The Bidder awarded the Contract shall comply with ARS Title 34 and all licensing requirements imposed by Owner and any other Political Subdivision with jurisdiction. Failure to provide this information with the Bidders Questionnaire may be just cause for Owner declaring the Bidder's Bid nonresponsive.

3.2. Bidders shall have the necessary equipment therefore and shall possess sufficient capital to properly execute the Work within the time allowed.

3.3. All Bidders wishing to remain in contention for award of the contract must submit completed contract documents listed below. The documents must be submitted to Design and Construction Procurement Section, 5th Floor, or can be sent by email to julie.b.smith@phoenix.gov.

4. Examination of Bid Documents and Site

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

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

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

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

4.1.4. To study and carefully correlate Bidder's knowledge and observations with the Bid Documents and such other related data; and

4.1.5. To promptly notify Julie B. Smith, Contracts Specialist II, 200 W. Washington Street, 5th Floor, Phoenix, AZ 85003-1611; Phone 602-534-2418; email julie.b.smith@phoenix.gov of all conflicts, errors, ambiguities or discrepancies which the Bidder has discovered in or between the Bid Documents and such other related documents. **All questions regarding the plans and specifications must be received in writing at a minimum seven calendar days prior to bid opening. Questions received after that time may not be given any consideration.**

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

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

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

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

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

4.4. Provisions concerning responsibilities for the adequacy of data furnished to prospective Bidders with respect to subsurface conditions, other physical conditions and underground facilities, and possible changes in the Bid Documents due to differing or unanticipated conditions appear in Paragraphs 4.02 and 4.03 of the General Conditions.

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

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

4.7. The submission of a Bid will constitute an incontrovertible representation by Bidder that Bidder has complied with each and every requirement of this Paragraph 4, that without exception the Bid is premised upon performing and furnishing the Work required by the Bid Documents and applying the specific means, methods, techniques, sequences or procedures of construction (if any) shown or

indicated or expressly required by the Bid Documents; that Bidder has given Design Professional written notice of all conflicts, errors, ambiguities and discrepancies that Bidder has discovered in the Bid Documents and the written resolutions thereof by Design Professional is acceptable to Bidder, and that the Bid Documents are sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work.

4.8. The provisions of the above Paragraphs 4.1 through 4.8, inclusive, do not apply to Asbestos, Polychlorinated biphenyls (PCBs), Petroleum, Hazardous Waste or Radioactive Material covered by Paragraph 4.08 of the General Conditions.

5. Interpretations and Addenda

5.1. **Acknowledge all addenda; a bid will be deemed non-responsive if all issued addenda for this project are not acknowledged in writing on Page 1 of Section 300 - Bid Form.** The City of Phoenix shall not be responsible for any oral responses or instructions made by any employees or officers of the City of Phoenix in regard to the bidding instructions, plans, drawings, specifications, or contract documents. A verbal reply to an inquiry does not constitute a modification of the Invitation for Bids. Any changes to the plans, drawings and specifications will be in the form of an addendum.

5.2. It shall be the responsibility of the prospective bidder to determine, prior to the submittal of its bid, if any addenda to the project have been issued by The City of Phoenix, Design and Construction Procurement Section. Any changes to the plans and specifications will be in the form of an addendum. All addenda will be posted online within the bid folder at the following website:

<https://solicitations.phoenix.gov>

Prospective bidders are responsible for ensuring they have all addenda for all projects they are submitting on. Prospective bidders are strongly encouraged to check the Solicitations website in order to ascertain if any addenda have been issued for this project.

5.3. All technical questions relating to this Work should be directed to the City representative identified in Paragraph 4.1.5.

5.4. For additional information prior to bid submission please contact:

NAME: Julie B. Smith, Design and Construction Procurement
ADDRESS: 200 W. Washington St., 8th Floor, Phoenix AZ 85003-1611
PHONE: 602-534-2418 EMAIL: julie.b.smith@phoenix.gov (preferred)

SBE Utilization
Equal Opportunity Department: 602-262-6790

6. Bid Security

6.1. No Bid will be read unless accompanied by a proposal guarantee certified check, cashier's check, or surety bond using the form in Section 00310 of the Bid Documents, for an amount not less than ten percent (10%) of the total bid amount included in the proposal as a guarantee that the Bidder will enter into a contract to perform the proposal in accordance with the Bid Documents. Surety bonds submitted for this project shall be provided by a company which has been rated "A- or better for the prior four quarters" by the A.M. Best Company. **A bid will be deemed non-responsive if not accompanied by this guarantee.**

6.2. The surety bond shall be executed solely by a surety company or companies holding a certificate of authority to transact surety business in the State of Arizona issued by the Director of the Department of Insurance pursuant to Title 20, Chapter 2, Article 1. The surety bond shall not be executed by an individual surety or sureties even if the requirements of Section 7-101 are satisfied. The Owner will return the certified check, cashier check, or surety bond to Bidders which are not the apparent low Bidder and do not want to remain in contention for the award, and to the Bidder awarded the contract upon execution of the contract.

6.3. Bids without adequate Bid security, including compliance with Paragraph 6.1 above, shall be considered as nonconforming in a material respect with the requirements of the Bid Documents and justifies Owner's refusal to read the Bid.

6.4. The Bid security of the apparent Successful Bidder and the security of any other Bidder remaining in contention for award of contract will be retained by Owner until the end of the period specified in Paragraph 14 below, during which Bids will remain open, or seven (7) days after Owner executes the Agreement, whichever occurs last.

6.5. When providing a surety bond, failure to provide an “A- or Better for the prior four quarters” bond will result in bid rejection.

7. Construction Time

7.1. The number of calendar days within which, or the dates by which, the Work is to be Substantially Completed and also Completed and ready for final payment are set forth in the Agreement and may be supplemented as set forth in the agreement.

7.2. If a Bidder believes that any of the Construction Times specified are insufficient or excessive, that Bidder shall advise Owner in accordance with the requirements of Paragraph 5 above.

7.3. Liquidated Damages are specified in the Agreement and may be supplemented as provided in the Agreement.

8. Pre-Approved Equal and Or-Equal Items

8.1. The Contract, if awarded, will be on the basis of materials and equipment described in the Drawings or specified in the Specifications unless Bidder requests consideration of a proposed material and/or equipment as a “pre-approved equal” as defined in General Conditions Paragraph 6.05.B. Design Professional will only consider application for acceptance as a “pre-approved equal” during the bidding phase. Such application must be received by Design Professional at least twelve (12) **calendar days** prior to the established bid date. The Bidder, at his own expense, shall complete the Pre-Approved Equal Application Form labeled as Attachment A at the end of this Section, and provide the additional information requested on the form. The completed form with required attachments shall be submitted to Design and Construction Procurement, Attn: Julie B. Smith, Contracts Specialist II, Phoenix City Hall 5th Floor, 200 W. Washington St., Phoenix AZ 85003 or send via email to julie.b.smith@phoenix.gov. It is the Bidder's responsibility to provide the necessary data to validate that the physical and operational performance and qualities of the proposed material and/or equipment is equivalent to the material and/or equipment named in the Drawings or Specifications. If, in the opinion of the Design Professional, the proposed material and/or equipment is equivalent, a “pre-approved equal” status will be granted by Design Professional through a written Addendum to the Contract Documents no fewer than seven calendar days prior to the established bid date (A.R.S. 34-104).

If in the opinion of the Design Professional the pre-approved equal application is incomplete and lacks sufficient information to judge the quality and conformance of the proposed pre-approved equal, the Bidder will be notified in writing and the application will be returned without further consideration.

8.2. The Contract, if awarded, will be on the basis of materials and equipment described in the Drawings or specified in the Specifications, without consideration of “or equal” items as defined in General Conditions Paragraph 6.05.A. Whenever it is indicated in the Drawings or specified in the Specifications that an “or equal” item of material or equipment may be furnished or used by Contractor if acceptable to Design Professional, application for such acceptance will be considered by Design Professional only after the Notice to Proceed Date. General Conditions 6.05, describe the procedures for the approval of “or equal” items.

9. Subcontractors, Manufacturers, Suppliers, Persons, Firms and Corporations

9.1. Bidder shall submit to Owner the forms found in Sections 00330, 00331 and 00340 of the Bid Documents, listing all Subcontractors, Manufacturers, Suppliers, persons, firms and corporations proposed for those portions of the Work for which such identification is required. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and

other evidence of qualification for each such Subcontractor, Manufacturer, Supplier, person, firm or corporation if requested by Owner. An Owner or Design Professional who after due investigation has reasonable objection to any proposed Subcontractor, Manufacturer, Supplier, person, firm or corporation, may before the Notice of Award is given request apparent Successful Bidder to submit an acceptable substitute, without an increase in Bid price.

9.2. If apparent Successful Bidder declines to make any such substitution, Owner may award the contract to the next lowest responsive and responsible Bidder that proposes to use acceptable Subcontractors, Manufacturers, Suppliers, persons, firms and corporations. The declining to make requested substitutions will not constitute grounds for sacrificing the Bid security of any Bidder. Any Subcontractor, Manufacturer, Supplier, person, firm or corporation listed to whom Owner or Design Professional does not make written objection prior to the giving of the Notice of Award will be deemed acceptable to Owner and Design Professional subject to revocation of such acceptance after the Effective Date of the Agreement as provided in Paragraph 6.06.B of the General Conditions.

10. SBE Utilization

SEE SECTION 350 - SMALL BUSINESS ENTERPRISE GOAL MEMO, CLAUSE AND FORMS

11. Bid Form and Bid Form Attachments

11.1. The Bid Documents due at time of bid include:

- Bid Form (Section 00300)
- Acknowledge all addenda (Section 00300, Paragraph 1.3.1)
- Bid Bond (Section 00310), including evidence of Power of Attorney (rated A- or better for the prior four quarters)
- List of Major Subcontractors and Suppliers (Section 00330)
- Statement of Proposed SBE Utilization Form (Section 00350-1) or a fully documented waiver packet
- Letters of Intent to Perform as a Subcontractor/Supplier (Section 351)

The Bid Documents due post-bid include:

- Completed Bidder's Questionnaire – Section 00320
- Completed List of All Subcontractors and Suppliers Form – Section 00331
- Schedule of Manufacturers and Suppliers – Section 00340
- Completed Bidder's Disclosure Statement – Section 00360
- Affidavit of Identity if Sole Proprietor – Section 00370

PRIOR TO CONTRACT EXECUTION

- Verification of Experience Modifications Rate (EMR) – the awarded company will be required to provide an EMR verification letter from the insurance company prior to contract execution – Section 00320

These checklists are included solely to aid the Bidder in submitting a Bid. They shall not be relied on to include all items necessary to ensure a complete Bid. The Bidder is solely responsible for including all items as required by the Bid Documents, including any items required by Addenda, which may not be listed in the checklist.

If the Bid Form or any of the Bid Form Attachments are modified by Addendum, revised forms will be reissued in which case Bids shall be submitted on the latest revision of the form issued.

11.2. All blanks on the Bid Form and Bid Form Attachments must be completed by printing in ink or typewriter.

11.3. Bids by corporations must be executed in the corporate name by the president or a vice-president (or other corporate officer accompanied by evidence of authority to sign) and attested by the secretary or an assistant secretary. The corporate address and state of incorporation must be shown below the signature.

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

11.5. Bids by Joint Ventures must be executed in the manner of each individual, partnership and corporation that is a party of the Joint Venture indicated herein.

11.6. All names must be typed or printed in ink below the signature.

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

11.8. Evidence of authority to conduct business as an out-of-state corporation in Arizona shall be provided in accordance with Paragraph 3 above. State contractor license number must also be shown.

12. Submission of Bids

12.1. Prior to bidding on this Project the Bidder must possess the correct license to perform the Work described in the plans and specifications, as deemed appropriate by the Arizona Registrar of Contractors.

12.2. The properly completed bid documents along with the ten (10) percent bid guarantee shall be submitted in a sealed envelope. The outside of the envelope shall be marked as follows:

Bid of: **[Firm's Name, Address, and Phone Number]**
For: **Northwest Wastewater Master Plan Package 4B**
51st Avenue Gravity Sewer
City of Phoenix **WS90500307**
Project Number:

12.3. Sealed bids shall be submitted to the Design and Construction Procurement bid box located on the 1st floor lobby of the Phoenix City Hall building, 200 W. Washington St., Phoenix AZ 85003 prior to the time and date specified for the bid opening.

13. Withdrawal of Bids

13.1. No bidder may withdraw or revise a proposal after it has been deposited with the City, except as provided in Phoenix City Code Chapter 2, Section 190.2. Proposals, read or unread, will not be returned to the bidders until after determination of award has been made.

14. Protest Procedures

A bidder wishing to file a protest for the subject project shall comply with Phoenix City Code Chapter 2, Section 188.

15. Opening of Bids, Objection to Award

15.1. Bids will be opened and (unless obviously non-responsive) read aloud publicly. An abstract of the amounts of the Base Bids will be made available to Bidders after the opening of Bids. Any Bid received after the closing time will not be considered. Any uncertainties on whether a Bid was submitted in time will be resolved against that Bidder, in Owner's sole discretion.

15.2. Only Bids submitted with the following forms will be read aloud publicly: Bid Form (Section 00300), Acknowledgment of Addenda (Section 00300, Paragraph 1.3.1), Bid Bond (Section 00310), Statement of Proposed SBE Utilization Form (Section 00350-1) and associated Letters of Intent to Perform as a

Subcontractor/Supplier (Section 00351-1) or a fully documented waiver packet, and List of Major Subcontractors and Suppliers (Section 00330).

16. Other Bid Items

16.1. List of Major Subcontractors and Suppliers

16.1.1. **A bid will be deemed non-responsive if not accompanied by a properly completed and signed “List of Major Subcontractors and Suppliers” form.**

16.1.2. To assist in eliminating the practice of bid shopping on City construction projects, the Bidder shall list all Major Subcontractors and Suppliers (including SBE) to whom the Bidder intends to contract with that are equal to or greater than 5% of the base bid. The list of major subcontractors and suppliers shall be provided on the “List of Major Subcontractors and Suppliers” form. **Failure to properly complete and sign this form will result in bid rejection.** This form is due with the bid.

16.1.3. If substantial evidence exists that bid shopping occurred on this Project, the Bidder will be ineligible to bid on City construction projects for a period of one year.

16.1.4. The list of All Subcontractors and Suppliers shall be provided on the “List of All Subcontractors and Suppliers” form. This form is due three calendar days after bid opening by 5:00 p.m. All bidders will be required to submit the List of Major Subcontractors and Suppliers form. The three lowest bidders will be required to submit the List of All Subcontractors and Suppliers form. If the List of All Subcontractors and Suppliers form is not submitted by the post-bid deadline, the Bidder will still be required to submit the document prior to award. If the Bidder fails to submit the required List of All Subcontractors and Suppliers form by the post-bid deadline, the Bidder’s bid bond may be placed in jeopardy because the City may make a claim against the Bidder’s bid bond for the cost difference between the lowest responsive and responsible Bidder’s bid and the next lowest bid (and any additional costs involved in awarding the contract to the next lowest responsive and responsible bidder).

16.1.5. Verification of the Bidders Experience Modifications Rate (EMR) from their respective insurer on the insurance company’s letterhead must be submitted.

17. Bids to Remain Subject to Acceptance

17.1. All Bids will remain subject to acceptance for 50 calendar days after the day of the Bid opening, but Owner may, in its sole discretion, release any Bid and return the Bid security prior to that date.

17.2. Extensions of the period during which Bids shall remain open may only be made by agreement between Owner, the apparent Successful Bidder and any other Bidder wishing to remain in contention for the award. Any such agreement shall be based on no increase in the Base Bid of the Bidders involved or any Construction Time stated in days. If the apparent Successful Bidder or any other Bidder wishing to remain in contention for the award fails to agree to any such extension, as conditioned in this paragraph, that Bidder shall be disqualified from further consideration for the award. However, that Bidder’s failure to agree to any such extension will not constitute grounds for forfeiting that Bidder’s Bid security.

17.3. Cancellation of Contract for Conflict of Interest

17.3.1. All parties hereto acknowledge that this Agreement is subject to cancellation by the City of Phoenix pursuant to the provisions of Section 38-511, Arizona Revised Statute.

18. Award of Contract

18.1. It shall be the Bidder’s responsibility, liability and risk to verify and confirm with the Arizona Registrar of Contracts that the Bidder possesses the correct license for this Project. Prior to the submission of a Bid on this Project, the Bidder shall possess the correct license to perform the Work described in the Plans and Specifications. Consistent with Arizona Revised Statute Section 32-1123 (West Supp. 2002), as amended from time to time, and enforced by the Arizona Registrar of Contractors; the license requirement set forth above may not apply if this Project is: (i) funded in whole

or in part by the United States Department of Transportation, (ii) a Department of Transportation Project, or (iii) a Project subject to Federal Acquisition Regulations, Title 48 Code of Federal Regulations, including Department of Defense Federal Acquisition Regulations.

Prior to Award of the Contract, the successful Bidder shall provide to the City of Phoenix the successful Bidder's Contractor License Classification and number, City of Phoenix Privilege License Number, and Federal Tax Identification Number.

18.2. Owner reserves the right to reject any and all Bids, including without limitation the rights to reject any or all nonconforming, nonresponsive, unbalanced or conditional Bids and to reject the Bid of any Bidder if Owner believes that it would not be in the best interest of the Project to make an award to that Bidder, whether the Bid is not responsive or the Bidder is unqualified or of doubtful financial ability or fails to meet any other pertinent standard or criterion established by Owner. Owner also reserves the right to reject any or all Bids, to waive any non-conformance, to readvertise for Bids, to withhold the award for any reason the Owner determines.

18.2.1. The proposal total will be obtained by adding the extension amount or lump sum indicated for the individual pay items. If there is a conflict between words and figures, the words shall apply. If there is a conflict between the unit bid price and the extension for a particular pay item, the unit bid price shall govern. In either case, the Contracting Agency shall correct the discrepancy in accordance with the above procedure and the corrected proposal total will apply.

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

18.4. Owner will consider the qualifications and experience of Subcontractors, Manufacturers, Suppliers, persons, firms and corporations proposed for those portions of the Work as to which the identity of Subcontractors, Manufacturers, Suppliers, persons, firms and corporations must be submitted as provided herein. Owner also may consider the operating costs, maintenance requirements, performance data, and guarantees or major items of materials and equipment proposed for incorporation in the Work when such data is required to be submitted prior to the Notice of Award.

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

18.6. If the Contract is to be awarded, it will be awarded to a responsive and responsible Bidder based on the low total base bid (Items 1 through 25 on the BID FORM). If unit pricing is required in the proposal, the extensions and additions will be verified to assure correctness. Award will be based on the revised total if any errors are found. Additionally, the Contractor shall meet the minimum SBE subcontracting goal set for this Project or have been granted a full or partial waiver of the goal.

Any bidder that currently contracts with the City must be in good standing for its proposal to be considered responsive. For the purpose of this Invitation to Bid, good standing means compliance with all contractual provisions, including payment of financial obligations.

18.7. If the contract is to be awarded, Owner will give the Successful Bidder a Notice to Proceed within sixty (60) days after the date of the Bid opening.

18.8. The Owner expressly reserves the right to cancel this award without recourse or prejudice to contractor until all parties have executed the agreement in full.

19. Contract Security

19.1. Article 5 of the General Conditions set forth the Owner's requirements as to Performance and Payment Bonds. When the Successful Bidder delivers the executed Agreement to Owner, it must be accompanied by the required Performance and Payment Bonds issued by surety company or companies holding a certificate of authority to transact surety business in the State of Arizona issued by the Director of the Department of Insurance pursuant to Title 20, Chapter 2, Article 1. The bonds

shall not be executed by an individual surety or sureties even if the requirements of Section 7-101 are satisfied. Failure to comply with these provisions will be cause for rejection of the Bidders Bid.

20. Insurance Requirements

20.1. Article 5 of the General Conditions and set forth the Owner's requirements as to insurance requirements. When the Successful Bidder delivers the executed Agreement to the Owner, it must be accompanied by the Certificate of Insurance on a standard insurance industry ACORD form. The ACORD form shall be issued by an insurance company authorized to transact business in the State of Arizona, or one that is named to the List of Qualified Unauthorized Insurers maintained by the Arizona Department of Insurance.

21. Signing Agreement

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

21.2. The Agreement is subject to cancellation by the City of Phoenix for prohibited conflicts of interest, if any exist, pursuant to the provisions of ARS Title 38, Section 511.

22. Sequence of Work

22.1. The Work under this Contract must be accomplished while the existing facility is in operation, unless otherwise allowed in the General Requirements. Work must be performed so that operation of the facility will not be jeopardized or reduced in efficiency. Bidders are referred to the General Requirements for requirements concerning sequencing of the Work.

23. Compliance with Other Regulations

23.1. ADA and ANSI Access of Premises During Construction

23.1.1. Contractor shall maintain ADA and ANSI accessibility requirements during construction activities in an occupied building or facility. ADA and ANSI accessibility requirements shall include, but not be limited to, parking, building access, entrances, exits, restrooms, areas of refuge, and emergency exit paths of travel. Contractor shall be responsible for the coordination of all Work to minimize disruption to building occupants and facilities.

23.2. Immigration Reform and Control Act

23.2.1. Compliance with Federal Laws Required. Contractor understands and acknowledges the applicability of the Immigration Reform and Control Act of 1986 and the Drug Free Workplace Act. Contractor agrees to comply with these Federal Laws in performing under this Agreement and to permit City inspection of personnel records to verify such compliance.

24. Confidentiality of Plans and Specifications

24.1. Any plans generated for this project must include the following statement in the Title Block on every page: "Per City of Phoenix City Code Chapter 2, Article 2-28, these plans are for official use only and may not be shared with others except as required to fulfill the obligations of the Design Professional's contract with the City of Phoenix."

25. Leadership in Energy and Environmental Design (LEED)

25.1. The contractor shall provide an easily accessible area to serve the construction site that is dedicated to the separation, collection and storage of materials for recycling including (at a minimum) paper, glass, plastics, metals and designate an area specifically for construction and demolition waste recycling. The Contractor must provide documentation that the materials have been taken to a Maricopa County approved recycling facility.

26. Legal Worker Requirements

26.1. The City of Phoenix is prohibited by A.R.S. § 41-4401 from awarding a contract to any Consultant/Architect/Engineer/Contractor who fails, or whose Subconsultants/subcontractors fail, to comply with A.R.S. § 23-214(A). Therefore, Contractor agrees that:

26.1.1. Contractor and each subcontractor it uses warrants their compliance with all federal immigration laws and regulations that relate to their employees and their compliance with § 23-214, subsection A.

26.1.2. A breach of a warranty under paragraph 1 shall be deemed a material breach of the contract that is subject to penalties up to and including termination of the contract.

26.1.3. The City of Phoenix retains the legal right to inspect the papers of any Contractor or subcontractor employee who works on the contract to ensure that the Contractor or subcontractor is complying with the warranty under paragraph 1.

27. Contractor and Subcontractor Worker Background Screening

Contractor agrees that all Contractor's and subcontractors' workers (collectively "Contract Worker(s)") pursuant to this Agreement will be subject to background and security checks and screening (collectively "Background Screening") at Contractor's sole cost and expense, unless otherwise provided for in the scope of work. Contractor's background screening will comply with all applicable laws, rules and regulations. Contractor further agrees that the background screening is necessary to preserve and protect the public health, safety and welfare. The City requires a completed Contract Worker Badge/Key/Intrusion Detection Responsibilities Agreement for each Contract Worker who requires a badge or key.

Background Screening Risk Level: The City has established two levels of risk: Standard and Maximum risk. The current risk level and background screening required is **MAXIMUM LEVEL**. If the scope of work changes, the City may amend the level of risk, which could require the Contractor to incur additional contract costs to obtain background screens or badges.

Terms of This Section Applicable to all Contractor's Contracts and Subcontracts: Contractor will include Contract Worker background screening in all contracts and subcontracts for services furnished under this agreement.

Materiality of Background Screening Requirements; Indemnity: The background screening requirements are material to City's entry into this agreement and any breach of these provisions will be deemed a material breach of this contract. In addition to the indemnity provisions set forth in this agreement, Contractor will defend, indemnify and hold harmless the City for all claims arising out of this background screening section including, but not limited to, the disqualifications of a Contract Worker by Contractor. The background screening requirements are the minimum requirements for the Agreement. The City in no way warrants that these minimum requirements are sufficient to protect Contractor from any liabilities that may arise out of the Contractor's services under this Agreement or Contractor's failure to comply with this section. Therefore, Contractor and its Contract Workers will take any reasonable, prudent and necessary measures to preserve and protect public health, safety and welfare when providing services under this Agreement.

Continuing Duty; Audit: Contractor's obligations and requirements will continue throughout the entire term of this Agreement. Contractor will maintain all records and documents related to all background screenings and the City reserves the right to audit Contractor's records.

BACKGROUND SCREENING – MAXIMUM RISK:

The current risk level and background screening required is **MAXIMUM RISK**.

A maximum risk background screening will be performed every five years when the Contract Worker's work assignment will:

- work directly with vulnerable adults or children, (under age 18); or

- any responsibility for the receipt of payment of City funds or control of inventories, assets, or records that are at risk of misappropriation; or
- unescorted access to:
 - City data centers, money rooms, high-value equipment rooms; or
 - unescorted access to private residences; or
 - access to critical infrastructure sites/facilities; or
- direct or remote access to Criminal Justice Information Systems (CJIS) infrastructure.

Requirements: The background screening for maximum risk level will include a background check for real identity/legal name and will include felony and misdemeanor records from any county in the United States, the State of Arizona, plus any other jurisdiction where the Contractor worker has lived at any time in the preceding seven years from the Contract Worker's proposed date of hire. In addition, Maximum screening levels may require additional checks as included herein, depending on the scope of work, and may be amended if the scope of work changes.

Contractor Certification; City Approval of Maximum Risk Background Screening: Unless otherwise provided for in the Scope of Work, Contractor will be responsible for:

- determining whether Contract Worker(s) are disqualified from performing work for the City for maximum risk level background checks; and,
- submitting pass/fail results to the City for approval; and,
- reviewing the results of the background check every three to five years, dependent on scope; and,
- to engage in whatever due diligence is necessary to make the decision on whether to disqualify a Contract Worker; and,
- Submitting the list of qualified Contract Workers to the contracting department; and,
- If, upon review of the background information, the City will advise the Contractor if it believes a Contract Worker should be disqualified. The Contractor will evaluate the Contract Worker and if the Contractor believes that there are extenuating circumstances that suggest that the person should not be disqualified, the Contractor will discuss those circumstances with the contracting department. The contracting department decision on disqualification of a Contract Worker is final.
- For sole proprietors, the Contractor must comply with the background check for himself and any business partners, or members or employees who will assist on the contract and for whom the requirements of the Agreement apply.
- By executing this agreement, Contractor certifies and warrants that Contractor has read the background screening requirements and criteria in this section, and that all background screening information furnished to the City is accurate and current.
- The City final documented decision will be an "approve" or "deny" for identified Contract Workers.
- The City will not keep records related to background checks once they are confirmed. Information to verify the results will be returned to the Contractor, or any contracted agency that assists with review, after the City's completed review.
- By executing this agreement, Contractor further certifies and warrants that Contractor has satisfied all such background screening requirements for the maximum risk background screening, and verified legal worker status, as required.
- Contract Workers will not apply for the appropriate City of Phoenix identification and access badge or keys until Contractor has received the City's written acceptance of Contract Worker's maximum risk background screening. The City may, in its sole discretion, accept or reject any or all the Contract Workers proposed by Contractor for performing work under this Agreement. A Contract Worker rejected for work at a maximum risk level under this agreement will not be proposed to perform work under other city contracts or engagements without city's prior written approval.

The background checks will be conducted prior to any employee entering to work and will be based upon information provided to the Police Department including, but not limited to: name, address, date

and place of birth, social security number, INS number if applicable, and a copy of a valid photo identification. The information will be provided to the Water Services Department at least five business days (excluding weekends and holidays) in advance of the need for access. The form will be provided by Water Services Department. A designated Water Services Department representative will conduct the security check.

The City may, at any time, in its sole discretion, refuse to allow an employee access to an area for any of the following reasons, but not limited to:

- Conviction of a felony.
- Conviction of a misdemeanor (not including traffic or parking violation).
- Any outstanding warrants (including traffic and parking violations).
- A person currently on parole or probation.
- A person currently involved in an investigation.

CONFIDENTIALITY AND DATA SECURITY: All data, regardless of form, including originals, images and reproductions, prepared by, obtained by, or transmitted to Contractor in connection with this Agreement is confidential, proprietary information owned by the City, unless otherwise agreed upon within this Agreement. Except as specifically provided in this Agreement, the Contractor shall not disclose data generated in the performance of the service to any third person without the prior written consent of the City Manager or his/her designee.

Contractor agrees to abide by all current applicable legal and industry data security and privacy requirements and to notify the City immediately if the scope of work changes or personal identifying information or information subject to Payment Card Industry Standards becomes part of the Agreement.

Contractor agrees to comply with all City information security and technology policies, standards, and procedures when accessing City networks and computerized systems whether onsite or remotely.

A violation of this Section may result in immediate termination of this Agreement without notice. The obligations of Contractor under this Section shall survive the termination of this Agreement.

SECURITY INQUIRIES: Contractor acknowledges that all of the employees that it provides pursuant to this Contract shall, at Contractor's expense, be subject to background and security checks and screening at the request of the City. Contractor shall perform all such security inquiries and shall make the results available to the City for all employees considered for performing work (including supervision and oversight) under this Contract. City may make further security inquiries. Whether or not further security inquiries are made by the City, City may, at its sole, absolute and unfettered discretion, accept or reject any or all the employees proposed by the Contractor for performing work under this Contract. Employees rejected by the City for performing services under this Contract may still be engaged by Contractor for other work not involving the City. An employee rejected for work under this Contract shall not be proposed to perform work under other City contracts or engagements without the City's prior approval.

The City, in its sole discretion, reserves the right, but not the obligation to:

- require an employee/prospective employee of the Contractor to provide fingerprints and execute such other documentation as may be necessary to obtain criminal justice information pursuant to A.R.S. 41-1750 (G) (4);
- act on newly acquired information whether or not such information should have been previously discovered;
- unilaterally change its standards and criteria relative to the acceptability of Contractor's employees and/or prospective employees; and

- object, at any time and for any reason, to an employee of Contractor performing work (including supervision and oversight) under this Agreement. Contractor will bear the costs of all inquiries requested by the City.

28. Business and Operation Licenses, Permits and Certifications Required

28.1. On or before the submission of a bid for this project, bidder must possess all federal, state, county and City licenses, permits, certifications and any other legal authorizations required by law to transact business and to perform the services set forth in this Agreement (collectively “Business Licenses”). Bidder shall submit a completed Bidder’s Disclosure Statement as set forth in Section 00360, and provide the following Business License information with its bid:

- 28.1.1. proper State of Arizona contractors license classification and number;
- 28.1.2. City of Phoenix transaction privilege license number;
- 28.1.3. federal tax identification number; and
- 28.1.4. any special use or other zoning permits required for Bidder’s operation and performance of the services under this Agreement.

Unless provided otherwise in this solicitation, **Bidder will be deemed non-responsive, and the bid rejected if Bidder fails to possess the proper Business Licenses at the time of bid or fails to submit a substantially completed Bidder’s Disclosure Statement** as specified in this paragraph.

29. Tax Liabilities; Disclosure of Convictions and Breach(s) of Contract

On or before the award of the contract for this project, the successful bidder will: (i) file all applicable tax returns and will make payment for all applicable State of Arizona and Maricopa County Transaction Taxes (ARS Sec. 41-1305) and City of Phoenix Privilege License Taxes (Phoenix City Code Sec.14-415); (ii) disclose any civil fines, penalties or any criminal convictions, other than for traffic related offenses, for violation of federal, state, county or city laws, rules or regulations including, but not limited to, environmental, OSHA, or labor compliance laws (collectively “Laws”) by Bidder, Bidder’s directors, managing members, responsible corporate officers or party who will be responsible for overseeing and administering this project (collectively “Bidder”); and (iii) disclose any material breach(s) of an agreement with the City of Phoenix, any termination for cause or any litigation involving the City of Phoenix occurring within the past three calendar years. Unless provided otherwise in this solicitation, the successful bidder will be deemed non-responsible and the bid rejected for any of the following: (i) Bidder’s civil or criminal conviction, other than for traffic related offenses, for a violation of Laws within the past three calendar years; (ii) liability or culpability resulting in payment of fines or penalties in the cumulative total amount of \$100,000 or greater for a violation of “Laws” within the past three calendar years; (iii) material breach of a City of Phoenix agreement, termination for cause or litigation with the City of Phoenix within the past three calendar years; and (iv) Bidder’s failure to disclose the information as required by this provision. Further, after award of contract, in addition to any other remedy, Bidder’s failure to remit proper taxes to the City of Phoenix may result in the City withholding payment pursuant to Phoenix City Charter Chapter XVIII, Section 14 until all delinquent taxes, interest, and penalties have been paid.

State and Local Transaction Privilege Taxes:

In accordance with applicable state and local law, transaction privilege taxes may be applicable to this transaction. The state and local transaction privilege (sales) tax burden is on the person who is conducting business in Arizona and the City of Phoenix. The legal liability to remit the tax is on the person conducting business in Arizona. Any failure by the Contractor to collect applicable taxes from the City will not relieve the Contractor from its obligation to remit taxes.

It is the responsibility of the Contractor to determine any applicable taxes. The City will review the price or offer submitted and will not deduct, add or alter pricing based on taxes.

If you have questions regarding tax liability, seek advice from a tax professional prior to submitting a bid. Once the bid is submitted, the Offer is valid for the time specified in this Solicitation, regardless of mistake or omission of tax liability.

If the City finds over payment of a project due to tax consideration that was not due, the Contractor will be liable to the City for that amount, and by contracting with the City agrees to remit any overpayments back to the City for miscalculations on taxes included in a bid price.

For purposes of A.R.S. 42-5075(P), this contract is subject to A.R.S. Title 34.

Tax Indemnification:

Contractor will, and require the same of all subcontractors, pay all federal, state and local taxes applicable to its operation and any persons employed by the Contractor. Contractor will, and require the same of all subcontractors, hold the City harmless from any responsibility for taxes, damages and interest, if applicable, contributions required under federal, and/or state and local laws and regulations and any other costs including transaction privilege taxes, unemployment compensation insurance, Social Security and Worker's Compensation.

Tax Responsibility Qualification:

Contractor may be required to establish, to the satisfaction of City, that all fees and taxes due to the City or the State of Arizona for any License or Transaction Privilege taxes, Use Taxes or similar excise taxes, are currently paid (except for matters under legal protest).

Contractor agrees to a waiver of the confidentiality provisions contained in the City Finance Code and any similar confidentiality provisions contained in Arizona statutes relative to State. Transaction Privilege Taxes or Use Taxes.

Contractor agrees to provide written authorization to the City Finance Department and to the Arizona State Department of Revenue to release tax information relative to Arizona Transaction Privilege Taxes or Arizona Use Taxes to assist the Department in evaluating Contractor's qualifications for and compliance with contract for duration of the term of contract.

30. Lawful Presence Requirement

30.1. Pursuant to A.R.S. §§ 1-501 and 1-502, the City of Phoenix is prohibited from awarding a contract to any natural person who cannot establish that such person is lawfully present in the United States. To establish lawful presence, a person must produce qualifying identification and sign a City-provided affidavit affirming that the identification provided is genuine. This requirement will be imposed at the time of contract award. This requirement does not apply to business organizations such as corporations, partnerships or limited liability companies.

31. City of Phoenix Equal Employment Opportunity Requirement

1. In order to do business with the City, Contractor must comply with Phoenix City Code, 1969, Chapter 18, Article V, as amended, Equal Employment Opportunity Requirements. Contractor will direct any questions in regard to these requirements to the Equal Opportunity Department, (602) 262-6790.

2. Any Contractor in performing under this contract shall not discriminate against any worker, employee or applicant, or any member of the public, because of race, color, religion, sex, national origin, age, or disability nor otherwise commit an unfair employment practice. The Contractor will ensure that applicants are employed, and employees are dealt with during employment without regard to their race, color, religion, sex, national origin, age, or disability, and will adhere to a policy to pay equal compensation to men and women who perform jobs that require substantially equal skill, effort, and responsibility, and that are performed within the same establishment under similar working conditions. Such action shall include but not be limited to the following: Employment, promotion, demotion or transfer, recruitment or recruitment advertising, layoff or termination; rates of pay or other forms of

compensation; and selection for training; including apprenticeship. The Contractor further agrees that this clause will be incorporated in all subcontracts with all labor organizations furnishing skilled, unskilled and union labor, or who may perform any such labor or services in connection with this contract.

If the Contractor employs more than thirty-five employees, the following language shall apply as the last paragraph to the clause above:

The Contractor further agrees not to discriminate against any worker, employee or applicant, or any member of the public, because of sexual orientation or gender identity or expression and shall ensure that applicants are employed, and employees are dealt with during employment without regard to their sexual orientation or gender identity or expression.

3. *Documentation.* Contractor may be required to provide additional documentation to the Equal Opportunity Department affirming that a nondiscriminatory policy is being utilized.
4. *Monitoring.* The Equal Opportunity Department shall monitor the employment policies and practices of suppliers and lessees subject to this article as deemed necessary. The Equal Opportunity Department is authorized to conduct on-site compliance reviews of selected firms, which may include an audit of personnel and payroll records, if necessary.

32. Fair Treatment of Workers

32.1. The Contractor shall keep fully informed of all Federal and State laws, County and City ordinances, regulations, codes and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any way affect the conduct of the work. He shall at all times observe and comply with all such laws, ordinances, regulations, codes, orders and decrees; this includes, but is not limited to laws and regulations ensuring fair and equal treatment for all employees and against unfair employment practices, including OSHA and the Fair Labor Standards Act (FLSA). The contractor shall protect and indemnify the Contracting Agency and its representatives against any claim or liability arising from or based on the violation of such, whether by himself or his employees.

33. Record Drawings

33.1. The Contractor shall maintain a record set of plans at the job site. These shall be kept legible and current and shall show all changes or work added in a contrasting, reproducible color. When the project is substantially complete, the Contractor shall submit these plans to the Engineer for approval. When landscaping is included, the Contractor shall submit, prior to final inspection, corrected landscape drawings showing the location of all utility services, controller, pipe, valves, and wiring. The Engineer shall be the sole judge as to the acceptability of the record plans and receipt of an acceptable set is a pre-requisite for final payment.

34. Compliance with Laws

34.1 Contractor must comply with all existing and subsequently enacted federal, state and local laws, ordinances and codes, all applicable ADA requirements, and regulations that are, or become applicable to this Agreement. If a subsequently enacted law imposes substantial additional costs on Contractor, a request for an amendment may be submitted pursuant to this Agreement. Contractor is also required to certify its compliance with all applicable laws and Contractor must pass along these requirements to its Subcontractors. If any of Contractor's certifications is found to be false, the City may terminate this Agreement or impose other remedies due to the false certification.

Attachment A: Pre-Approved Equal Application Form

Project Name:

Project Number:

The Bidder, _____, requests “pre-approved equal” status be granted to the following material and/or equipment:

This item(s) is proposed as an “equal” to the similar item specified (or named): _____ in Section _____, Page _____, Paragraph/Line _____, of the Specifications.

Attach the following documentation to verify compliance with the Contract Documents:

1. Complete product description consisting of detailed dimensioned shop drawings, photographs, performance and test data, model number(s), materials of construction finishes, options, etcetera.
2. A copy of the referenced specification section, and all other applicable specification sections, with each paragraph check marked to indicate material and/or equipment compliance. Check marks (☐) shall denote full compliance with a paragraph as a whole. Deviations from the specifications shall be underlined and shall be listed and identified below.
3. A list of existing installations including the names and phone numbers of references at those installations.

The Bidder will submit dimensioned drawings necessary to prove to Design Professional that the proposed equipment will fit the installation shown on the Drawings without any modification to the building or structure housing the equipment, piping system, and electrical/control system; without modification to or compromising the process the equipment is a part of; and without modification of other associated equipment and components.

If the Bidder knows that modifications are required to the building or structure housing the equipment, the process, or other associated equipment and components, the submittal must list all such modifications required, and the Bidder must submit a signed statement agreeing to pay for the design changes, engineering costs, and drawing changes, which will be made by Design Professional.

The Bidder will identify all deviations from the Contract Documents. If there are differences between proposed substitution and specified item, please list them below.

Specified	Proposed Substitution

What effect does the substitution, or pre-approved equal have on other trades?

Does manufacturer’s warranty of proposed substitution, or pre-approved equal, differ from that specified?

Yes No If YES, explain:

Will substitution, or pre-approved equal, affect progress schedule?

Yes No If YES, explain:

Will substitution, or pre-approved equal, require more license fees or royalties than specified product?

Yes No If YES, explain:

Will maintenance and service parts be locally available for substitution or pre-approved equal? The Bidder will give the address of the nearest source of factory certified maintenance parts.

Yes No If YES, explain:

Submitted By:

Signature: _____ Title: _____ Date: _____

Firm: _____

Address: _____

Phone: _____ Fax: _____

For Design Professional's Use Only:

Pre-approved Equal status is:

- Granted
- Denied
- Granted with special requirements attached
- Denied because of late submittal
- Not Reviewed because of incomplete submittal

By: _____ Date: _____

Remarks: _____

END OF ATTACHMENT "B" TO SECTION 00100

SECTION 00300 – BID FORM AND BID FORM ATTACHMENTS

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SECTION 00300 - BID FORM

PROPOSAL to the City Engineer of the City of Phoenix. In compliance with the Advertisement for Bids, by the City Engineer, the undersigned bidder:

(Print or type contractor name)

1. Bid Submission

- 1.1 The undersigned Bidder proposes and agrees, if this Bid is accepted, to enter into an agreement with Owner in the form included in the Bid Documents to perform and furnish all Work as specified or indicated in the Bid Documents for the Bid Price and within the Bid Times indicated in this Bid and in accordance with the other terms and conditions of the Bid Documents.
- 1.2 Bidder accepts all of the terms and conditions of the Call for Bids and Instructions to Bidders, including without limitation those dealing with the disposition of Bid security. This Bid will remain subject to acceptance for 50 calendar days after the day of Bid opening. Bidder will sign and deliver the required number of counterparts of the Agreement with the bonds and other documents required by the Bid Requirements within ten (10) days after the date of Owner's Notice of Award.
- 1.3 In submitting this Bid, Bidder represents, as more fully set forth in the Agreement, that:
 - 1.3.1 Bidder has examined and carefully studied the Bidding Documents and the following Addenda receipt of all which hereby is acknowledged: (List Addenda by Addendum Number)

Addenda #	Date of Addenda	Addenda #	Date of Addenda

- 1.3.2 Bidder has visited the site and become familiar with and is satisfied as to the general, local and site conditions that may affect cost, progress, performance and furnishing of the Work.
- 1.3.3 Bidder is familiar with and is satisfied as to all federal, state and local Laws and Regulations that may affect cost, progress, performance and furnishing of the Work.
- 1.3.4 Bidder has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in Article 4 of the General Conditions. Bidder accepts the determination set forth in Article 4 of the General Conditions of the extent of the "technical data" contained in such reports and drawings upon which Bidder is entitled to rely. Bidder acknowledges that such reports and drawings are not Bid Documents and may not be complete for Bidder's purposes. Bidder acknowledges that Owner and Design Professional do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Bid Documents with respect to Underground Facilities at or contiguous to the site. Bidder has obtained and carefully studied (or assumes responsibility for having done so) all such additional or supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise

which may affect cost, progress, performance or furnishing of the Work or which relate to any aspect of the means, methods, techniques, sequences and procedures of construction to be employed by Bidder and safety precautions and programs incident thereto. Bidder does not consider that any additional examinations, investigations, explorations, tests, studies or data are necessary for the determination of this Bid for performance and furnishing of the Work in accordance with the times, price and other terms and conditions of the Bid Documents.

- 1.3.5 Bidder is aware of the general nature of Work to be performed by Owner and others at the site that relates to Work for which this Bid is submitted as indicated in the Bid Documents.
- 1.3.6 Bidder has correlated the information known to Bidder, information and observations obtained from visits to the site, reports and drawings identified in the Bid Documents and all additional examinations, investigations, explorations, tests, studies and data with the Bid Documents.
- 1.3.7 Bidder has given Design Professional written notice of all conflicts, errors, ambiguities or discrepancies that Bidder has discovered in the Bid Documents and the written resolution thereof by Design Professional is acceptable to Bidder, and the Bid Documents are generally sufficient to indicate and convey understanding of all terms and conditions for performing and furnishing the Work for which this Bid is submitted.
- 1.3.8 This Bid is genuine and not made in the interest of or on behalf of any undisclosed person, firm or corporation and is not submitted in conformity with any agreement or rules of any group, association, organization or corporation; Bidder has not directly or indirectly induced or solicited any person, firm or corporation to refrain from bidding; and Bidder has not sought collusion to obtain for itself any advantage over any other Bidder or over Owner.

(THE REMAINDER OF THIS PAGE IS INTENTIONALLY LEFT BLANK)

1.4 Bid Schedule

1.4.1 Bidder will complete the Work in accordance with the Bid Documents and accept in full payment for the Work items listed below, the following Unit Prices and/or Bid Prices, as applicable:

Bid Item No.	Bid Quantity	Unit	Description	Unit Price	Bid Price
1	17,547	LF	36" VCP Sanitary Sewer	\$	\$
2	11	EA	60" Lined Sewer Manhole	\$	\$
3	20	EA	Deflection Manhole Less Than 10 Degrees	\$	\$
4	12	EA	Deflection Manhole More Than 10 Degrees	\$	\$
5	1	EA	Junction Structure No. 1	\$	\$
6	70	LF	72" Steel Casing	\$	\$
7	1	LS	Jack and Bore Pit	\$	\$
8	1	LS	Receiving Pit	\$	\$
9	1	LS	Mobilization and Demobilization	\$	\$
10	1	EA.	Cut and Plug Waterline	\$	\$
11	4	EA	Type B Drop Sewer Connection	\$	\$
12	7	EA	Vertically Realign Waterline	\$	\$
13	135	LF	Concrete Encase Pipe	\$	\$
14	151,902	SF	Remove and Replace AC Pavement	\$	\$
15	1,530	LF	Remove and Replace Curb and Gutter	\$	\$
16	119	SF	Remove and Replace Driveway	\$	\$
17	7	EA	Replace Concrete Collar	\$	\$
18	1	EA	VCP Stub Out and Plug	\$	\$

Bid Item No.	Bid Quantity	Unit	Description	Unit Price	Bid Price
19	5	EA	Deflection Manhole More Than 40 Degrees	\$	\$
20	9	EA.	ACP Waterline Replacement	\$	\$
21	1	LS	Replace Landscaping (Allowance)	\$100,000.00	\$100,000.00
22	1	LS	Traffic Control (Allowance)	\$350,000.00	\$350,000.00
23	1	LS	Owners Allowance	\$750,000.00	\$750,000.00

Base Bid (The sum of the computed totals for Bid Items 1 through 23 only):

_____ Dollars and _____ Cents
 (Written words)

\$ _____
 (Figures)

24 (ALT)	1	LS	CAP Crossing	\$	\$
25 (ALT)	48	EA.	Polymer Concrete Manholes	\$	\$

Alternative Bid (The sum of the computed totals for Bid Item 24 and 25 only):

_____ Dollars and _____ Cents
 (Written words)

\$ _____

THE BIDDER ACKNOWLEDGES AND AGREES THAT DETERMINATION OF THE LOWEST BIDDER SHALL BE IN ACCORDANCE WITH THE REQUIREMENTS OF PARAGRAPH 17.6 OF THE INSTRUCTIONS TO BIDDERS.

THE BASE BID DOLLAR VALUE WILL BE ANNOUNCED AT THE BID OPENING.

2. Time of Completion

- 2.1 Bidder agrees that the Work will be substantially complete within 455 calendar days after the date when the Construction Times commence to run as provided in Article 2 of the General Conditions and completed and ready for final payment in accordance with Article 14 of the General Conditions within thirty (30) calendar days after the actual date when pursuant to paragraph 14.04 of Section 00700, General Conditions, Substantial Completion of the Work has been achieved.

- 2.2 Bidder accepts the provisions of the Agreement as to liquidated damages in the event of failure to complete the Work within the times specified in the Agreement.
- 2.3 In addition, Bidder agrees to meet the specified interim Milestones as defined in the General Requirements.

3. Bid Terms

- 3.1 Terms used in this Bid which are defined in the General Conditions or Instructions to Bidders will have the meanings indicated in the General Conditions or Instructions to Bidders.

Submitted on _____, 20____.

3.2 If Bidder is an Individual:

Name of Individual: _____

Name & Title of Person
Authorized to sign: _____

Signature: _____

Doing business as: _____

Business Address: _____

Phone Number: _____ FAX Number: _____

3.3 If Bidder is a Corporation:

By: _____
(CORPORATION NAME)

Signature: _____

Name and Title: _____

Attest: _____

Name and Title: _____

Business Address: _____

Phone Number: _____ FAX Number: _____

State of Incorporation: _____

3.4 If Bidder is a Joint Venture (Partnership):

By: _____ (NAME OF PARTNERSHIP)	By: _____ (NAME OF PARTNERSHIP)
Signature: _____	Signature: _____
Name & Title: _____ _____	Name & Title: _____ _____
Business Address: _____ _____	Business Address: _____ _____
Phone Number: _____	Phone Number: _____
FAX Number: _____	FAX Number: _____

3.5 If Bidder is a Joint Venture (Corporation):

By: _____ (CORPORATION NAME)	By: _____ (CORPORATION NAME)
Signature: _____	Signature: _____
Name and Title: _____ _____	Name and Title: _____ _____
Attest: _____	Attest: _____
Name and Title: _____ _____	Name and Title: _____ _____
Business Address: _____ _____	Business Address: _____ _____
Phone Number: _____	Phone Number: _____
FAX Number: _____	FAX Number: _____
State of Incorporation: _____	State of Incorporation: _____

3.6 Phone and Address for receipt of official communications: _____

That we, _____,
as Principal, (hereinafter called the Principal) and the _____, a corporation duly
organized under the laws of the State of _____, as Surety, (hereinafter called the Surety)
are held and firmly bound unto the City of Phoenix as Obligee, in the sum of ten (10) percent of the total
amount of the bid of Principal, submitted by him to the City of Phoenix for the work described below, for the
payment of which sum, well and truly to be made, the said Principal and the said Surety, bind ourselves,
our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents
and in conformance with A.R.S. #34-201.

WHEREAS, the said Principal is herewith submitting its proposal for Northwest Wastewater Master Plan
Package 4B – 51st Avenue Gravity Sewer.

NOW, THEREFORE, if the City of Phoenix shall accept the proposal of the Principal and the Principal shall
enter into a contract with the City of Phoenix in accordance with the terms of such proposal and give such
Bonds and Certificates of Insurance as specified in the Standard Specifications with good and sufficient
Surety for the faithful performance of such contract and for the prompt payment of labor and material
furnished in the prosecution thereof, or in the event of the failure of the Principal to enter into such contract
and give such Bonds and Certificates of Insurance, if the Principal shall pay to the City of Phoenix 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 shall be null and void, otherwise to remain in full force and
effect.

Signed and sealed this _____ day of _____ A.D., 2023

Principal

Title

Mailing Address

Surety

WITNESS:

A.M. BEST RATING:

SECTION 00320 - BIDDER'S QUESTIONNAIRE

The undersigned Bidder warrants that all statements and answers made to the interrogatories that follow are current, accurate and complete as of the date stated below.

This form is due no later than 5:00pm on the 3rd day after the Bid.

1. Organization

1.1 How many years has your organization been in business under your present name? _____

1.2 Date and state of organization/incorporation: _____ (IRS) EIN: _____

1.3 Title and name of Principals (President, Vice-President, Secretary and Treasurer, if a corporation; partners, if a partnership).

1.4 If your organization, any business entity related to or affiliated with your organization, or any present or former executive employee, officer, director, shareholder (owning 20% or more of the outstanding shares), partner, or owner of your organization or of any such related or affiliated entity has ever been convicted of a felony, or has felony charges pending, in any state within the last three years from the date of Bid opening, including but not limited to a felony conviction under ARS Title 34, Section 252, furnish with this Bidder's Questionnaire all materials facts relating to any such felony conviction or any such pending felony charges against (1) your organization, (2) any such business entity related to or affiliated with your organization, or (3) any such present or former executive employee, officer, director, shareholder (owning 20% or more of the outstanding shares), partner, or owner of your organization or of any such related or affiliated entity.

Attachment _____, consisting of _____ pages.

2. Licensing

2.1 For each Arizona Contractor's license required to perform the Work identified in the Bid Documents, attach a copy of the "identification card" issued by the Registrar of Contractors. Also attach a copy of any privilege license issued to your organization by the City of Phoenix, the State, and any other Political Subdivision with jurisdiction over the Work. Information concerning the City of Phoenix Privilege License may be obtained from the City of Phoenix Finance Department, Tax and License Division, 251 West Washington Street, 3rd Floor, Phoenix, Arizona, 85003, Attention: License Services, telephone (602) 262-6785, FAX (602) 495-5605.

Attachment _____, consisting of _____ pages.

2.2 Does your organization hold contractor's licenses covering specialty classification of Work that your organization itself intends to perform and for which a specific specialty license is required under ARS Title 32, by Owner, or any other Political Subdivision with jurisdiction over the Work? _____ If so, attach a list with all licenses by number and classification; state the name of the organization holding the license, the renewal date of each license, and whether each license is active. Also, attach a copy of the corresponding identification cards issued by the Registrar of Contractors, the Owner or the particular Political Subdivision with jurisdiction over the Work.

Attachment _____, consisting of _____ pages.

3. Experience

3.1 What is the general character of the work performed by your organization? _____

3.2 (A) How many years of experience has your organization had as a General Contractor and as a Subcontractor involving work similar in character and scope to the Work described by the Bid Documents? _____

(B) How many years of experience has your subcontractors listed in Section 00330 - List of Subcontractors and Suppliers had as a General Contractor and as a Subcontractor involving Work similar in character and scope to the Work described by the Bid Documents? _____

3.3 (A) Attach a list of all public contracts and subcontracts that your organization has performed within the last five years over \$15 million involving Work similar in character and scope to the Work described by the Bid Documents (using the forms in the "References Attachment" provided with this Questionnaire). If the contract or subcontract referenced is not substantially completed, furnish the percent complete for that contract or subcontract.

Attachment _____, consisting of _____ pages.

(B) Attach a list of all public contracts and subcontracts that your major subcontractors listed in Section 00330 - List of Subcontractors and Suppliers have performed within the last five years over \$15 million involving Work similar in character and scope to the Work described by the Bid Documents (using the forms in the "References Attachment" provided with this Questionnaire). If the contract or subcontract referenced is not substantially completed, furnish the percent complete for that contract or subcontract.

Attachment _____, consisting of _____ pages.

3.4 Within the last five years, has your organization failed to complete a contract or subcontract awarded to it? _____ If so, for each contract or subcontract, state when, where and why.

3.5 Within the last five years, has any officer or partner of your organization been an officer or partner of another organization that failed to complete a contract or subcontract awarded to it? _____ If so, for each contract or subcontract, state the name of each officer or partner, the name of the organization(s), the name of the owner(s), and the reasons why the contract(s) or subcontract(s) was/were not completed.

3.6 Within the last five years, has any officer or partner of your organization failed to complete a contract or subcontract awarded in that person's own name? _____ If so, for each contract or subcontract, state the name of each officer or partner, the name of the owner(s), and the reasons why the contract(s) or subcontract(s) was/were not completed?

- 3.7 Within the last five years, have any claims arising from or relating to a contract or subcontract been made against your organization or any officer or partner of your organization that resulted in litigation or arbitration? _____ If so, the Bidder shall attach a description of each claim, the amount of the claim, the parties involved, and the settlement amount or award.

Attachment _____, consisting of _____ pages.

- 3.8 Within the last five years, has your organization or an officer or partner of your organization made any claims arising from or relating to a contract or subcontract that resulted in litigation or arbitration? _____ If so, the Bidder shall attach a description of each claim, the amount of the claim, the parties involved, and the settlement amount or award.

Attachment _____, consisting of _____ pages.

- 3.9 Bidder shall have an Experience Modifications Rate (EMR) of less than or equal to 1.20 as determined by insurance industry standards. Failure to submit verification of their Experience Modifications Rate (EMR) from their respective insurer on the insurance company's letterhead, within the specified period, justifies the disqualification of the Bidder for consideration for the award.

Attachment _____, consisting of _____ pages.

4. Additional Eligibility Data Under ARS Section 34-255

- 4.1 Parts of the Work, besides those disclosed on the List of Subcontractors and Suppliers, Section 00330, that you intend to subcontract: _____

- 4.2 If any of those Subcontractors nominated in paragraph 4.1 has ever been convicted of a felony, or has felony charges pending, in any state within the last three years from the date of Bid opening, including but not limited to a felony conviction under ARS Title 34, Section 252, furnish with this Questionnaire all material facts relating to any such felony conviction or any such pending felony charges strictly in accordance with the requirements of paragraph 1.4.

Attachment _____, consisting of _____ pages.

- 4.3 If any of the Suppliers (having a direct Sub-agreement with the Bidder or any of the Bidder's Subcontractors) has ever been convicted of a felony charge or has any felony charges pending in any state within the last three years from the date of Bid opening, including but not limited to a felony conviction under ARS Title 34, Section 252, furnish with this Questionnaire all material facts relating to any such felony conviction or any such pending felony charges strictly in accordance with the requirements in paragraph 1.4.

Attachment _____, consisting of _____ pages.

- 4.4 State the name, address and telephone number of a representative of your organization who personally visited and inspected the site:

Also, describe subsurface and physical conditions at or contiguous to the site that your representative investigated and how they were accounted for in the preparation of your organization's Bid.

Attachment _____, consisting of _____ pages.

- 4.5 Attach a list of construction equipment and machinery your organization intends to use in the execution of the Work, as estimated in the preparation of your organization's Bid.

Attachment _____, consisting of _____ pages.

- 4.6 Does your organization rent and/or lease equipment and/or facilities from other affiliate organizations? _____. If so, state the name of the affiliate organization(s): _____

- 4.7 Credit available? _____ Amount: \$

- 4.8 Will your organization, i.e., the Bidder named in the Authorized Signature Article on the Bid Form, be the only named Principal in the Performance Bond and Payment Bond? _____

If not, please identify the organization who will be named as Principal or Co-Principal on the Performance Bond and Payment Bond _____.

Also, state how such organization relates to the Bidder _____.

(NOTE: If another organization is identified, the Bidder shall submit to the Owner or Design Professional a separate Questionnaire filled out by that organization as part of the Qualification Submittal required under Paragraph 3 of the Instructions to Bidders.)

(THE REMAINDER OF THIS PAGE IS INTENTIONALLY LEFT BLANK)

5. References

5.1 Trade references of work similar in character and scope to the Work described by the Bid Documents. (Minimum of three):

5.2 Bank references:

5.3 Insurance:

6. Certificate of Submittal

By: _____
(name of individual, partnership, corporation or joint venture)

Signed By: _____

Name and Title: _____

on this _____ day of _____, 20____.

(THE REMAINDER OF THIS PAGE IS INTENTIONALLY LEFT BLANK)

REFERENCES ATTACHMENT TO BIDDER'S QUESTIONNAIRE

REFERENCE

Public Owner: _____

Project/Contract Name: _____

Location of Project: _____

Contract Price: _____

Project Started: _____ Completed: _____

Owner's Representative (Name & Phone): _____

Bidder's Representative (Name & Phone): _____

Scope of Project: _____

REFERENCE

Public Owner: _____

Project/Contract Name: _____

Location of Project: _____

Contract Price: _____

Project Started: _____ Completed: _____

Owner's Representative (Name & Phone): _____

Bidder's Representative (Name & Phone): _____

Scope of Project: _____

REFERENCE

Public Owner: _____

Project/Contract Name: _____

Location of Project: _____

Contract Price: _____

Project Started: _____ Completed: _____

Owner's Representative (Name & Phone): _____

Bidder's Representative (Name & Phone): _____

Scope of Project: _____

REFERENCES ATTACHMENT TO BIDDER'S QUESTIONNAIRE (continued):

REFERENCE

Public Owner: _____

Project/Contract Name: _____

Location of Project: _____

Contract Price: _____

Project Started: _____ Completed: _____

Owner's Representative (Name & Phone): _____

Bidder's Representative (Name & Phone): _____

Scope of Project: _____

REFERENCE

Public Owner: _____

Project/Contract Name: _____

Location of Project: _____

Contract Price: _____

Project Started: _____ Completed: _____

Owner's Representative (Name & Phone): _____

Bidder's Representative (Name & Phone): _____

Scope of Project: _____

REFERENCE

Public Owner: _____

Project/Contract Name: _____

Location of Project: _____

Contract Price: _____

Project Started: _____ Completed: _____

Owner's Representative (Name & Phone): _____

Bidder's Representative (Name & Phone): _____

Scope of Project: _____

CITY OF PHOENIX: Water Services Department
 PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Avenue Gravity Sewer
 PROJECT NUMBER: WS90500307

SECTION 00330- LIST OF MAJOR SUBCONTRACTORS/SUPPLIERS

DESCRIPTION OF WORK OR MATERIALS (CONTRACTOR TO ENTER TRADE/SUPPLIER AREAS)	SELF-PERFORMED BY PRIME CONTRACTOR	SUBCONTRACTOR/SUPPLIER COMPANY NAME (IF NOT SELF-PERFORMED)	CONTACT PERSON	PHONE NUMBER	DOLLAR VALUE OF WORK OR MATERIALS IN BID
	<input type="checkbox"/> YES <input type="checkbox"/> NO				
	<input type="checkbox"/> YES <input type="checkbox"/> NO				
	<input type="checkbox"/> YES <input type="checkbox"/> NO				
	<input type="checkbox"/> YES <input type="checkbox"/> NO				
	<input type="checkbox"/> YES <input type="checkbox"/> NO				
	<input type="checkbox"/> YES <input type="checkbox"/> NO				

I hereby certify by signing below that the above listed companies will be utilized to perform work on this project for an amount **equal to or greater than 5% of the base bid**. These companies shall not be removed or replaced without prior written approval by the City of Phoenix Project Manager. The City requires, as in Paragraph D – List of Major Subcontractors and Suppliers in the Information for Bidders that ALL vendors are listed, or you will be disqualified. If you are self-performing the work, you must still list any suppliers for materials, or list any contractors that will assist you in any form.

COMPANY NAME _____ SIGNATURE _____
 NAME & TITLE _____ PHONE NUMBER _____ DATE _____
 EMAIL ADDRESS _____

CITY OF PHOENIX: Water Services Department
 PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Avenue Gravity Sewer
 PROJECT NUMBER: WS90500307

SECTION 00331 - LIST OF ALL SUBCONTRACTORS/SUPPLIERS

DESCRIPTION OF WORK OR MATERIALS (CONTRACTOR TO ENTER TRADE/SUPPLIER AREAS)	SELF-PERFORMED BY PRIME CONTRACTOR	SUBCONTRACTOR/SUPPLIER COMPANY NAME (IF NOT SELF-PERFORMED)	CONTACT PERSON	PHONE NUMBER	DOLLAR VALUE OF WORK OR MATERIALS IN BID
	<input type="checkbox"/> YES <input type="checkbox"/> NO				
	<input type="checkbox"/> YES <input type="checkbox"/> NO				
	<input type="checkbox"/> YES <input type="checkbox"/> NO				
	<input type="checkbox"/> YES <input type="checkbox"/> NO				
	<input type="checkbox"/> YES <input type="checkbox"/> NO				
	<input type="checkbox"/> YES <input type="checkbox"/> NO				

I hereby certify by signing below that the above listed companies will be utilized to perform work on this project. These companies shall not be removed or replaced on the project without prior written approval by the City of Phoenix Project Manager. The City requires, as in Paragraph D - List of All Subcontractors and Suppliers in the Information for Bidders that ALL vendors are listed, or you will be disqualified. If you are self-performing the work, you must still list any suppliers for materials, or list any contractor's that will assist you in any form.

COMPANY NAME _____ SIGNATURE _____
 NAME & TITLE _____ PHONE NUMBER _____ DATE _____
 EMAIL ADDRESS _____

CITY OF PHOENIX: Water Services Department
 PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Avenue Gravity Sewer
 PROJECT NUMBER: WS90500307 SECTION 00340 -SCHEDULE OF MANUFACTURERS AND SUPPLIERS OF MAJOR EQUIPMENT AND MATERIALS

ITEMS

As provided in the Instructions to Bidders, the Bidder proposes that the items of major equipment or materials named herein will be supplied by the Manufacturers and Suppliers set forth below as written by the Bidder, unless changes are specifically authorized by the Owner. Preliminary acceptance of equipment or materials listed by the Manufacturer's name shall not in any way constitute a waiver of the specifications; final acceptance will be based on full conformity with the specifications covering the equipment and/or materials. Failure to provide this information will be just cause for Owner declaring the Bidder's Bid nonresponsive. **This form is due no later than 5:00pm on the 3rd day after the Bid.**

<u>LISTING OF MAJOR EQUIPMENT</u>		
<u>SECTION</u>	<u>TITLE/DESCRIPTION</u>	<u>MANUFACTURER</u>

<u>MATERIAL</u>		
<u>SECTION</u>	<u>TITLE/DESCRIPTION</u>	<u>MANUFACTURER</u>

Submitted By: _____
 (name of individual, partnership, corporation or joint venture)

Signed By: _____

Name and Title: _____



City of Phoenix

To: Marcel Begay
Project Manager
Water Services Department

Date: 9/14/2023

From: Amy Thomas, Co-Chair
Tiana Madrid, Co-Chair *TM*
SBE Goal Setting Committee

Subject: SBE GOALS FOR NORTHWEST MASTER PLAN 51ST AVE GRAVITY SEWER
(PACKAGE 4B) (DBB)
PROJECT: WS90500307

Attendees: Amy Thomas, Tiana Madrid, Karina Matthiessen, Marcel C. Begay, and Stacey L. Kisling

A Small Business Enterprise (SBE) goal of 7% was established for the above referenced project in accordance with Chapter 18 of the City's Ordinance, A.R. 1.89.

The goal was derived from the current availability of certified SBE firm(s) in the following specified scope(s) of work:

- Traffic Control
- Site preparation
- Asphalt
- Manholes
- Pipeline
- Concrete
- Landscaping

Only SBE subcontractors certified by the City of Phoenix under Chapter 18, Article VII of the Phoenix City Code are eligible to fulfill the participation goals as stated. A firm's certification must be current and in force at the date and time of the bid. The most current electronic listing of all certified firms can be accessed through the Internet at: www.phoenix.diversitycompliance.com/

If you have any questions or concerns regarding the goal for this project, please contact us at Small.Business.Enterprise@Phoenix.Gov.

Thank you for your continued support of the City's SBE Program.

c: Eric J. Froberg, City Engineer
Patty Kennedy, Deputy Water Services Director
Equal Opportunity Division Office
Design and Construction Procurement Section Office



City of Phoenix

Small Business Enterprise Program

CONTRACTOR'S STATEMENT OF PROPOSED SBE UTILIZATION (DBB)

PROJECT NUMBER/TITLE: WS90500307 / Northwest Master Plan 51st Ave Gravity Sewer (Package 4B)

Required SBE Goal: 7%

SBE FIRMS	COMPANY NAME	SERVICES TO BE PROVIDED	SUPPLIER- (YES or NO) May not satisfy more than 25% of the Goal	SBE \$ AMOUNT from LOI Tables - Sections C, D, or E	Countable SBE \$ Amount (towards proposed goal)

(\$ _____) - (\$ _____) - (\$ _____) = (\$ _____)
Total Bid - **Allowances & Contingencies** - **Alternates** = **Base Bid**

(\$ _____) ÷ \$ _____) X 100 = _____ % (NO ROUNDING)
Total Proposed SBE Dollars ÷ **Base Bid** X 100 = **Proposed SBE %**

Proposed SBE Percentage must equal or exceed the Required SBE Goal Percentage.
Do **NOT** propose SBE dollars in scopes related to Alternates, Allowances, or Contingencies as part of meeting the required SBE %.
All additional contract dollars, including selected alternates, contingencies, and allowances paid after award of contract, will be subject to the SBE contract goal %.

Total Proposed SBE Dollars

\$ _____

I hereby certify by signing below the foregoing SBE firms shall be contracted to work on the trades identified above and/or supply material/equipment for this project.

The information shown above is a **true reflection of the proposed subcontracts.**

COMPANY NAME: _____ EMAIL: _____ PHONE: _____

NAME : _____ TITLE: _____

SIGNATURE: _____ DATE: _____



City of Phoenix

Small Business Enterprise Program

SBE – DESIGN BID BUILD (DBB) CONTRACT CLAUSE

PROJECT #: WS90500307

CONTRACT #: TBD

PROJECT TITLE: Northwest Master Plan 51st Ave Gravity Sewer (Package 4B)

The City of Phoenix Small Business Enterprise Program (SBE) is managed and administered by the Equal Opportunity Department, Contract Compliance Division. Phoenix is one of the fastest growing, multicultural cities in the country and has shown a historical commitment to business diversity. The City strives to advance the economic growth of businesses through its Small Business Enterprise (SBE) Program.

Through a coordinated effort among several city departments, the SBE Program provides SBE certification, procurement opportunities, construction subcontracting utilization, small business management and technical assistance and educational services and networking opportunities.

The Small Business Enterprise (SBE) participation goal for this project is as follows:

SBE Required Goal = 7%

An annual SBE subcontracting participation goal has been established under this Contract. The Prime Contractor is required to demonstrate good faith efforts to utilize certified SBE firms to achieve this goal during the life of this contract.

For purposes of determining the Contractor's actual SBE utilization during and at the end of the project, the Contractor shall meet or exceed their **Proposed SBE Goal Percentage (as indicated on the Submitter's received SBE Utilization Form with their bid submittal)** for the contract, for ALL work performed on the project, including any amount paid for contingencies and allowances, and selected alternates. **The Proposed Goal shall meet/or exceed the Required Goal.**

For purposes of calculating the Contractor's "Proposed SBE Goal Percentage" on the Contractor's Statement of Proposed SBE Utilization form, bidders must not propose SBE subcontractors from areas identified on the bid form as contingencies and allowances or proposed alternates. Any SBE participation proposed from these areas will be not counted towards meeting the SBE goal requirement necessary for contract award.

The "Total Bid" shall be defined as the total of all the unit prices, or the lump sum total, including alternates and contingencies and allowances. The "Base Bid" shall be defined as the "Total Bid" minus "all proposed alternates" as determined by the project manager. Any additional dollars paid under this contract, including any selected alternate(s), shall be subject to the **Proposed SBE Goal Percentage** listed on the Contractor's Statement of Proposed SBE Utilization form.



City of Phoenix

Small Business Enterprise Program

SBE PROGRAM DEFINITIONS

Broker, Packager, Manufacturers' Representative, or Jobber means a firm that is not a manufacturer or regular dealer as defined herein.

Commercially Useful Function (CUF) means that a SBE firm is responsible for execution of the work of the contract and is carrying out its responsibilities by actually performing, managing, and supervising the work involved. A SBE must perform at least 75% of the total cost of its contract with its own work force in order to be determined to be performing a CUF on the contract.

Contract is a written agreement obligating the seller or business enterprise to furnish goods or services as submitted and the Purchaser or Buyer to pay for such goods or services.

Contractor is an individual, partnership, joint venture, corporation or firm that executes a contract with the City to perform services requested by a solicitation or procurement. The Contractor may be direct or through an authorized representative.

Joint Venture (JV) is an association between two or more persons, partnerships, corporations, or any combination thereof, formed to carry on a single business activity. The JV is limited in scope and duration to this contract. The resources, assets and labor of the participants must be combined in an effort to accrue profit.

Manufacturer means a firm that operates or maintains a factory or establishment that produces, on the premises, the materials, supplies, articles, or equipment required under the contract.

Purchaser for purposes of this contract means the City.

Regular Dealer or Supplier means a business that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles or equipment of the general character described by the specifications are bought, kept in stock, and regularly sold or leased to the public in the usual course of business. The firm must be an established, regular business that engages, as its principal business and under its own name, in the purchase and sale or lease of the products in question.

Small Business Enterprise (SBE) means a small business that has been determined to meet the requirements for SBE certification with the City of Phoenix and whose certification is in force at the time of the award of business by the City. A directory of currently certified SBE firm is located at <https://phoenix.diversitycompliance.com>.

Subcontract a contract at any tier below the prime contract, including purchase orders.

Subcontractor is an individual, partnership, joint venture, corporation or firm that holds a contract at any tier below the prime contract, including purchase orders.

Successful Submitter is a Submitter who has been selected to perform services requested by a solicitation or procurement.



City of Phoenix

Small Business Enterprise Program

SECTION I. SBE CERTIFIED FIRMS

Only firms certified by the City of Phoenix under Chapter 18, Article VIII of the Phoenix city code are eligible to fulfill the participation goal stated above. A firm's ***certification must be in the trade areas listed on the proposed utilization form and current and in force at the date and time of the bid opening deadline.***

The most current electronic directory of all certified **SBE** firms can be accessed at:

<https://phoenix.diversitycompliance.com>

If you need to verify certification status, please contact the Equal Opportunity Department at (602) 262-6790 and identify yourself as a prime contractor bidding on this project. Prime contractors should verify that the certifications of the SBE firms are current prior to bid opening. ***If a firm's certification expires and is not renewed prior to the bid-opening deadline, that firm will be ineligible to satisfy the goal.***

SECTION II. SBE BID PROCEDURES

The bid envelope shall contain all information and documents related to the SBE requirements of this section. ***Failure to properly complete the "Contractor's Statement of Proposed SBE Utilization" and "Letter of Intent to Perform as a Subcontractor/Supplier" forms, or submit a fully documented waiver request as described below, will result in bid rejection.*** The required documentation includes:

1. **A Contractor's Statement of Proposed SBE Utilization** - The form shall document the name of each SBE firm that will be awarded a subcontract; services to be performed by each subcontractor; dollar amount to be paid for those services; and the total dollar amount that is being proposed in SBE participation.
2. **A Letter of Intent to Perform as a SBE Subcontractor/Supplier** (required for each SBE subcontractor/supplier proposed) The form shall be completed by the SBE firm that will be awarded the subcontract. The form documents services to be performed by the subcontractor/supplier and the total dollar amount of the subcontract that will be awarded to the SBE. Only the services performed in the area(s) described by the SBE's certification description can be counted towards the SBE goal requirement.

The bidder's proposed utilization of SBE firms to fulfill the participation goal must be submitted on the "Contractor's Statement of Proposed SBE Utilization" form included in the specification packet. Additionally, each of the **SBE** subcontractors/suppliers the bidder is proposing to use to meet the goal requirement on this contract must complete the "Letter of Intent to Perform as an SBE Subcontractor/Supplier" (LOI) form. Both forms must be completed and submitted as part of the bid packet by the bid-opening deadline.

Failure to submit a completed "Contractor's Statement of Proposed SBE Utilization" and signed "Letter of Intent to Perform as an SBE Subcontractor/Supplier" form for each of the proposed SBE firms will result in a bidder being declared non-responsive to the requirements of these specifications and the bid will not be considered. The forms must contain the following:

1. The Certified SBE firm name and the certified trade or services to be performed.
2. The dollar amount of the proposed subcontract to be awarded to each SBE firm.
3. The total dollar amount of all SBE proposed subcontracts.

In instances where an exact dollar amount to be subcontracted with a SBE firm cannot be determined, the bidder shall indicate on Columns 3 and 4 of Part B Section 1 of the "Letter of Intent To Perform as a SBE Subcontractor/Supplier" form the minimum guaranteed hours/units and dollar amount that will be paid to the SBE firm. This situation applies only when a Contractor proposes to utilize a SBE firm that engages in work



City of Phoenix

Small Business Enterprise Program

related to a broker, supplier or; a bid that is based on a per hour charge as in hauling/trucking or construction site security. Please note that this exception does not permit the Prime contractor to complete or modify any other part of the LOI document. Both, the SBE and the bidder must sign the LOI document prior to bid submittal. By signing the document, the bidder affirms that it has not altered or modified the document in any way other than, if applicable, entering the Unit/Hours and Total Quote Amount in Part B SECTION 1.

If a bidder proposes to utilize a firm not certified by the City of Phoenix and/or not certified in the proposed scope of work at the time of bid, the proposed utilization amount for that firm will be deducted from the total proposed SBE utilization amount used for determining if the bidder is responsive to the requirements of this section. Bidder shall not include any amount the SBE firm has indicated in the LOI document as work it will sublet or is not covered in their certification description in the Contractor's Statement of Proposed SBE Utilization form. Only amounts associated with the work to be performed by the SBE, and indicated in the SBE's certification description, may be counted towards the SBE participation goal requirement of this section.

If the reduced proposed SBE utilization is insufficient to meet the established participation goal required for this contract, and no waiver documentation has been submitted, the bidder shall be determined to be **non-responsive** to the requirements of this section and the bid will not be considered.

A certified SBE firm bidding as a Prime Contractor cannot count the work it will self-perform towards meeting the required SBE subcontracting goal.

A "Letter of Intent to Perform as a Subcontractor/Supplier" will be used in determining compliance with the requirements of this section. **The proposed subcontract dollar amount listed for each SBE firm on the "Contractor's Statement of Proposed SBE Utilization" must match the SBE dollar amount indicated in the boxed areas in Parts C, D or E of the signed "Letter of Intent to Perform as a Subcontractor/Supplier."** Failure to submit a completed LOI document with the SBE's and bidder's signatures shall be determined to be **non-responsive** to the requirements of this section and the bid will not be considered.

SECTION III. IF THE BIDDER IS UNABLE TO MEET THE GOAL

A fully documented waiver request detailing why the bidder has been unable to meet the SBE utilization goal in whole, or in part, and the "good faith" effort of the bidder to obtain SBE participation. In order to be viewed as good faith efforts, a bidder's activities must be consistent with all activities that could reasonably be expected from a bidder who was actively and aggressively seeking to meet the SBE goal. To show proof of having exercised good faith efforts in trying to obtain bids from SBE firms to meet the utilization goals. The following factors are illustrative of those matters that shall be considered when judging whether the bidder made "good faith efforts".

1. A cover letter addressed to the Street Transportation Procurement Section clearly indicating whether a full or partial waiver is being requested, the percentage to be waived, and the reasons the waiver is being sought.
2. If a partial waiver is being requested, a Bidder's Statement of Proposed Utilization listing firms that will satisfy the portion of the goal that will be met must be included with the bid proposal. Additionally, a Letter of Intent to Perform as a Subcontractor/Supplier from each SBE firm that is proposed to be utilized must be included with the bid proposal.
3. Proof of contact with SBE firms, including but not limited to, fax logs, telephone logs, mail receipts, etc, including documentation of the number of times that firms were contacted, the dates of contact, and the name, phone number, fax number, and address of the contact person associated with each SBE firm. Solicitation of SBE subcontractors must be consistent with the solicitation of all subcontractors and must clearly demonstrate that SBE firms had sufficient time to submit an effective response.
4. Copies of the documents submitted to all subcontractors requesting their bid. This should include the scope of work to be bid and performed on the project.



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5. Copies of bid responses/quotes from all subcontractors who bid to perform work on the project in the areas that SBE firms were also bidding on, including information as to why SBE bids were not considered.
6. Documentation that shows efforts made to provide assistance to SBE firms in the areas of bonding, insurance, or other contracting requirements.
7. Documentation of attendance at the pre-bid conference held for the project.
8. Documentation of contact made with City personnel seeking assistance in identifying eligible SBE firms for contracting opportunities on the project.

SECTION IV. SBE WAIVER PROCEDURES

Requests for a partial or full waiver of the SBE goal for the project including all Good Faith Documentation shall be submitted as part of the bid packet. The request will be reviewed to ensure compliance with the requirements of this section. If the request is determined to meet the requirements, a waiver hearing will be scheduled and the bidder notified of the date, time, and place of the hearing. All waiver hearings are open to the public. However, only the designated representative for the contractor and City staff may participate in the proceedings.

The contractor requesting the waiver may appear at the hearing to present their request and answer questions from the Waiver Review Committee regarding their submittal. The Committee will consider the information and documentation that was submitted at the time of bid. The bidder may not present additional or new information at the hearing. At the conclusion of the hearing process the Committee will make independent recommendations on the request for waiver. The presiding officer, on behalf of the Committee, will provide a written summary of the Committee's recommendations to the City Manager's designee, the City Engineer. The City Engineer will make the final decision to grant or deny the waiver request. The City Engineer's decisions shall be final. The City will notify the contractor regarding the final decision of the City Engineer.

If a partial or full waiver of the SBE goal is granted to a bidder, the bidder shall be considered to have met the project goals and their bid will be considered responsive to the requirements of this section. If a waiver is denied, the bidder is deemed non-compliant and non-responsive to the requirements of this section and their bid will not be considered.

Failure to submit the Contractor's Statement of Proposed SBE Utilization form and a LOI from each SBE firm proposed OR a fully documented waiver request at the time of bid will be cause to determine the bidder non-responsive to the requirements of this section.

SECTION V. LIMITATION OF THE USE OF SUPPLIERS AND BROKERS TO FULFILL THE SBE GOAL

Proposed expenditures to brokers and suppliers can be used to meet the utilization goal, provided that the combined applicable expenditures do not exceed 25 percent (25%) of the total SBE goal requirement. Contractors may count one hundred percent (100%) of the dollars proposed to be paid to a SBE supplier, and all costs associated with fees and commission to be paid to a SBE broker, up to the 25% limitation.

Supplier (or Wholesaler) is defined as firm that does not directly manufacture the product being supplied and has an established, regular business that engages, as its principal business and under its own name, in the purchase and sale or lease of the products in question. A supplier is a firm that owns, operates, or maintains a store, warehouse, or other establishment in which the materials, supplies, articles or equipment of the general character described by the specifications and required under the contract are bought, kept in stock, and regularly sold or leased to the public in the usual course of business.



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EXAMPLE: An SBE goal of 5% has been established on a project where the contractor has submitted a base bid of \$1,000,000. This results in a dollar goal of \$50,000 to be subcontracted to SBE's. The contractor proposes to contract with a SBE supplier for \$100,000. Only \$12,500, or 25 percent (25%), may be counted

towards achievement of the SBE goal for this project. The remaining \$37,500 must be achieved through the use of firms that are not suppliers or brokers.

Broker is defined as firm that arranges or expedites services or transactions through the use of individuals not directly employed by the company. Brokers are not regular suppliers. Only costs associated with the fees and commission paid to the certified firm for providing such services may be applied towards the SBE contract goal.

The following defines the expenditures to SBE firms that are NOT subject to the 25% limitation. The following expenditures may be counted in their entirety towards fulfilling 100% of the utilization goal:

1. Expenditures to certified SBE firms that operate and maintain an establishment or factory to produce, on the premises, the materials or supplies purchased for the contract.
2. Expenditures to a certified SBE fabricator that operates and maintains a factory to substantially alter materials or supplies before resale.
3. Expenditures, including fees and commissions, charged to provide bona fide technical and professional personnel recruitment for the contract. The total cost paid that shall be comparable to the industry standards customarily charged for the same or similar services.
4. Expenditures, including fees and commissions, charged for providing bonds and insurance specifically required for the performance of the contract. The total cost shall be comparable to the industry standards charged for the same or similar services.

All SBE firms proposed to participate on this contract opportunity must be SBE certified by the City of Phoenix prior to the date and time of the bid.

Participation on the contract will be calculated based on that portion (dollar value) of the contract that the SBE actually performs with its own forces. This includes the cost of supplies and materials obtained by the SBE for the work on the contract, **except** in cases when; it has been determined by the City *not* to be part of the firm's certification description; the SBE is certified as a "placer", "finisher", or "installer" of those materials only, or when the supplies and/or equipment it uses to perform its work is purchased or leased from the Contractor or its affiliate.

Special emphasis and care should be taken to ensure that the following types of participation are handled properly when preparing your bid packet, as failure to correctly calculate the allowable SBE participation in the following areas shall result in your bid being declared non-responsive if the SBE goal requirement is not met:

Fees & Commissions: SBE firms that supply a bona fide service for a fee or commission may be counted only to the extent of the fees or commissions charged by the SBE. This includes, but is not limited to, providing professional, technical, consultant, or managerial services, and bonds or insurance specifically required for the performance of a contract. Fees must be reasonable, not excessive, compared to fees customary for similar services.

EXAMPLE: A SBE firm that supplies uniformed officers for security or traffic control may count only the amounts charged as a commission. The hourly amount paid to the officers may not be counted. If the "per hour" bid amount to the prime contractor is \$35, and \$25 per hour will be paid to the officers, only \$10 per hour can be counted towards achieving the SBE goal. If the firm or bidder estimates that there will be 200 hours of work bid at a rate of \$35 per hour, only \$2,000 of the total \$7,000 bid could be counted.



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Trucking & Hauling: The amount of a trucking/hauling subcontract that may be counted towards the utilization requirements may be limited. An SBE must itself own and operate at least one fully licensed,

insured, and operational truck that will be used on the contract. In addition, trucks the SBE leases without drivers under a long-term leasing agreement may be considered part of the trucking firm's workforce and

counted in full, provided the leasing agreement(s) is/are for a period of not less than 6 months and; **the leased vehicles have been recorded with the City's Equal Opportunity Department's Certification Office prior to the submittal of the LOI document.**

***EXAMPLE:** A SBE trucking firm uses seven trucks on a job; two are owned by the SBE and five are leased from other firms. If two of the five trucks are leased without drivers and the remaining three are leased with drivers from another firm, then the amount paid to the SBE for the services provided by the trucks it owns and the two it leases without drivers and operates with its own employees can be counted in full towards meeting the SBE requirements. The Contractor may not count any portion of the amount the SBE receives for the two trucks it leases with drivers towards the SBE utilization goal.*

SECTION VI. POST AWARD SBE COMPLIANCE INFORMATION - DBB

Submittal of a bid to the City of Phoenix shall constitute an agreement by the bidder to comply with the SBE utilization requirements of this section should the bidder be awarded a contract. This includes, but is not limited to, the following compliance activities:

1. The contractor shall contract, or attempt to contract, in good faith with all SBE firms listed on the Bidder's Statement of Proposed SBE Utilization form submitted with their bid. The subcontract shall be for an amount that is equal to, or greater than, the total proposed dollar amount listed on the form, with the exception of instances where the City changes a scope of work in the contract that would reduce the available work in the subcontractor's area of performance.
2. The contractor shall not reduce any of the proposed SBE scopes of work or amounts indicated on the Bidder's Statement of Proposed SBE Utilization form without first submitting a Request for Exemption and receiving approval in writing from the City's Equal Opportunity Department (EOD), Contract Compliance Division.
3. The contractor shall notify the City of Phoenix Equal Opportunity Department immediately if any firm listed on the Bidder's Statement of Proposed SBE Utilization form refuses to enter into a subcontract or fails to perform according to the requirements of the subcontract.
4. Any reduction of retention by the City to the contractor shall result in a corresponding reduction to subcontractors or suppliers who have performed satisfactory work. The contractor has 14 days from the date their retention reduction takes effect to reduce retention to the subcontractors.
5. The contractor shall return all retention monies to subcontractors at such time as the work originally proposed by the subcontractor, and expressed in the original subcontract agreement, is complete and the purchaser (City) has accepted the work and paid the prime for the work performed by the subcontractor. Retention shall be paid no later than 30 days after such payment is made by the City.
6. The contractor shall act in good faith to meet the contract SBE utilization goal and provide all necessary documentation to show proof of those efforts as requested by the City.

If for any reason the SBE firm is decertified prior to the execution of a subcontract agreement, the bidder shall find additional SBE participation in the amount equivalent to or greater than that which was originally proposed for the SBE firm. Bidder shall make every good faith effort possible in finding a SBE replacement in the proposed trade area first, before considering SBE participation in other trade areas.



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SECTION VII. Subcontract Assurances

Each contract signed by the Agency and the Successful Bidder and each subcontract signed by the Successful Bidder with a Subcontractor, including Subcontractors with lower tier Subcontractors must include the following assurances verbatim:

Prompt Payment of Subcontractors *The Contractor and Subcontractor shall promptly pay its lower tier subcontractors, sub consultants, or suppliers upon receipt of payment from the City of Phoenix (Agency).*

Progress Payments: In accordance with the Arizona Revised Statutes (ARS), Section 34-221(G), the Contractor(s) shall promptly pay its subcontractors, sub consultants, or suppliers within seven (7) calendar days of receipt of each progress payment from the Agency. Any diversion by the Contractor(s) of payments received for work performed on the contract, or failure to reasonably account for the application or use of such payments, constitutes grounds for a declaration of breach of the contract with the Agency.

Retention Payments: If the Agency reduces the Contractor's retention, the Contractor shall correspondingly, within 14 days, reduce the retentions held against the Subcontractors and suppliers that have performed satisfactory work.

Release of Retention: The Contractor(s) shall ensure prompt and full payment of retentions to Subcontractors and suppliers when their work is complete, the Agency has accepted the work, and the Agency has paid the Contractor for the work. The Contractor shall pay each Subcontractor's and supplier's retention no later than 30 days after the Agency pays Contractor for the completed scope of work.

Changes to Subcontracts and Values *The City of Phoenix prohibits Contractor(s) from altering the Contractor's Statement of Proposed SBE Utilization form without receiving prior, written consent from the City. The Equal Opportunity Department must be informed, in writing, and in advance of the following:*

- *Reduction to the scope of work performed by subcontractors working on the contract*
- *Changes in any of the subcontract values resulting in a reduced dollar amount*
- *Replacement and/or release of any subcontractor after contract award*

Contractor(s) and Subcontractor(s) are required to complete a Request for Exemption Form and have the written approval of the Contract Compliance Office prior to taking action on any of the above listed matters related to SBE subcontractors.

In the event that any provision of this subcontract varies from the provisions of the contract or subcontract, the provisions for SBE contract compliance as contained in Administrative Regulation 1.89, Section IX, shall provide definitive guidance.

Disclaimer: *Nothing in this section prevents the Contractor or Subcontractor from enforcing its subcontract with a lower tier Subcontractor or supplier for defective work, late performance, and other claims arising under the Subcontract.*



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SECTION VIII. RECORDS and REPORTING REQUIREMENTS

1. Records

During performance of the Contract, the Successful Submitter shall keep all records necessary to document the participation of all subcontractors and suppliers. The Successful Submitter shall provide the records to the Agency within 72 hours of the Agency's request and at final completion of the Contract. The Agency will prescribe the form, manner, and content of reports. The required records may include but not limited to:

- a) A complete listing of all Subcontractors and suppliers on the project;
- b) Each Subcontractor's and supplier's scope performed;
- c) The dollar value of all subcontracting work, services, and procurement;
- d) Copies of all executed Subcontracts, purchase orders, and invoices; and
- e) Copies of all payment documentation.

2. Reports

- a. The contractor shall participate in all compliance reviews determined necessary by the City. This includes, but is not limited to participating in on-site reviews, providing monthly utilization reports of SBE activity, providing signed copies of subcontracts and/or purchase orders with each SBE listed on the Bidder's Statement of Proposed SBE Utilization form, and complying with any and all requests for information the City deems appropriate for effectively monitoring this contract for compliance with the SBE Program requirements.
- b. The contractor shall provide regular, monthly report/audit information that will assist us in effectively monitoring your compliance with the SBE Program requirements. This shall include listing all subcontractors working on the contract and reporting payments into the Certification and Compliance System <https://phoenix.diversitycompliance.com>. Reporting audits shall include all payments received from the City and payments you have issued to all subcontractors and suppliers. **Copies of the first 2 pages of the Pay Request submittal are required with each report. All Monthly audit reports are to be completed online by the 15th of every month. (<https://phoenix.diversitycompliance.com>).**
 - i. The total of all payments received from the City during the previous month.
 - ii. The first two pages of each payment application submitted for those payments.
 - iii. All payments made to Subcontractors during the previous month.

Before the Agency processes the Successful Submitter's final payment and/or outstanding retention held against the Successful Submitter, the Successful Submitter shall submit to the Agency a final certification of full and final payment to each Subcontractor in the form prescribed by the Agency. The form must be completed and certified by the Successful Submitter's and each Subcontractor's duly authorized agents.

SECTION IX. PERFORMANCE OF A COMMERCIALY USEFUL FUNCTION

The prime contractor may count only expenditures to SBE subcontractors that perform a commercially useful function in the work of the contract, as defined in Chapter 18 Article VI of the City Code. A "commercially useful function" constitutes performing real and actual services related to the contract.

SBE subcontractors may enter into second-tier subcontracts consistent with normal industry practices. If an SBE subcontracts greater than twenty-five (25) percent of the work of their contract, the SBE subcontractor shall be presumed not to be performing a commercially useful function. In this event, the prime contractor will not be allowed to claim any expenditure to the SBE subcontractor.



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SECTION X. FAILURE TO COMPLY WITH THE SBE PROGRAM REQUIREMENTS

If the Equal Opportunity Department determines that the contractor will fail, or has failed, to meet the SBE subcontracting goals, and/or has failed to act in good faith to ensure compliance with the SBE conditions of its contract; it shall deem the contractor “noncompliant” and not in good standing. A noncompliant status shall result in the rejection of all future contract bids or offers for all projects or other procurements with the City until such time that the contractor has cured its breaches and demonstrates that it has faithfully performed its approved SBE utilization plan and all other provisions of this article required to be deemed in good standing. In addition to this action, the City may also exercise its option to impose any or all of the following remedies:

1. Withholding from the contractor ten percent (10%) of all future payments on the involved eligible project until it is determined that the contractor is in compliance;
2. Withholding from the contractor all future payments on the involved project until it is determined that the contractor is in compliance

Failure to cure a non-compliance status within the time frame provided by the City may result in further action, including but not limited to imposing any or all of the following sanctions:

1. Rejection of all future bids or offers from the contractor for any eligible project with the City or any of its departments or divisions for a period of (1) year after substantial completion of the contract.
2. Cancellation of the contract.



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Letter of Intent (LOI) To Perform as an SBE Subcontractor

(THIS FORM MUST BE COMPLETED BY THE SBE SUBCONTRACTOR – BOTH SBE SUBCONTRACTOR & PRIME SIGNATURE ARE REQUIRED)

Project Number: WS90500307
Contract #: TBD

Project Description: Northwest Master Plan 51st Ave Gravity Sewer (Package 4B)

TO: (Insert Name of Prime Contractor)

FROM: (Insert Name of SBE Firm)

A. The undersigned declares that the firm bidding to perform the work described herein, has been granted certification by the City of Phoenix (COP) as a Small Business Enterprise (SBE) in the area(s) of:

(COP) Certification Description:

B. The undersigned is bidding to perform the following scope(s) of work on the above referenced project:

SECTION 1 - COMPLETE THIS PORTION IF THE SCOPE OF WORK IS BEING BID BY UNIT PRICE OR HOURLY RATE SUPPLIER, BROKER, TRUCKING, HAULING, UNIFORMED OFFICERS MUST USE THIS SECTION

Table with 4 columns: Scope of Work, Unit/Hourly Rate, # of Units/Hours, Total Quote Amount

SECTION 2 - GENERAL OR SPECIALTY CONSTRUCTION TRADE AREAS MUST USE THIS SECTION

Table with 2 columns: Scope of Work, Total Quote Amount

C. Of the Total Quote Amount reflected in Part B-SECTION 2, the following scope(s) of work with the given amount will not be performed by the SBE or is/are not covered under the SBE's certification description:

Scope(s) of Work Amount \$

Subtract Amount in Part C above from the Total Quote Amount in Part B-Section 2 = * \$
* Only this amount shall be reflected on the Bidder's Statement of Proposed Utilization.

D. If trucking services are included in Part B - SECTION 1 above, SBE MUST complete the following:

Of the Total Quote Amount noted in part B-Section 1, the SBE affirms that the amount of * \$ shall be performed by drivers the firm employs, and trucks the SBE owns and leases without drivers.
(The amount referenced above is transferred from Step 9 of the Worksheet (L.O.I.W.-1). *Only this amount shall be on the Statement of Proposed Utilization)

E. All subcontractors providing Broker or Traffic Control/Security Services indicated in Part B-SECTION 1 above MUST Complete the Following:

Rate of the SBE's fees/commissions %; for a Total Amount in fees/commissions of: \$
The Percentage and Total Amount referenced above is transferred from Steps 2 and 3 of the Worksheet (page L.O.I. W.-1).
Only the Total Amt in fee/commissions shall be reflected on the Bidders Statement of Proposed Utilization.

Should the prime contractor receiving this form be selected for award of the contract, the undersigned affirms that he/she will enter into an agreement to perform the work bid herein.

(SBE Subcontractor Authorized Signature)

(Date)

(Print Name and Title)

(Phone Number)

By signing this LOI document, the Prime Contractor affirms that it has not altered or modified this document in any way other than, if applicable, entering the Unit/Hours and Total Quote Amount in Part B SECTION 1.

(Prime Contractor Authorized Signature)

(Date)

(Print Name and Title)

(Phone Number)



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**LETTER OF INTENT TO PERFORM AS A SUBCONTRACTOR/SUPPLIER
INSTRUCTIONS AND WORKSHEET - L.O.I. W.-1**

A Letter of Intent to Perform as a SBE Subcontractor/Supplier (required for each SBE subcontractor/supplier proposed). The form documents services to be performed by the subcontractor/supplier and the total dollar amount of the subcontract that will be awarded to the SBE. Only the services performed in the area(s) described by the SBE's certification description can be counted towards the SBE goal requirement.

Part I. Trucking and Hauling: SBEs should indicate on Part B-Section 1 and Part D, of the LOI form, the information regarding trucks to be used in executing the contract. The City allows the counting of all payments for services provided by trucks which the SBE owns. Trucks which the SBE leases on a long-term basis and are operated with drivers the SBE employs may also be counted in full. The payments for short-term leased trucks, with or without SBE employed drivers cannot be counted.

Only trucks for which leasing agreements have been submitted and approved by EOD as part of the SBE firm's current certification file shall be considered eligible for counting towards the goal.

STEP ONE	STEP TWO	STEP THREE
Value of work expected to be performed by trucks owned by the SBE (2 Trucks)	Value of work expected to be performed by trucks leased (with drivers) by the SBE on a long-term basis (2 Trucks)	Combined value of work expected to be performed by other trucking firms and/or trucks leased (without drivers) by the SBE (3 Trucks)
\$20,000	\$20,000	\$33,000
STEP FOUR	STEP FIVE	STEP SIX
Estimated value for services provided by all trucks the SBE will use on the contract. (Add Steps One, Two, and Three)	Expected value of work performed by trucks not eligible for counting as SBE participation (Value in Step Three)	Total estimated value that can be counted for SBE participation (Subtract Step Five from Step Four)
\$73,000	\$33,000	\$73,000 - \$33,000 =\$40,000

Part II. Fees and Commissions: Insert the information from below under Step Three-Commission/Fees Percentage and the Countable Amount for SBE Participation into Part E of the LOI form. This part is applicable for the use of uniformed officers to provide traffic control and security and other services provided at an hourly rate by non-employees of the SBE contractor.

(The following information is provided as a sample only)

STEP ONE			
Total Number of Hours	Per Hour Bid Amount	Calculation Formula: Total Gross Bid Amount	
200	\$35	200 × \$35 = \$7,000	
STEP TWO			
Per Hour Bid Amount	Officers Hourly Rate	SBE Firm Commission/Fee	Calculation Formula: Fees/Commissions Percentage
\$35	\$25	\$10	(10 / 35) * 100 = 28.57%
STEP THREE			
Gross Bid Amount (from Step One)	Commission/Fee % (from Step Two)	Calculation Formula: Amount Countable for SBE Participation	
\$7,000	28.57%	\$7,000 × .2857 = \$2,000	

Part III. Construction Trade Areas: SBE must indicate in the Scope of Work of Part B-Section 2 of the LOI form, **all** scope(s) of work associated with the Total Quote Amount. The SBE must complete Part C of the LOI form by entering the Scope of Work and amount not expected to be performed by the SBE or which is not covered under the SBE's certification description. Subtracting this amount from the Total Quote Amount in Part B-Sect. 2 will result in the portion of work that can be counted as SBE participation.

Authorized Contact for this Disclosure Statement

Name: _____
Title: _____
E-mail: _____
Phone number: _____
FAX number: _____

List any other DBA, trade name, other identity, or EIN used in the last five (5) years, the state or country where filed, and the status (active or inactive):
(if applicable):

Business Characteristics:

Business entity type – Please check appropriate box and provide additional information:

- | | | |
|--|-----------------------------|-------|
| <input type="checkbox"/> Corporation | Date of incorporation: | _____ |
| <input type="checkbox"/> Limited Liability Company | Date organized: | _____ |
| <input type="checkbox"/> Limited Liability Partnership | Date of registration: | _____ |
| <input type="checkbox"/> Limited Partnership | Date established: | _____ |
| <input type="checkbox"/> General Partnership | Date established: | _____ |
| <input type="checkbox"/> Sole Proprietor | How many years in business: | _____ |
| <input type="checkbox"/> Other (explain) | Date established: | _____ |

Was the business entity formed in the State of Arizona? Yes No

If no, indicate jurisdiction where Business Entity was formed: _____

Is the Business Entity currently registered to do business in Arizona with the Arizona Corporation Commission? Yes No Not required _____
(if sole proprietor or general partnership)

Does the Business Entity have a City of Phoenix business privilege license? Yes N If “no” explain and provide detail such as “not required” or “application in progress” or other reason.

Is the Business Entity publicly traded? Yes No

Is the responding Business Entity a Joint Venture? Yes No Note: If the Submitting Business entity is a Joint Venture, also submit a questionnaire for each Business Entity comprising the Joint Venture.

Is the Business Entity's Principal Place of Business/Executive office in Phoenix? Yes No

If "no" does the Business Entity maintain an office in Phoenix? Yes No

Provide the address and phone number for the Phoenix office.

Is the business certified by Phoenix as a Small Business Enterprise? Yes No

Identify Business Entity Officials and principal Owners:

Name(s) _____ Title _____

Percentage ownership ____%(Enter 0% if not applicable).

Name(s) _____ Title _____

Percentage ownership ____%(Enter 0% if not applicable).

Name(s) _____ Title _____

Percentage ownership ____%(Enter 0% if not applicable).

Name(s) _____ Title _____

Percentage ownership ____%(Enter 0% if not applicable).

Affiliates and Joint Venture Relationships

Does the Business entity have any Affiliates? Yes No Attach additional pages if necessary.

Affiliate name: _____

Affiliate EIN (if available): _____.

Affiliate's primary Business Activity: _____

Explain relationship with Affiliate and indicate percent ownership, if applicable. _____

Are there any Business Entity Officials or Principal Owners that the Business Entity has uncommon with this Affiliate? Yes No

Individual's Name: _____

Position/Title with Affiliate: _____

CITY OF PHOENIX: Water Services Department

PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Avenue Gravity Sewer

PROJECT NUMBER: WS90500307

SECTION 00360 – BIDDERS DISCLOSURE STATEMENT

Has the Business Entity participated in any joint Ventures within the past three years? Yes No

(Attach additional pages if necessary)

Joint Venture Name: _____

Joint venture EIN (if applicable): _____

Identify parties to the Joint Venture:

Contract History

Has the Business Entity held any contracts with the City of Phoenix in the last three (3) years?

Yes No If “yes” attach a list.

Integrity – Contract Bidding

Within the past three (3) years:

Has the Business Entity or any Affiliate been suspended or debarred from any government contracting process or been disqualified on any government procurement? Yes No

Been subject to a denial or revocation of a government prequalification? Yes No

Been denied a contract award or had a bid rejected based upon a finding of a non-responsibility by a government entity? Yes No

Agreed to a voluntary exclusion from bidding/contracting with a government entity? Yes No

Initiated a request to withdraw a bid submitted to a government entity or made any claim of an error on a bid submitted to a government entity? Yes No

Initiated a request to withdraw a bid submitted to a government entity or made any claim of an error on a bid submitted to a government entity? Yes No

For each “Yes” answer above, provide an explanation of the issues.

Integrity – Contract Award

Within the past three (3) years has the Business Entity or any Affiliate been suspended, cancelled, or terminated for cause on any government contract?

Yes No

Been subject to an administrative proceeding or civil action seeking specific performance or restitution in connection with any government contract? Yes No

Yes No

For each “yes” answer, provide an explanation. (Attach explanation on a separate sheet of paper).

Certifications/Licenses

CITY OF PHOENIX: Water Services Department

PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Avenue Gravity Sewer

PROJECT NUMBER: WS90500307

SECTION 00360 – BIDDERS DISCLOSURE STATEMENT

Within the past three (3) years, has the Business Entity or Affiliate had a revocation, suspension, or disbarment of any business or professional permit and/or license? Yes No

If “yes” provide an explanation of the issue(s), the Business Entity involved, the relationship to the submitting Business Entity, relevant dates, the government entity involved, and any remedial or corrective action(s) taken and the current status of the issues.

Legal Proceedings

Within the past three (3) years, has the Business Entity of any Affiliate:

Been the subject of an investigation, whether open or closed, by any government entity for a civil or criminal violation? Yes No

Been the subject of an indictment, grant of immunity, judgment or conviction, (including entering into a plea bargain for conduct constituting a crime)? Yes No

Received any OSHA citation and Notification of Penalty containing a violation classified as serious or willful? Yes No

Had a government entity find a willful prevailing wage or supplemental payment violation? Yes No

Been involved in litigation as either a plaintiff or a defendant involving a copyright or patent infringement violation or an anti-trust violation? Yes No

Other than previously disclosed, for the past three (3) years:

Been subject to the imposition of a fine or penalty in excess of \$1000 imposed by any government as a result of the issuance of citation, summons or notice of violation, or pursuant to any administrative, regulatory, or judicial determination? Yes No

Been charged or convicted of a criminal offense pursuant to any administrative and/or regulatory action taken by any government entity? Yes No

If “yes” provide an explanation of the issue(s), the Business Entity involved, the relationship to the submitting Business Entity, relevant dates, the government entity involved, and any remedial or corrective action(s) taken and the current status of the issues.

Leadership Integrity

If the Business Entity is a joint Venture Entity, answer “N/A – Not Applicable” to questions below:

Within the past three (3) years has any individual previously identified, or any other Business Entity Leader not previously identified, or any individual having the authority to sign, execute, or approve bids, proposals, contracts or supporting documentation with the city of Phoenix been subject to:

A sanction imposed relative to any business or professional permit and/or license? Yes No

N/A

An investigation, whether open or closed, by any government entity for a civil or criminal violation for any business-related conduct? Yes No N/A



City of Phoenix
AFFIDAVIT OF IDENTITY

Your completion of this form is required by Arizona state law. A.R.S. §§ 1-501 and -50 only if you are a sole proprietor.

I, _____ (print full name exactly as on document), hereby affirm, upon penalty of perjury, that I presented the document marked below to the City of Phoenix, that I am lawfully present in the United States, and that I am the person stated on the document. (*select one category only*)

- Arizona driver license issued after 1996.
 Print first four numbers/letters from license:

--	--	--	--
- Arizona non-operating identification license.
 Print first four numbers/letters from license:

--	--	--	--
- Birth certificate or delayed birth certificate issued in any state, territory or possession of the U.S.
 Year of birth: _____ Place of birth: _____
- United States Certificate of birth abroad
 Year of birth: _____ Place of birth: _____
- United States Passport
 Print first four number/letters on Passport:

--	--	--	--
- Foreign Passport with United States Visa
 Print first four number/letters on Passport:

--	--	--	--

 Print first four number/letters on Visa:

--	--	--	--
- I-94 Form with a photograph
 Print first four numbers on I-94

--	--	--	--
- USCIS Employment Authorization Document (EAD)
 Print first four numbers on EAD

--	--	--	--

 or Perm. Resident Card (acceptable alternative):

--	--	--	--
- Refugee Travel Document
 Date of issuance: _____ Refugee Country: _____
- U.S. Certificate of Naturalization
 Print first four digits of CIS Reg. No.

--	--	--	--
- U.S. Certificate of Citizenship
 Date of issuance: _____ Place of issuance: _____
- Tribal Certificate of Indian Blood
 Date of issuance: _____ Name of Tribe: _____
- Tribal or Bureau of Indian Affairs Affidavit of Birth
 Year of birth: _____ Place of birth: _____

Signed: _____ Dated: _____

SECTION 00500 - AGREEMENT

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SECTION 00500 - AGREEMENT

THIS AGREEMENT made and entered into as of the date of the Clerk's attestation below by and between the City of Phoenix, Arizona, an Arizona municipal corporation organized and existing under and by virtue of the laws of the State of Arizona (hereinafter called Owner) and «**Company**», «**LegalEntity**» (hereinafter called Contractor). Owner and Contractor, in consideration of the mutual covenants hereinafter set forth, agree as follows:

ARTICLE 1 - WORK

The contractor shall complete all Work as specified or indicated in the Contract Documents. This includes, but is not limited to, the installation of approximately 17,500 feet of 36" gravity sewer pipeline and manholes along 51st Avenue, from the Central Arizona Project (CAP) Canal south to Pinnacle Peak Road and then east to 47th Avenue terminating in a new junction structure constructed on an existing 36" sewer. The project also includes a bid alternate to jack and bore 405 feet of 60" steel casing and install 458 feet of 36" sewer under the CAP Canal at 51st Avenue. The scope may also include CAP Crossing and Polymer Concrete Manholes.

ARTICLE 2 - DESIGN PROFESSIONAL

The Owner has retained Wilson Engineers, LLC, who is hereinafter called the Design Professional and who is to act as Owner's representative, assume all duties and responsibilities of and have the rights and authority assigned to the Design Professional in the Contract Documents in connection with completion of the Work in accordance with the Contract Documents.

ARTICLE 3 - CONTRACT TIMES

The periods allowed for completion of the Work are as follows:

The entire Work shall be Substantially Complete in accordance with the requirements of the Contract Documents within four hundred and fifty-five (455) calendar days from the date when the Contract Times commence to run.

All Work shall be complete and ready for final acceptance as specified in the Contract Documents within thirty (30) calendar days from the actual date when pursuant to Section 00700, General Conditions, Substantial Completion of the Work has been achieved.

Liquidated Damages. Owner and Contractor recognize that time is of the essence of this Agreement and that Owner will suffer financial loss if the Work is not completed within the times specified above, plus any extensions thereof allowed in accordance with Article 12 of the General Conditions. They also recognize the delays, expense and difficulties involved in proving the actual loss suffered by Owner if the Work is not completed on time. Accordingly, instead of requiring any such proof, Owner and Contractor agree that as liquidated damages for delay (but not as a penalty) Contractor shall pay Owner one thousand seven hundred eighty dollars and no cents (\$1,780.00) for each day that expires after the time specified above for Substantial Completion until the Work is substantially complete. After Substantial Completion, if Contractor shall neglect, refuse or fail to complete the remaining Work within the time specified above for completion and readiness for final payment or any proper extension thereof granted by Owner, Contractor shall pay Owner one thousand seven hundred eighty dollars and no cents (\$1,780.00) for each day that expires after the time specified above for completion and readiness for final payment.

In addition, Contractor agrees to meet any additional Contract Times set forth in Attachment A to this Agreement. Contractor further agrees to pay Owner the liquidated damage amounts as specified in Attachment A to this Agreement if such work is not completed on time.

All time limits stated in the Contract Documents are of the essence of the Agreement.

ARTICLE 4 - CONTRACT PRICE

Owner shall pay Contractor for completion of the Work in accordance with the Contract Documents an amount in current funds equal to the amount determined pursuant to below:

for all Work, in accordance with the Bid Form, a Sum of:

_____ DOLLARS AND _____ CENTS
(written words)
\$ _____
(figures)

All specific cash allowances are included in the above price and have been computed in accordance with paragraph 11.02 of the General Conditions.

ARTICLE 5 - PAYMENT PROCEDURES

Contractor shall submit to Design Professional for review Applications for Payment covering Work performed during the preceding calendar month. Owner and Contractor mutually agree that Owner will make a progress payment based on a duly certified (by Design Professional) and approved (by a duly authorized representative of Owner) estimate of the Work covered by the corresponding Application for Payment, subject to those conditions stipulated below, in the General Conditions and in other parts of the Contract Documents.

Owner may deduct from each progress payment and final payment an amount equal to Owner's estimate of the liquidated damages then due or that would become due based on Owner's estimate of late completion of the Work, provided Contractor fails to submit and implement a written schedule recovery plan describing the cause of schedule slippage or delayed progress and the actions proposed and taken to recover schedule.

ARTICLE 6 - INTEREST

All moneys not paid when due as provided in Article 14 of the General Conditions shall bear interest in accordance with ARS #34-221(G).

ARTICLE 7 - CONTRACTOR'S REPRESENTATIONS

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

Contractor has examined and carefully studied the Contract Documents (including the Addenda listed in paragraph 8) and the other related data identified in the Bidding Documents including "technical data."

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

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

Contractor has carefully studied all reports of explorations and tests of subsurface conditions at or contiguous to the site and all drawings of physical conditions in or relating to existing surface or subsurface structures at or contiguous to the site (except Underground Facilities) which have been identified in the Supplementary Conditions as provided in paragraph 4.02 of the General Conditions. Contractor accepts

the determination set forth in Article 4 of the General Conditions of the extent of the "technical data" contained in such reports and drawings upon which Contractor is entitled to rely. Contractor acknowledges that such reports and drawings are not Contract Documents and may not be complete for Contractor's purposes. Contractor acknowledges that Owner and Design Professional do not assume responsibility for the accuracy or completeness of information and data shown or indicated in the Contract Documents with respect to Underground Facilities at or contiguous to the site. Contractor has obtained and carefully studied (or assumes responsibility for having done so) all such additional supplementary examinations, investigations, explorations, tests, studies and data concerning conditions (surface, subsurface and Underground Facilities) at or contiguous to the site or otherwise which may affect cost, progress, performance or furnishing all the Work or which relate to any aspect of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto. Contractor does not consider that any additional examinations, investigations, explorations, tests, studies or data are necessary for the performance and furnishing of the Work at the Contract Price, within the Contract Times and in accordance with the other terms and conditions of the Contract Documents.

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

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

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

ARTICLE 8 - CONTRACT DOCUMENTS

The Contract Documents are complementary, and anything mentioned or shown in a part of the Contract Documents shall be of like effect as if mentioned or shown in all parts of the Contract Documents. In resolving conflicts, the Contract Documents shall be given the priority determined by Design Professional which results in Work consistent with and reasonably inferable from their intent. Except when in contradiction with this priority rule, the Contract Documents shall be given priority by Design Professional in the following order:

- This Agreement (pages 00500-1 to 00500-5, inclusive), fully executed by Owner and Contractor.
- Addenda numbers ___ to ___, inclusive.
- Performance Bond (page 00610-1) and Payment Bond (page 00620-1).
- Notice to Proceed.
- Change orders.
- Contractor's Bid Package (Sections 00300 thru 00370).
- Supplementary Conditions (pages 00800-1 to 00800-2, inclusive).
- General Conditions (pages 00700-1 to 00700-52, inclusive).
- Specifications bearing the following general title and consisting of Divisions 1 through 33 and pages

listed in table of contents therein:

- Northwest Wastewater Master Plan Package 4B; Volume 2 of 3.
- Drawings bearing the following general title and consisting of a cover sheet and sheets listed in the Index of Drawings therein.
- Northwest Wastewater Master Plan Package 4B; Volume 3 of 3.
- Insurance Policies

The following which may be delivered or issued after the Effective Date of the Agreement and are not attached hereto:

- All Written Amendments and other documents amending, modifying or supplementing the Contract Documents pursuant to paragraphs 3.06 of the General Conditions.
- The documents listed in paragraphs 8.2 et seq. above are attached to this Agreement (except as expressly noted otherwise above).

There are no Contract Documents other than those listed above in this Article 8. The Contract Documents may only be amended, modified or supplemented as provided in paragraphs 3.06 of the General Conditions.

ARTICLE 9 - MISCELLANEOUS

Terms used in this Agreement which are defined in Article 1 of the General Conditions will have the meanings indicated in the General Conditions.

No assignment by a party hereto of any rights under or interests in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and, specifically but without limitation, moneys that may become due and moneys that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law), and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignor from any duty or responsibility under the Contract Documents.

Owner and Contractor each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns and legal representatives in respect to all covenants, agreements and obligations contained in the Contract Documents.

Any provision or part of the Contract Documents held to be void or unenforceable under any Law of Regulation shall be deemed stricken, and all remaining provisions shall continue to be valid and binding upon Owner and Contractor, who agree that the Contract Documents shall be reformed to replace such stricken provision or part thereof with a valid and enforceable provision that comes as close as possible to expressing the intention of the stricken provision.

ARTICLE 10 - CITY OF PHOENIX EQUAL EMPLOYMENT OPPORTUNITY REQUIREMENT

1.1 See Section 00100-14 - Instructions to Bidders

ARTICLE 11 - SBE UTILIZATION GOAL

See Section 350-1 – Small Business Enterprise Goal Clause and Forms

IN WITNESS WHEREOF, this Agreement has been duly executed by the parties herein named, on the date and year first above written.

The Contractor agrees that this Contract, as awarded, is for the stated work and understands that payment for the total work will be made on the basis of the indicated amount(s), as bid in the Proposal.

**PROJECT NO. WS90500307
NORTHWEST WASTEWATER MASTER PLAN PACKAGE 4B – 51ST AVENUE GRAVITY SEWER**

**BASE BID
ALTERNATE
TOTAL CONTRACT AMOUNT**

**\$«BaseBidAmount»
\$«AlternateAmount»
\$«ContractAmountInFigures»**

CITY OF PHOENIX,
an Arizona municipal corporation
Jeffrey Barton, City Manager

FIRM NAME,
a/an [enter State] [Enter Business Type]

By: _____
Eric J. Froberg, PE, City Engineer

By: _____
Name of Signatory, Title

ATTEST:

City Clerk

APPROVED AS TO FORM;
JULIE M. KRIEGH, City Attorney

By: _____

BOND NO. _____

PREMIUM: \$ _____

SECTION 00600 – BOND FORMS

<u>Subject</u>	<u>Page</u>
Performance Bond	00610-1
Payment Bond	00620-1

BOND NO. _____

PREMIUM: \$ _____

**STATUTORY PERFORMANCE BOND
PURSUANT TO TITLE 34, CHAPTER 6
OF THE ARIZONA REVISED STATUTES**

(Penalty of this bond must be 100% of the Contract Amount)

KNOW ALL MEN BY THESE PRESENT, that, «**Company**», (hereinafter called the Principal), as Principal, and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____, (hereinafter called the Surety), as Surety, are held and firmly bound unto the City of Phoenix in the County of Maricopa, State of Arizona, (hereinafter called the Obligee), in the amount of **CONTRACT AMOUNT IN WORDS DOLLARS, (\$ContractAmountInFigures)**, for the payment thereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these present.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the «**City Clerk Date WSuffix**» day of «**CouncilActionDateMonth**», «**CouncilActionDateYear**», for **WS90500307 NORTHWEST WASTEWATER MASTER PLAN PACKAGE 4B – 51ST AVENUE GRAVITY SEWER**, for 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 THIS OBLIGATION IS SUCH, that, if the said Principal shall faithfully perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of said Contract during the original term of said Contract any extension thereof, with or without notice to the Surety, and during the life of any guaranty required under the Contract, and shall also perform and fulfill all the undertakings, covenants, terms, conditions, and agreements of any all duly authorized modifications of said Contract that may hereafter be made, notice of which modifications to the Surety being hereby waived; then the above obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Title 34, Chapter 6, of the Arizona Revised Statutes, and all liabilities on this Bond shall be determined in accordance with the provisions of said Title, Chapter, and Article, to the extent as if it were copied at length herein.

THE prevailing party in a suit on this Bond shall be entitled to such reasonable attorney's fees as may be fixed by a judge of the Court.

WITNESS our hands this _____ day of _____, 20____

«**Company**»
PRINCIPAL

SEAL

AGENT OF RECORD

By: _____

AGENT ADDRESS

SURETY

SEAL

TELEPHONE NUMBER

A.M. BEST RATING:

By: _____
ATTORNEY-IN-FACT

By: _____
AGENT

BOND NO. _____

PREMIUM: \$ _____

**LABOR AND MATERIALS BOND
STATUTORY PAYMENT BOND PURSUANT TO
TITLE 34, CHAPTER 6, OF THE ARIZONA REVISED STATUTES
(Penalty of this Bond must be 100% of the Contract Amount)**

KNOW ALL MEN BY THESE PRESENT, that, «**Company**», (hereinafter called the Principal), as Principal, and _____, a corporation organized and existing under the laws of the State of _____, with its principal office in the City of _____, (hereinafter called the Surety), as Surety, are held and firmly bound unto the City of Phoenix in the County of Maricopa, State of Arizona, (hereinafter called the Obligee), in the amount of **CONTRACT AMOUNT IN WORDS DOLLARS, (\$ContractAmountInFigures)**, for the payment thereof, the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these present.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated the «**City Clerk Date WSuffix**» day of «**CouncilActionDateMonth**», «**CouncilActionDateYear**», for **WS90500307 NORTHWEST WASTEWATER MASTER PLAN PACKAGE 4B – 51ST AVENUE GRAVITY SEWER**, for 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 THIS OBLIGATION IS SUCH, that, if the said Principal shall promptly pay all moneys due to all persons supplying labor or materials to him or his subcontractors in the prosecution of the work provided for in said contract, then this obligation shall be void, otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Title 34, Chapter 6, of the Arizona Revised Statutes, and all liabilities on this Bond shall be determined in accordance with the provisions of said Title, Chapter, and Article, to the extent as if it were copied at length herein.

THE prevailing party in a suit on this Bond shall be entitled to such reasonable attorney's fees as may be fixed by a judge of the Court.

WITNESS our hands this _____ day of _____, 20____

«**Company**»
PRINCIPAL

SEAL

AGENT OF RECORD

By: _____

AGENT ADDRESS

SURETY

SEAL

TELEPHONE NUMBER

A.M. BEST RATING:

By: _____
ATTORNEY-IN-FACT

By: _____
AGENT

SECTION 00700 - GENERAL CONDITIONS

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ARTICLE 1 - DEFINITIONS AND TERMINOLOGY

1.01 Defined Terms

1.01.A Wherever used in the Bidding Requirements or Contract Documents and printed with initial capital letters, the terms listed below will have the meanings indicated which are applicable to both the singular and plural thereof. In addition to terms specifically defined, terms with initial capital letters in the Contract Documents include references to identified articles and paragraphs, and the titles of other documents or forms.

1.01.A.1 Addenda - Written or graphic instruments issued prior to the opening of Bids which clarify, correct, or change the Bidding Requirements or the proposed Contract Documents.

1.01.A.2 Agreement - The written instrument which is evidence of the agreement between Owner and Contractor covering the Work.

1.01.A.3 Application for Payment - The form acceptable to Design Professional which is to be used by Contractor during the course of the Work in requesting progress or final payments and which is to be accompanied by such supporting documentation as is required by the Contract Documents.

1.01.A.4 Asbestos - Any material that contains more than one percent asbestos and is friable or is releasing asbestos fibers into the air above current action levels established by the United States Occupational Safety and Health Administration.

1.01.A.5 Bid - The offer or proposal of a Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

1.01.A.6 Bidder - The individual or entity who submits a proposal directly to Owner.

1.01.A.7 Bidding Documents - The Bidding Requirements and the proposed Contract Documents (including all Addenda).

1.01.A.8 Bidding Requirements - The advertisement or invitation to bid, Instructions to Bidders, Bid security of acceptable form, if any, and the Bid Form with any supplements.

1.01.A.9 Bonds - Performance and Payment bonds and other instruments of security.

1.01.A.10 Change Order - A document recommended by Design Professional which is signed by Contractor and Owner and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Times, issued on or after the Effective Date of the Agreement.

1.01.A.11 Claim - An assertion by Owner or Contractor seeking an adjustment of Contract Price or Contract Times, or both, and other relief with respect to the terms of the Contract. A demand for money or services by a third party is not a Claim.

1.01.A.12 Contract - The entire and integrated written agreement between the Owner and Contractor concerning the Work. The Contract supersedes prior negotiations, representations, or agreements, whether written or oral.

1.01.A.13 Contract Documents - Those items so designated in the Agreement. Only printed or hard copies of the items listed in the Agreement are Contract Documents. Approved Shop Drawings, other Contractor submittals, and the reports and drawings of subsurface and physical conditions are not Contract Documents.

1.01.A.14 Contract Price - The moneys payable by Owner to Contractor for completion of the Work in accordance with the Contract Documents as stated in the Agreement (subject to the provisions of Paragraph 11.03 in the case of Unit Price Work).

1.01.A.15 Contract Times - The number of days or the dates stated in the Agreement to: (i) achieve Milestones, if any, (ii) achieve Substantial Completion; and (iii) complete the Work so that it is ready for final payment as evidenced by Design Professional's written recommendation of final payment.

1.01.A.16 Contractor - The individual or entity with whom Owner has entered into the Agreement.

1.01.A.17 Contractor's Contingency - means a fund to cover cost growth during the Project used at the discretion of the Contractor usually for costs that result from Project circumstances. The amount of the Contractor's Contingency is negotiated as a separate line item in each JOA proposal.

1.01.A.18 Cost of the Work - See Paragraph 11.01 for definition. Cost of the Work does not equal Contract Price or adjusted Contract Price.

1.01.A.19 Design Professional – The individual or entity named as such in the Agreement.

1.01.A.20 Design Professional's Consultant - An individual or entity having a contract with Design Professional to furnish services as Design Professional's independent professional associate or consultant with respect to the Project and who is identified as such in the Supplementary Conditions.

1.01.A.21 Drawings - That part of the Contract Documents prepared or approved by Design Professional which graphically shows the scope, extent, and character of the Work to be performed by Contractor. Shop Drawings and other Contractor submittals are not Drawings as so defined.

1.01.A.22 Effective Date of the Agreement - The date indicated in the Agreement on which it becomes effective.

1.01.A.23 Engineer - May be used interchangeably with Design Professional

1.01.A.24 Field Order - A written order issued by Design Professional which requires minor changes in the Work, but which does not involve a change in the Contract Price or the Contract Times.

1.01.A.25 General Conditions Costs – Includes, but not limited to, the following types of costs for the Contractor during the construction phase: payroll costs for project manager or construction manager but not both for Work conducted at the Site, payroll costs for the superintendent and full - time general foremen, payroll costs for management personnel resident and working on the Site, workers not included as direct labor costs engaged in support (e.g. loading/unloading, clean - up, etc.), costs of offices and temporary facilities including office materials, office supplies, office equipment minor expenses, utilities, fuel, sanitary facilities and telephone services at the Site, costs of liability insurance premiums not included in labor burdens for direct labor costs, costs of bond premiums, costs of consultants not in the direct employ of the Contractor or Subcontractors, taxes on the Work and for which the Contractor is liable, fees for permits and licenses. Certain limitations and exclusions related to Changes are described in the General Conditions for the construction phase.

1.01.A.26 General Requirements - Sections of Division 1 of the Specifications.

1.01.A.27 Hazardous Environmental Condition - The presence at the Site of Asbestos, PCBs, Petroleum, Hazardous Substance, or Radioactive Material in such quantities or circumstances that may present a substantial danger to persons or property exposed thereto.

1.01.A.28 Hazardous Substance - any material, whether solid, semi - solid, liquid or gas, which, if not stored and/or used properly, may cause harm or injury to persons through inhalation, ingestion, absorption or injection, or which may negatively impact the environment through the use or discharge of the material on the ground, in the water (including groundwater), or to the air.

1.01.A.29 Hazardous Waste - The term Hazardous Waste shall have the meaning provided in Section 1004 of the Solid Waste Disposal Act (42 USC Section 6903) as amended from time to time.

1.01.A.30 Laws and Regulations; Laws or Regulations - Any and all applicable laws, rules, regulations, ordinances, codes, and orders of any and all governmental bodies, agencies, authorities, and courts having jurisdiction.

1.01.A.31 Milestone - A principal event specified in the Contract Documents relating to an intermediate completion date or time prior to Substantial Completion of all the Work.

1.01.A.32 Notice of Award - The written notice by Owner to the Successful Bidder stating that upon timely compliance by the Successful Bidder with the condition's precedent listed therein, Owner will sign and deliver the Agreement.

1.01.A.33 Notice to Proceed - A written notice given by Owner to Contractor fixing the date on which the Contract Times will commence to run and on which Contractor shall start to perform the Work under the Contract Documents.

1.01.A.34 Owner - The individual or entity with whom Contractor has entered into the Agreement and for whom the Work is to be performed.

1.01.A.35 Owner's Contingency - means a fund to cover cost growth during the Project used at the discretion of the City usually for costs that result from City directed changes or differing/unforeseen site conditions. Owner's Contingency applies to conditions that are unanticipated and may be referred to as "unknown unknowns". The amount of the Owner's Contingency is set by the City and is in the Contract Price.

1.01.A.36 PCBs - Polychlorinated biphenyls.

1.01.A.37 Petroleum - Petroleum, including crude oil or any fraction thereof which is liquid at standard conditions of temperature and pressure (60 degrees Fahrenheit and 14.7 pounds per square inch absolute), such as oil, petroleum, fuel oil, oil sludge, oil refuse, gasoline, kerosene, and oil mixed with other non-Hazardous Waste and crude oils.

1.01.A.38 Progress Schedule - A schedule, prepared and maintained by Contractor, describing the sequence and duration of the activities comprising the Contractor's plan to accomplish the Work within the Contract Times.

1.01.A.39 Project - The total construction of which the Work to be performed under the Contract Documents may be the whole, or a part.

1.01.A.40 Radioactive Material - Source, special nuclear, or byproduct material as defined by the Atomic Energy Act of 1954 (42 USC Section 2011 et seq.) as amended from time to time.

1.01.A.41 Related Entity - An officer, director, partner, employee, agent, consultant, or Subcontractor.

1.01.A.42 Resident Project Representative - The authorized representative of Design Professional who may be assigned to the Site or any part thereof.

1.01.A.43 Samples - Physical examples of materials, equipment, or workmanship that are representative of some portion of the Work, and which establish the standards by which such portion of the Work will be judged.

1.01.A.44 Schedule of Submittals - A schedule, prepared and maintained by Contractor, of required submittals and the time requirements to support scheduled performance of related construction activities.

1.01.A.45 Schedule of Values - A schedule, prepared and maintained by Contractor, which divides the Contract Price into pay items, such that the sum of all pay items equals the Contract Price for the Work, or for any portion of the Work having a separate specified Contract Price.

1.01.A.46 Shop Drawings - All drawings, diagrams, illustrations, schedules, and other data or information which are specifically prepared or assembled by or for Contractor and submitted by Contractor to illustrate some portion of the Work.

1.01.A.47 Site - Lands or areas indicated in the Contract Documents as being furnished by Owner upon which the Work is to be performed, including rights - of - way and easements for access thereto, and such other lands furnished by Owner which are designated for the use of Contractor.

1.01.A.48 Specifications - That part of the Contract Documents consisting of written requirements for materials, equipment, systems, standards and workmanship as applied to the Work, and certain administrative requirements and procedural matters applicable thereto.

1.01.A.49 Subcontractor - An individual or entity having a direct contract with Contractor or with any other Subcontractor for the performance of a part of the Work at the Site.

1.01.A.50 Substantial Completion - The time at which the Work (or a specified part thereof) has progressed to the point where, in the opinion of Design Professional, the Work (or a specified part thereof) is sufficiently complete, in accordance with the Contract Documents, so that the Work (or a specified part thereof) can be utilized for the purposes for which it is intended. The terms "substantially complete" and "substantially completed" as applied to all or part of the Work refer to Substantial Completion thereof.

1.01.A.51 Successful Bidder - The Bidder submitting a responsive Bid to whom Owner makes an award.

1.01.A.52 Supplementary Conditions - That part of the Contract Documents which amends or supplements these General Conditions.

1.01.A.53 Supplier - A manufacturer, fabricator, supplier, distributor, materialman, or vendor having a direct contract with Contractor or with any Subcontractor to furnish materials or equipment to be incorporated in the Work by Contractor or Subcontractor.

1.01.A.54 Total Float - Number of calendar days by which the Work or any part of the Work may be delayed without necessarily extending a pertinent Contract Time.

1.01.A.55 Underground Facilities - All underground pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels, or other such facilities or attachments, and any encasements containing such facilities, including those that convey electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, water,

wastewater, storm water, other liquids or chemicals, or traffic or other control systems.

1.01.A.56 Unit Price Work - Work to be paid for on the basis of unit prices.

1.01.A.57 Warranty Period – Period for which Contractor is responsible for correction of defective Work as defined in Paragraph 13.07.

1.01.A.58 Work - The entire construction or the various separately identifiable parts thereof required to be provided under the Contract Documents. Work includes and is the result of performing or providing all labor, services, and documentation necessary to produce such construction, and furnishing, installing, and incorporating all materials and equipment into such construction, all as required by the Contract Documents.

1.01.A.59 Work Change Directive - A written statement to Contractor issued on or after the Effective Date of the Agreement and signed by Owner and recommended by Design Professional ordering an addition, deletion, or revision in the Work, or responding to differing or unforeseen subsurface or physical conditions under which the Work is to be performed or to emergencies. A Work Change Directive will not change the Contract Price or the Contract Times but is evidence that the parties expect that the change ordered or documented by a Work Change Directive will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Price or Contract Times.

1.01.A.60 Written Amendment - A written amendment of the Contract Documents, signed by Owner and Contractor on or after the Effective Date of the Agreement and normally dealing with the non-engineering or nontechnical rather than strictly construction related aspects of the Contract Documents.

1.02 Terminology

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

1.02.B Intent of Certain Terms or Adjectives:

1.02.B.1 The Contract Documents include the terms “as allowed,” “as approved,” “as ordered,” “as directed” or terms of like effect or import to authorize an exercise of professional judgment by

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

1.02.C Day:

1.02.C.1 The word “day” means a calendar day of 24 hours measured from midnight to the next midnight.

1.02.D Defective:

1.02.D.1 The word “defective,” when modifying the word “Work,” refers to Work that is unsatisfactory, faulty, or deficient in that it:

1.02.D.1.a does not conform to the Contract Documents; or

1.02.D.1.b does not meet the requirements of any applicable inspection, reference standard, test, or approval referred to in the Contract Documents; or

1.02.D.1.c has been damaged prior to Design Professional's recommendation of final payment (unless responsibility for the protection thereof has been assumed by Owner at Substantial Completion in accordance with Paragraph 14.04 or 14.05).

1.02.E Furnish, Install, Perform, Provide:

1.02.E.1 The word “furnish,” when used in connection with services, materials, or equipment, shall mean to supply and deliver said services, materials, or equipment to the Site (or some other specified location) ready for use or installation and in usable or operable condition.

1.02.E.2 The word “install,” when used in connection with services, materials, or equipment, shall mean to put into use or place in final position

said services, materials, or equipment complete and ready for intended use.

1.02.E.3 The words “perform” or “provide,” when used in connection with services, materials, or equipment, shall mean to furnish and install said services, materials, or equipment complete and ready for intended use.

1.02.E.4 When “furnish,” “install,” “perform,” or “provide” is not used in connection with services, materials, or equipment in a context clearly requiring an obligation of Contractor, “provide” is implied.

1.02.F Unless stated otherwise in the Contract Documents, words or phrases that have a well-known technical or construction industry or trade meaning are used in the Contract Documents in accordance with such recognized meaning.

1.02.G Shall, Will

1.02.G.1 The words “shall” and “will” are used interchangeably to express what is mandatory.

ARTICLE 2 - PRELIMINARY MATTERS

2.01 Delivery of Bonds and Evidence of Insurance

2.01.A When Contractor delivers the executed counterparts of the Agreement to Owner, Contractor shall also deliver to Owner such bonds as Contractor may be required to furnish.

2.01.B Evidence of Insurance: Before any Work at the Site is started, Contractor shall deliver to Owner, with copies to each additional insured identified in the Supplementary Conditions, certificates of insurance which Contractor is required to purchase and maintain in accordance with Article 5.

2.02 Copies of Documents

2.02.A Owner shall furnish to Contractor one reproducible copy of the Drawings and Specifications. Additional copies will be furnished upon request at the cost of reproduction.

2.03 Commencement of Contract Times; Notice to Proceed

2.03.A The Contract Times will commence to run on the day indicated in the Notice To Proceed. A Notice To Proceed may be given at any time within ninety (90) days after the Effective Date of the Agreement.

2.04 Starting the Work

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

2.05 Before Starting Construction

2.05.A Preconstruction Conference: A conference attended by Contractor, Design Professional, Owner and others as appropriate will be held to establish a working understanding among the parties as to the Work and to discuss the schedules referred to in the General Requirements, procedures for handling Shop Drawings and other submittals, processing Applications for Payment and maintaining required records.

2.05.B Designation of Authorized Representatives: At this conference Owner and Contractor each shall designate, in writing, a specific individual to act as its authorized representative with respect to the services and responsibilities under the Contract. Such individuals shall have the authority to transmit instructions, receive information, render decisions relative to the Contract, and otherwise act on behalf of each respective party.

2.06 Dust Control and Prevention

2.06.A To facilitate and encourage strict compliance with the Maricopa County Air Pollution Control Regulations pertaining to fugitive dust control, Contractor shall submit the following documentation to the Project Manager at the pre-construction conference prior to conducting any earth moving or dust generating activities under the Contract.

2.06.A.1 Copy of a valid Maricopa County Earth Moving (Dust Control) Permit applicable to the Work or services under the Contract.

2.06.A.2 Copy of the Dust Control Plan applicable to the Work or services under the Contract.

2.06.A.3 Documentation that all of Contractor’s on-site project managers have received the Comprehensive or Basic dust control training as required by Maricopa County Rule 310 based on project disturbed acres.

2.06.B For construction sites where:

2.06.B.1 5-acres or more are disturbed, Contractor shall designate and identify to the City

an individual who has completed the dust control training set forth in Section 2 above as the site Dust Control Coordinator. The Dust Control Coordinator shall be present on-site all times that earth moving or dust generating activities are occurring and until all ground surfaces at the site have been stabilized.

2.06.B.2 less than 1-acre is disturbed, the Contractor shall designate an individual who has completed Basic Training to be on site at all times that earth moving or dust generating activities are occurring.

2.06.C Contractor shall notify the Project manager within twenty-four (24) hours of any inspection, Notice of Violation, or other contact by the Maricopa County Air Quality Department with it or any of its subcontractors regarding the Work or services under the Contract. A copy of any written communications, notices or citations issued to Contractor or any of its subcontractors regarding the work or services under the Contract shall likewise be transmitted to the Project Manger within twenty-four (24) hours.

2.06.D The Contractor shall prevent any dust nuisance due to construction operations in accordance with MAG Specifications, Section 104.1.3, Cleanup and Dust Control. The Contractor shall use a power pick-up broom as part of the dust control effort. No separate measurement or payment will be made for cleanup or dust control, or for providing a power pick-up broom on the job.

2.06.E The Contractor may be instructed by the Design Professional to provide additional pavement cleaning (in parking lots, or other locations) above and beyond the normal expected cleanup and dust control required by MAG Section 104.1.3 If requested by the Design Professional, Contractor shall clean the requested areas with a power pick-up broom.

2.06.F Use of the power pick-up broom in the special requested areas only, shall be measured and paid for on an hourly basis under the bid item, "Power Broom". The number of hours listed in the bid proposal is only an estimate. Actual hours requested for this project may vary.

2.06.G Contractor agrees to indemnify and reimburse Owner for any fine, penalty, fee or monetary sanction imposed on Owner by Maricopa County arising out of or caused by the performance of Work or services under the Contract. Contractor shall remit payment of the reimbursable sum to the City within thirty (30) days of being presented with a demand for Payment from Owner.

ARTICLE 3 - CONTRACT DOCUMENTS: INTENT, AMENDING, REUSE

3.01 Intent

3.01.A The Contract Documents are complementary; what is required by one is as binding as if required by all.

3.01.B It is the intent of the Contract Documents to describe a functionally complete project (or part thereof) to be constructed in accordance with the Contract Documents. Any labor, documentation, services, materials, or equipment that reasonably may be inferred from the Contract Documents or from prevailing custom or trade usage as being required to produce the indicated result will be provided whether or not specifically called for at no additional cost to Owner.

3.01.C Clarifications and interpretations of the Contract Documents shall be issued by Design Professional as provided in Article 9.

3.02 Reference Standards

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

3.02.A.1 Reference to standards, specifications, manuals, or codes of any technical society, organization, or association, or to Laws or Regulations, whether such reference be specific or by implication, shall mean the standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

3.02.A.2 No provision of any such standard, specification, manual or code, or any instruction of a Supplier shall be effective to change the duties or responsibilities of Owner, Contractor, or Design Professional, or any of their subcontractors, consultants, agents, or employees from those set forth in the Contract Documents. No such provision or instruction shall be effective to assign to Owner, or Design Professional, or any of their Related Entities, any duty or authority to supervise or direct the performance of the Work or any duty or authority to undertake responsibility inconsistent with the provisions of the Contract Documents.

3.03 Reporting and Resolving Discrepancies

3.03.A Reporting Discrepancies

3.03.A.1 Contractor's Review of Contract Documents Before Starting Work: Before

undertaking each part of the Work, Contractor shall carefully study and compare the Contract Documents and check and verify pertinent figures therein and all applicable field measurements. Contractor shall promptly report in writing to Design Professional any conflict, error, ambiguity, or discrepancy which Contractor may discover and shall obtain a written interpretation or clarification from Design Professional before proceeding with any Work affected thereby.

3.03.A.2 Contractor's Review of Contract Documents During Performance of Work: If, during the performance of the Work, Contractor discovers any conflict, error, ambiguity, or discrepancy within the Contract Documents, or between the Contract Documents and (a) any applicable Law or Regulation, (b) any standard, specification, manual, or code, or (c) any instruction of any Supplier, then Contractor shall promptly report it to Design Professional in writing. Contractor shall not proceed with the Work affected thereby (except in an emergency as required by Paragraph 6.16.A) until an amendment or supplement to the Contract Documents has been issued by one of the methods indicated in Paragraph 3.06.

3.03.A.3 Contractor shall not be liable to Owner or Design Professional for failure to report any conflict, error, ambiguity, or discrepancy in the Contract Documents unless Contractor knew or reasonably should have known thereof.

3.03.B Resolving Discrepancies

3.03.B.1 Except as may be otherwise specifically stated in the Contract Documents, the provisions of the Contract Documents shall take precedence in resolving any conflict, error, ambiguity, or discrepancy between the provisions of the Contract Documents and:

3.03.B.1.a the provisions of any standard, specification, manual, or code, or instruction (whether or not specifically incorporated by reference in the Contract Documents); or

3.03.B.1.b the provisions of any Laws or Regulations applicable to the performance of the Work (unless such an interpretation of the provisions of the Contract Documents would result in violation of such Law or Regulation).

3.04 If the issue of priority involves the Specifications and Drawings, figured dimensions shall govern over scaled dimensions. Work not dimensioned shall be subject to interpretation by Design Professional. Work not expressly shown,

identified, sized or located shall be the same as similar Work shown or specified. Detail drawings shall govern over general Drawings, larger scale Drawings take precedence over smaller scale Drawings and Contract Drawings govern over Shop Drawings. Whenever notes, specifications, dimensions, details or schedules in the Specifications or Drawings, or between the Specifications and Drawings conflict, Contractor shall furnish the higher performance requirement.

3.05 References made on the Plans and in the Specifications to Maricopa Association of Governments (MAG) Standards Details and Specifications are for information only. Any references made to the MAG General Provisions by these details and specifications are not applicable to this Project. The General Conditions and Supplementary Conditions as described in the Contract Documents are applicable.

3.06 Amending and Supplementing Contract Documents

3.06.A The Contract Documents may be amended to provide for additions, deletions, and revisions in the Work or to modify the terms and conditions thereof by:

3.06.A.1 a formal Written Amendment,

3.06.A.2 a Change Order, or

3.06.A.3 a Work Change Directive.

3.06.B The requirements of the Contract Documents may be supplemented, and minor variations and deviations in the Work may be authorized, by one or more of the following ways:

3.06.B.1 A Field Order;

3.06.B.2 Design Professional's approval of a Shop Drawing or Sample (subject to the provisions of Paragraph 6.17); or

3.06.B.3 Design Professional's written interpretation or clarification.

3.07 Reuse of Documents

3.07.A Contractor and any Subcontractor or Supplier or other individual or entity performing or furnishing all of the Work under a direct or indirect contract with Contractor, shall not:

3.07.A.1 have or acquire any title to or ownership rights in any of the Drawings, Specifications, or other documents (or copies of any thereof) prepared by or bearing the seal of

Design Professional or its consultants, including electronic media editions; or

3.07.A.2 reuse any such Drawings, Specifications, other documents, or copies thereof on extensions of the Project or any other project without written consent of Owner and Design Professional and specific written verification or adaptation by Design Professional.

3.07.B The prohibitions of this Paragraph 3.07 will survive final payment, or termination of the Contract. Nothing herein shall preclude Contractor from retaining copies of the Contract Documents for record purposes.

3.08 Electronic Data

3.08.A Unless otherwise stated in the Supplementary Conditions, the data furnished by Owner or Design Professional to Contractor or by Contractor to Owner or Design Professional, that may be relied upon are limited to the printed copies (also known as hard copies). Files in electronic media format of text, data, graphics, or other types are furnished only for the convenience of the receiving party. Any conclusion or information obtained or derived from such electronic files will be at the user's sole risk. If there is a discrepancy between the electronic files and the hard copies, the hard copies govern.

3.08.B Because data stored in electronic media format can deteriorate or be modified inadvertently or otherwise without authorization of the data's creator, the party receiving electronic files agrees that it will perform acceptance tests or procedures within 60 days, after which the receiving party shall be deemed to have accepted the data thus transferred. Any errors detected within the 60 - day acceptance period will be corrected by the transferring party.

3.08.C When transferring documents in electronic media format, the transferring party makes no representations as to long term compatibility, usability, or readability of documents resulting from the use of software application packages, operating systems, or computer hardware differing from those used by the data's creator.

3.09 Data Confidentiality

3.09.A "Data" means all information, whether written or verbal, including plans, photographs, studies, investigations, audits, analyses, samples, reports, calculations, internal memos, meeting minutes, data field notes, work product, proposals, correspondence and any other similar documents

or information prepared by, obtained by, or transmitted to the Contractor or its subcontractors in the performance of this Contract.

3.09.B The parties agree that all data, regardless of form, including originals, images, and reproductions, prepared by, obtained by, or transmitted to the Contractor or its subcontractors in connection with the Contractor's or its subcontractor's performance of this Contract is confidential and proprietary information belonging to the City.

3.09.C Except as specifically provided in this Contract, the Contractor or its subcontractors shall not divulge data to any third party without prior written consent of the City. The Contractor or its subcontractors shall not use the data for any purposes except to perform the services required under this Contract. These prohibitions shall not apply to the following data provided the Contractor or its subcontractors have first given the required notice to the City:

3.09.C.1 Data which was known to the Contractor or its subcontractors prior to its performance under this Contract unless such data was acquired in connection with work performed for the City;

3.09.C.2 Data which was acquired by the Contractor or its subcontractors in its performance under this Contract and which was disclosed to the Contractor or its subcontractors by a third party, who to the best of the Contractor's or its subcontractor's knowledge and belief, had the legal right to make such disclosure and the Contractor or its subcontractors are not otherwise required to hold such data in confidence; or

3.09.C.3 Data which is required to be disclosed by virtue of law, regulation, or court order, to which the Contractor or its subcontractors are subject.

3.09.D In the event the Contractor or its subcontractors are required or requested to disclose data to a third party, or any other information to which the Contractor or its subcontractors became privy as a result of any other contract with the City, the Contractor shall first notify the City as set forth in this section of the request or demand for the data. The Contractor or its subcontractors shall give the City sufficient facts so that the City can be given an opportunity to first give its consent or take such action that the City may deem appropriate to protect such data or other information from disclosure.

3.09.E The Contractor, unless prohibited by law, within ten calendar days after completion of services for a third party on real or personal property owned or leased by the City, the Contractor or its subcontractors shall promptly deliver, as set forth in this section, a copy of all data to the City. All data shall continue to be subject to the confidentiality agreements of this Contract.

3.09.F The Contractor or its subcontractors assume all liability for maintaining the confidentiality of the data in its possession and agrees to compensate the City if any of the provisions of this section are violated by the Contractor, its employees, agents or subcontractors. Solely for the purposes of seeking injunctive relief, it is agreed that a breach of this section shall be deemed to cause irreparable harm that justifies injunctive relief in court. Contractor agrees that the requirements of this Section shall be incorporated into all subcontracts entered into by Contractor. A violation of this Section may result in immediate termination of this Contract without notice.

3.10 Personal Identifying Information - Data Security

3.10.A Personal identifying information, financial account information, or restricted City information, whether electronic format or hard copy, must be secured and protected at all times. At a minimum, Contractor must encrypt and/or password protect electronic files. This includes data saved to laptop computers, computerized devices or removable storage devices.

3.10.B When personal identifying information, financial account information, or restricted City information, regardless of its format, is no longer necessary, the information must be redacted or destroyed through appropriate and secure methods that ensure the information cannot be viewed, accessed, or reconstructed.

3.10.C In the event that data collected or obtained by Contractor or its subcontractors in connection with this Contract is believed to have been compromised, Contractor or its subcontractors shall immediately notify the Project Manager and City Engineer. Contractor agrees to reimburse the City for any costs incurred by the City to investigate potential breaches of this data and, where applicable, the cost of notifying individuals who may be impacted by the breach.

3.10.D Contractor agrees that the requirements of these Paragraphs 3.09 and 3.10 shall be incorporated into all subcontracts entered into by

Contractor. It is further agreed that a violation of this Section shall be deemed to cause irreparable harm that justifies injunctive relief in court. A violation of this Section may result in immediate termination of this Contract without notice.

3.10.E Contractor shall indemnify, defend, save and hold harmless the City and its officers, officials, agents, and employees from and against any and all claims, actions, liabilities, damages, losses, or expenses (including court costs, attorneys' fees, and cost of claims processing, investigation and litigation) for any loss caused, or alleged to be caused, in whole or in part, by Contractor or any of its owners', officers', directors', agents' or employees' failure to comply with the requirements of this Section. This indemnity includes any claim arising out of the failure of Contractor to conform to any federal, state or local law, statute, ordinance, rule, regulation or court decree.

3.10.F The obligations of Contractor or its subcontractors under these Paragraphs 3.09 and 3.10 shall survive the termination of this Contract.

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

4.01 Availability of Lands

4.01.A The Contract Documents indicate the lands upon which the Work is to be performed and those rights - of - way and access easements furnished by Owner. Easements for permanent structures or for permanent changes in existing facilities will be obtained by Owner, unless otherwise stated.

4.01.B Contractor shall obtain, at no increase in Contract Price or Contract Time, any additional lands, rights - of - way and easements that Contractor, in its sole discretion, requires for temporary facilities, ingress and egress, storage, disposal of spoil or waste material or any other purpose. Contractor shall obtain

4.01.B.1 all required permits from the U.S. Government, the State and any Political Subdivision or public utility with jurisdiction, and

4.01.B.2 permission by written agreement if private property. Contractor shall submit copies of all permits and written agreements to Owner.

4.02 Subsurface and Physical Conditions

4.02.A Reports and Drawings: The Supplementary Conditions identify:

4.02.A.1 those reports known to Owner of explorations and tests of subsurface conditions at or contiguous to the Site; and

4.02.A.2 those drawings known to Owner of physical conditions relating to existing surface or subsurface structures at the Site (except Underground Facilities).

4.02.B Limited Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the "technical data" contained in such reports and drawings, but such reports and drawings are not Contract Documents. Such "technical data" is identified in the Supplementary Conditions. Except for such reliance on such "technical data," Contractor may not rely upon or make any claim against Owner or Design Professional, or any of their Related Entities with respect to:

4.02.B.1 the completeness of such reports and drawings for Contractor's purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences, and procedures of construction to be employed by Contractor, and safety precautions and programs incident thereto; or

4.02.B.2 other data, interpretations, opinions, and information contained in such reports or shown or indicated in such drawings; or

4.02.B.3 any Contractor interpretation of or conclusion drawn from any "technical data" or any such other data, interpretations, opinions, or information.

4.03 Differing Subsurface or Physical Conditions

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

4.03.A.1 is of such a nature as to establish that any "technical data" on which Contractor is entitled to rely as provided in Paragraph 4.02 is materially inaccurate; or

4.03.A.2 is of such a nature as to require a change in the Contract Documents; or

4.03.A.3 differs materially from that shown or indicated in the Contract Documents; or

4.03.A.4 is of an unusual nature and differs materially from conditions ordinarily encountered and generally recognized as inherent in work of the character provided for in the Contract Documents; then Contractor shall, promptly after becoming aware thereof and before further disturbing the subsurface or physical conditions or performing any Work in connection therewith (except in an emergency as required by Paragraph 6.16.A), notify Owner and Design Professional in writing about such condition. Contractor shall not further disturb such condition or perform any Work in connection therewith (except as aforesaid) until receipt of written order to do so.

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

4.03.C Possible Price and Times Adjustments

4.03.C.1 In accordance with Articles 11 and 12 of the General Conditions, an adjustment in the Contract Price or in the Contract Times, or both, will be allowed to the extent that the existence of such differing subsurface or physical condition causes an increase or decrease in Contractor's cost of, or time required for performance of, the Work subject, however, to the following:

4.03.C.1.a such condition must meet any one or more of the categories described in Paragraph 4.03.A; and

4.03.C.1.b with respect to Work that is paid for on a unit price basis, any adjustment in Contract Price will be subject to the provisions of Paragraphs 9.07 and 11.03.

4.03.C.2 Contractor shall not be entitled to any adjustment in the Contract Price or Contract Times if:

4.03.C.2.a Contractor knew of the existence of such conditions at the time Contractor made a final commitment to Owner with respect to Contract Price and Contract Times by the submission of a Bid or becoming bound under a negotiated contract; or

4.03.C.2.b the existence of such condition could reasonably have been discovered or revealed as a result of any examination, investigation, exploration, test, or study of the Site and contiguous

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

4.03.C.2.c Contractor failed to give the written notice as required by Paragraph 4.03.A.

4.03.C.3 If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times, or both, a Claim may be made therefor as provided in Paragraph 10.05. However, neither Owner nor Design Professional, nor and any of their Related Entities shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

4.04 Archaeological Deposits:

4.04.A Archaeological monitoring may be required within the limits of the project during construction. The Contractor must coordinate all ground disturbing work with the archaeologist(s) and provide a current work schedule to facilitate the archaeologist's investigation and monitoring of all ground disturbing work within the area(s) of interest. When archaeological materials are discovered, the Contractor must stop work immediately within a 10-meter zone of the discovery, secure the area, and immediately notify the on-site archaeologist(s) who must then contact the City Archaeology Office (602-495-0901) or the Street Transportation Environmental Section at 602-534-3747, who will coordinate with the City Archaeology Office. The Contractor must not recommence work in the area of discovery until directed in writing by the City Archaeology Office.

4.04.B If suspected archaeological materials are discovered during construction without an archaeologist present, the Contractor must stop work immediately within a 10-meter zone of the discovery, secure the area, and immediately notify the City Archaeology Office (602-495-0901). The Contractor must not recommence work in the area of discovery until directed in writing by the City Archaeology Office.

4.04.C In 1990, the Arizona legislature amended two state laws (Arizona Antiquities Act & State Historic Preservation Act) that protect human burials and associated artifacts on both private and

state land. As specified in these laws and rephrased below:

4.04.C.1 A person shall not knowingly excavate in or upon any historic or prehistoric archaeological site, except when acting as a duly authorized agent of an institution or corporation organized for scientific, research or land use planning purposes. [Arizona Revised Statute §41-841(A) - Archaeological Discoveries] Any person, institution or corporation violating any provision of this article is guilty of a class 2 misdemeanor. [A.R.S. §41-846 - Violation].

4.04.C.2 A person who knowingly excavates in violation of A.R.S. §41-841 is guilty of a class 5 felony pursuant to Arizona Criminal Code- Title 13. A second or subsequent violation under this subsection is a class 3 felony. [A.R.S. 17 .OJ - Excavating Certain Sites].

4.04.D A class 5 felony carries potential penalties of up to two years in prison. If a City of Phoenix (City) project may impact historic or pre-historic archaeological resources, the guidelines described above must be adhered to. Therefore, no subsurface disturbance activities related to this without having an archaeological consultant on-site prior to and during this project's ground disturbance activities.

4.04.E The City of Phoenix Office of the City Engineer is requesting that the Project Archaeological Requirements Acknowledgment Form is completed for all City sponsored or managed projects involving ground subsurface disturbance activities in areas that may include archaeological resources, as determined by the City of Phoenix Archaeology Office (CAO). If archaeological monitoring is required on a project, a City Archaeological Monitoring Acknowledgment form will be provided for your review and signature. The guidelines and the provisions in the Terms and Conditions of the Archaeological Monitoring Form must be followed as prescribed on the form and referenced above in this section. Penalties for non-compliance are detailed on the Archaeological Monitoring Form. Failure to comply with the requirements of this acknowledgment form and the City contract may constitute a breach of contract.

4.04.F If Contractor discovers archaeological sites or objects, Contractor may be allowed an adjustment of Contract Time(s) pursuant to Article 12. If Owner, with the advice of Design Professional, concludes that the Contract Documents require changes due to archaeological

features, Owner shall, pursuant to Article 10 of the General Conditions, order any changes in the Work and corresponding adjustments in Contract Price required solely because of the archaeological features encountered.

4.05 Underground Facilities

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

4.05.A.1 Owner and Design Professional shall not be responsible for the accuracy or completeness of any such information or data provided by others; and

4.05.A.2 the cost of all of the following will be included in the Contract Price, and Contractor shall have full responsibility for:

4.05.A.2.a reviewing and checking all such information and data;

4.05.A.2.b locating all Underground Facilities shown or indicated in the Contract Documents;

4.05.A.2.c coordination of the Work with the owners of such Underground Facilities, including Owner, during construction; and

4.05.A.2.d the safety and protection of all such Underground Facilities and repairing any damage thereto resulting from the Work.

4.05.B Not Shown or Indicated:

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

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

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

4.06 Compliance with A.R.S. 40-360.21

4.06.A Owner shall comply in all respects with A.R.S. 40 - 360.21 et seq. as amended.

4.07 Reference Points

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

4.08 Hazardous Environmental Condition at Site

4.08.A Reports and Drawings: The Supplementary Conditions identify those reports and drawings known to Owner relating to Hazardous Environmental Conditions that have been identified at the Site.

4.08.B Limited Reliance by Contractor on Technical Data Authorized: Contractor may rely upon the accuracy of the "technical data" contained

in such reports and drawings, but such reports and drawings are not Contract Documents. Such “technical data” is identified in the Supplementary Conditions. Except for such reliance on such “technical data,” Contractor may not rely upon or make any claim against Owner or Design Professional, or any of their Related Entities with respect to:

4.08.B.1 the completeness of such reports and drawings for Contractor’s purposes, including, but not limited to, any aspects of the means, methods, techniques, sequences and procedures of construction to be employed by Contractor and safety precautions and programs incident thereto; or

4.08.B.2 other data, interpretations, opinions and information contained in such reports or shown or indicated in such drawings; or

4.08.B.3 any Contractor interpretation of or conclusion drawn from any “technical data” or any such other data, interpretations, opinions or information.

4.08.C Contractor, Subcontractors, Manufacturers and Suppliers shall use, store, process, transfer, transport, dispose of and otherwise handle Hazardous Substances in accordance with applicable Rules and Regulations.

4.08.D Except as otherwise provided in the Technical Specifications, if Contractor encounters Hazardous Substances on-site (including, but not limited to Asbestos, polychlorinated biphenyls (PCBs), Petroleum products, radioactive products or materials used in the normal course of construction as paint thinners, solvents, gasoline, oil, etc.) which were neither shown in nor inferable from Contract Documents (or otherwise identified as part of the Work) and which may present substantial danger, Contractor shall immediately (a) stop all affected Work, (b) give verbal and written notice to Owner of the conditions, and (c) take appropriate health and safety precautions. Upon receipt of the notice, Owner will investigate the conditions. If the material is a Hazardous Substance which may present substantial danger, Owner shall stop the affected Work in writing. Except as otherwise provided in Paragraph 4.08.F, Owner shall arrange for removal or other appropriate handling of the Hazardous Substance by negotiating a change in the Work with Contractor, by separate contract with other contractors, or as Owner may otherwise deem expedient; in the alternative, Owner may terminate

the Agreement or affected Work with Contractor for Owner’s convenience.

4.08.E Once the Hazardous Substance has been removed or rendered harmless in accordance with Paragraph 4.08.D, the affected Work may be resumed as directed by Owner. Pursuant to A.R.S. Section 32.1129.03, and subject to Contractor’s compliance with that Section and Paragraph 12.03.A, Contractor may be entitled to damages and time for delay attributable to the discovery of Hazardous Substances which interrupt the Work.

4.08.F Requirements for the Contractor’s management of Hazardous Substances (materials) brought onto the construction site by Contractor are addressed in the General Requirements. If contamination occurs on-site due to (a) Contractor’s violation(s) of Rules, Regulations or Contract Documents covering the use, storage, processing, transfer, transport, disposal or otherwise handling of any Hazardous Substances, or (b) any other cause within the control attributable to the fault or negligence of the Contractor, such as the spillage of chemicals, Contractor shall be responsible for all costs and time required to clean up the Site and render harmless the Hazardous Substances to the satisfaction of Owner, the State and any political subdivision with jurisdiction. Immediately upon contamination of the Site, Contractor shall notify Owner’s representative or designee. If Contractor fails to proceed with due diligence or act appropriately, Owner, in its sole discretion, shall have the right to act, and if it does so, Contractor shall defend, indemnify and hold Owner harmless from and against all claims, as provided in Paragraph 6.20.A arising out of or in any way resulting from Owner’s action under this provision. If the Owner is cited and fined by any political subdivision with jurisdiction for the herein described actions of the Contractor, Contractor shall immediately reimburse Owner for the cost of such fines.

4.09 Materials Containing Asbestos

4.09.A Materials containing asbestos and/or lead in any form are unacceptable to incorporate into the Project unless formally accepted in writing by the Owner. This written approval shall take place prior to the material being incorporated into the project and/or brought to the site.

4.09.B Repair kits or touch-up materials, materials that include asbestos and/or lead introduced into the product at the factory or applied at the assembly plant are all unacceptable. Any and all field-applied

products that are comprised of asbestos and/or lead containing materials are also unacceptable.

4.09.C If asbestos and/or lead are installed without written approval by Owner, Contractor will remove these materials at his expense and dispose of these materials in accordance with all State and Federal laws and pay for the supervision and reporting costs in addition to the cost to properly remove them.

ARTICLE 5 – BONDS AND INSURANCE

5.01 Performance and Payment Bonds: Contractor shall furnish Performance and Payment Bonds, each in an amount at least equal to the Contract Price as security for the faithful performance and payment of all Contractor's obligations under the Contract Documents. The Payment Bond shall remain in effect at least until one year after the date when final payment becomes due, except as provided otherwise by Laws and Regulations or by the Contract Documents. The Performance Bond shall remain in effect as long as Contractor is liable for (a) defective Work appearing after final inspection, (b) failure to comply with the Contract Documents or the terms or any special guaranties specified therein, or (c) Contractor's continuing obligations under the Contract Documents. Failure to comply with these provisions will be cause for rejection of the bidder's proposal.

5.01.A Bonds shall be executed by surety company or companies holding a Certificate of Authority to transact surety business in the State of Arizona, issued by the Director of the Department of Insurance. A copy of the Certificate of Authority shall accompany the bonds. The certificate shall be made payable and acceptable to the City of Phoenix. The bonds shall be written or countersigned by an authorized representative of the surety who is either a resident of the state of Arizona or whose principal office is maintained in this state, as by law required, and the bonds shall have attached thereto a certified copy of Power of Attorney of the signing official. Personal or individual bonds are not acceptable.

5.01.B All bonds submitted for this project shall be provided by a company which has been rated "A- or better for the prior four quarters" by the A.M. Best Company.

5.02 If the surety on any Bond furnished by Contractor is declared a bankrupt or becomes insolvent or its right to do business is terminated in

the State of Arizona or it ceases to meet the requirements of paragraph 5.01, Contractor shall within ten days thereafter substitute another Bond and surety, both of which must be acceptable to Owner.

5.03 Contractor's Insurance

5.03.A Contractor and subcontractors must procure insurance against claims that may arise from or relate to performance of the work hereunder by Contractor and its agents, representatives, employees and subconsultants. Contractor and subcontractors must maintain that insurance until all their obligations have been discharged, including any warranty periods under this Contract.

5.04 The Owner in no way warrants that the limits stated in this section 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 may purchase additional insurance as they determine necessary.

5.05 Scope and Limits of Insurance

5.05.A Contractor must provide coverage with limits of liability not less than those stated below. An excess liability policy or umbrella liability policy may be used to meet the liability limits provided that (1) the coverage is written on a "following form" basis, and (2) all terms under each line of coverage below are met.

5.05.A.1 Commercial General Liability -

General Aggregate	\$2,000,000
Products - Completed	\$1,000,000
Operations Aggregate	
Personal & Advertising Injury	\$1,000,000
Each Occurrence	\$1,000,000

5.05.A.1.a The policy must name the City of Phoenix as an additional insured with respect to liability for bodily injury, property damage and personal and advertising injury with respect to premises, ongoing operations, products and completed operations, and liability assumed under an insured contract arising out of the activities performed by, or on behalf of the Contractor, related to this Contract.

5.05.A.1.b Coverage must include XCU coverage.

5.05.A.1.c There shall be no endorsement or modification which limits the scope of coverage or

the policy limits available to the City of Phoenix as an additional insured.

5.05.A.1.d City of Phoenix is an additional insured to the full limits of liability purchased by the Contractor.

5.05.A.1.e The Contractor’s insurance coverage must be primary and non-contributory with respect to any insurance or self-insurance carried by the City.

5.05.A.1.f Contractor’s policies must be endorsed to provide an extension of the completed operations coverage for a period of nine years.

5.05.A.2 **Automobile Liability** - Bodily injury and property damage for any owned, hired, and non-owned vehicles used in the performance of this Contract.

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

5.05.A.2.a The policy must be endorsed to include The City of Phoenix as an additional insured with respect to liability arising out of the activities performed by, or on behalf of the Contractor, related to this Contract

5.05.A.2.b City of Phoenix is an additional insured to the full limits of liability purchased by the Contractor

5.05.A.2.c The Contractor’s insurance coverage must be primary and non-contributory with respect to any insurance or self-insurance carried by the City.

5.05.A.3 Workers’ Compensation and Employers’ Liability -

Workers’ Compensation	Statutory
Employers’ Liability	
Each Accident	\$100,000
Disease – Each Employee	\$100,000
Disease – Policy Limit	\$500,000

5.05.A.3.a Policy must contain a waiver of subrogation against the City of Phoenix.

5.05.A.3.b This requirement does not apply when a Contractor or Subcontractor is exempt under A.R.S. §23-902(E), **AND** when such contractor or subcontractor executes the appropriate sole proprietor waiver form.

5.05.A.4 **Builders’ Risk Insurance** - Policy must be in an amount equal to the initial Contract Amount plus additional coverage equal to Contract amount for all subsequent Change Orders.

5.05.A.4.a The City of Phoenix, the Contractor and Subcontractors, must be named Insureds on the policy.

5.05.A.4.b Special Causes of Loss coverage must be written on a replacement cost basis and must include coverage for soft costs, flood and earth movement.

5.05.A.4.c Coverage must be written on an all risk,

5.05.A.4.d Policy must be maintained until whichever of the following must first occur: (1) final payment has been made; or, (2) until no person or entity, other than the Owner, has an insurable interest in the property required to be covered.

5.05.A.4.e Policy must be endorsed such that the insurance must not be cancelled or lapse because of any partial use or occupancy by the Owner.

5.05.A.4.f Policy must provide coverage from the time any covered property becomes the responsibility of the Contractor, and continue without interruption during construction, renovation, or installation, including any time during which the covered property is being transported to the construction installation site, or awaiting installation, whether on or off site.

5.05.A.4.g Policy must contain a waiver of subrogation against the Owner.

5.05.A.4.h Contractor is responsible for the payment of all policy deductibles.

5.05.B Notice of Cancellation

5.05.B.1 For each insurance policy required by the insurance provisions of this Contract, the Contractor must provide to the City, within five business days of receipt, a notice if a policy is suspended, voided or cancelled for any reason. Such notice must be sent directly to the Owner’s Project Manager listed in the Supplementary Conditions.

5.05.C Acceptability of Insurers

5.05.C.1 Insurance is to be placed with insurers duly licensed or authorized to do business in the State of Arizona and with an “A.M. Best” rating of not less than B+ VI. The Owner in no way warrants that the required minimum insurer rating is sufficient to protect the Contractor from potential insurer insolvency.

5.05.D Verification of Coverage

5.05.D.1 Contractor must furnish the Owner with certificates of insurance (ACORD form or

equivalent approved by the Owner) 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.

5.05.D.2 All certificates and any required endorsements are to be received and approved by the Owner 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 the Contract.

5.05.D.3 All certificates required by this Contract must be sent directly to Design and Construction Procurement, 200 W. Washington Street, 5th Floor, Phoenix, AZ 85003. **The Contract Number, Project Number, and Project title must be noted on the certificate of insurance.** The Owner reserves the right to require complete, certified copies of all insurance policies required by this Contract, at any time. **DO NOT SEND CERTIFICATES OF INSURANCE TO THE OWNER'S RISK MANAGEMENT DIVISION.**

5.05.E Subcontractors

5.05.E.1 Contractor's certificates shall include all subcontractors as additional insureds under its policies **OR** Contractor shall be responsible for ensuring and verifying that all subcontractors have valid and collectable insurance. At any time throughout the life of the contract, the City of Phoenix reserves the right to require proof from the Contractor that its subcontractors have insurance coverage. All subcontractors providing services included under this Contract's Scope of Services are subject to the insurance coverages identified above and must include the City of Phoenix as an additional insured. In certain circumstances, the Contractor may, on behalf of its subcontractors, waive a specific type of coverage or limit of liability where appropriate to the type of work being performed under the subcontract. Contractor assumes liability for all subcontractors with respect to this Contract.

5.05.F Approval

5.05.F.1 Any modification or variation from the insurance requirements and conditions must be documented by an executed contract amendment.

ARTICLE 6 – CONTRACTOR'S RESPONSIBILITIES

6.01 Supervision and Superintendence

6.01.A Contractor shall supervise, inspect, and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor shall not be responsible for the negligence of Owner or Design Professional in the design or specification of a specific means, method, technique, sequence, or procedure of construction which is shown or indicated in and expressly required by the Contract Documents.

6.01.B At all times during the progress of the Work, Contractor shall assign a competent resident superintendent who shall not be replaced without written notice to Owner and Design Professional except under extraordinary circumstances.

6.01.C All communications given to or received from the contractor's representative, designated pursuant to Paragraph 2.05.B, shall be binding on Contractor.

6.02 Labor; Working Hours

6.02.A Contractor shall provide competent, suitably qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the Site.

6.02.B Except as otherwise required for the safety or protection of persons or the Work or property at the Site or adjacent thereto, and except as otherwise stated in the Contract Documents, all Work at the Site shall be performed during regular working hours. Contractor will not permit the performance of Work on a Saturday, Sunday, or any legal holiday without Owner's written consent (which will not be unreasonably withheld) given after prior written notice to Design Professional.

6.02.B.1 Regular working hours, unless specifically disallowed by Laws or Regulations, shall be between 6:00 a.m. and 7:00 p.m. from May 1st through September 30th and between 7:00 a.m. and 7:00 p.m. from October 1st through April 30th, not exceeding forty-five (45) hours per week. Contractor shall reimburse Owner for all additional costs resulting from Work performed outside regular working hours, which shall include (a) premium time charges of Design Professional and Owner, and (b) added costs assessed against or

incurred by Owner which Contractor could reasonably foresee.

6.02.C The combined premium time charges of Design Professional and Owner shall be as defined in the Supplementary Conditions.

6.03 Services, Materials, and Equipment

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

6.03.B All materials and equipment incorporated into the Work shall be as specified or, if not specified, shall be of good quality and new, except as otherwise provided in the Contract Documents. All special warranties and guarantees required by the Specifications shall expressly run to the benefit of Owner. If required by Design Professional, Contractor shall furnish satisfactory evidence (including reports of required tests) as to the source, kind, and quality of materials and equipment.

6.03.C All materials and equipment shall be stored, applied, installed, connected, erected, protected, used, cleaned, and conditioned in accordance with instructions of the applicable Supplier, except as otherwise may be provided in the Contract Documents.

6.04 Progress Schedule

6.04.A Contractor shall adhere to the Progress Schedule developed and maintained by Contractor in accordance with the General Requirements.

6.04.B Proposed adjustments in the Progress Schedule that will change the Contract Times shall be submitted in accordance with the requirements of Article 12. Adjustments in Contract Times may only be made by a Change Order or Written Amendment.

6.05 Substitutes and “Or-Equals”

6.05.A Whenever an item of material or equipment is specified or described in the Contract Documents by using the name of a proprietary item or the name of a particular Supplier, the specification or description is intended to establish the type, function, appearance, and quality required. If the

specification or description contains or is followed by the words “or-equal”, other items of material or equipment or other Suppliers may be accepted by the Design Professional under circumstances stated in Paragraph 6.05.A.1 below. Requests for acceptance of “or-equal” items will be received by the Design Professional after Notice to Proceed has been issued.

6.05.A.1 “Or Equal” Items: If in Design Professional’s sole discretion an item of material or equipment proposed by Contractor is functionally equal to that named and sufficiently similar so that no change in related Work will be required, it may be considered by Design Professional as an “or equal” item, in which case review and approval of the proposed item may, in Design Professional’s sole discretion, be accomplished without compliance with some or all of the requirements for acceptance of proposed substitute items. For the purposes of this Paragraph 6.05.A.1, a proposed item of material or equipment will be considered functionally equal to an item so named if:

6.05.A.1.a in the exercise of reasonable judgment Design Professional determines that:

6.05.A.1.a.1it is at least equal in materials of construction, quality, durability, appearance, strength, and design characteristics;

6.05.A.1.a.2it will reliably perform at least equally well the function and achieve the results imposed by the design concept of the completed Project as a functioning whole; and

6.05.A.1.a.3it has a proven record of performance and availability of responsive service.

6.05.A.1.b Contractor certifies that, if approved and incorporated into the Work:

6.05.A.1.b.1there will be no increase in cost to the Owner or increase in Contract Times; and

6.05.A.1.b.2it will conform substantially to the detailed requirements of the item named in the Contract Documents.

6.05.B If the specification, description, list of acceptable equipment and/or Suppliers is not followed by the words “or-equal”, other equivalent equipment or Suppliers proposed by the Contractor will be reviewed as a “pre-approved equal” by the Design Professional only prior to the Bid date. The Instructions to Bidders describes the time schedule, procedure, and other requirements for application for “pre-approved equal” acceptance. Proposed “pre-approved equal” and “or-equal” items must be

determined by the Design Professional to be equivalent as prescribed in Paragraph 6.05.A.1.

6.05.C If the Contractor proposes to use equipment, Supplier(s) or materials not equivalent to what is specified, Contractor must make an application to the Design Professional for approval of a substitute in accordance with Paragraph 6.05.C.3. Requests by the Contractor to use substitute items must be submitted to the Design Professional after the Notice to Proceed has been issued. Generally, a substitute will not be approved without a cost credit to the Owner. A substitute will be approved only through a Change Order.

6.05.C.1 Substitute Items: If in Design Professional's sole discretion an item of material or equipment proposed by Contractor does not qualify as an "or equal" item under Paragraph 6.05.A.1, it will be considered a proposed substitute item.

6.05.C.2 Contractor shall submit sufficient information as provided below to allow Design Professional to determine if the item of material or equipment proposed is essentially equivalent to that named and an acceptable substitute therefor. Requests for review of proposed substitute items of material or equipment will not be accepted by Design Professional from anyone other than Contractor.

6.05.C.3 Contractor shall make written application to Design Professional for review of a proposed substitute item of material or equipment that Contractor seeks to furnish or use. The application:

6.05.C.3.a shall certify that the proposed substitute item will:

6.05.C.3.a.1 perform adequately the functions and achieve the results called for by the general design,

6.05.C.3.a.2 be similar in substance to that specified, and

6.05.C.3.a.3 be suited to the same use as that specified;

6.05.C.3.b will state:

6.05.C.3.b.1 the extent, if any, to which the use of the proposed substitute item will prejudice Contractor's achievement of Substantial Completion on time;

6.05.C.3.b.2 whether use of the proposed substitute item in the Work will require a change in any of the Contract Documents (or in the provisions

of any other direct contract with Owner for other work on the Project) to adapt the design to the proposed substitute item; and

6.05.C.3.b.3 whether incorporation or use of the proposed substitute item in connection with the Work is subject to payment of any license fee or royalty;

6.05.C.3.c will identify:

6.05.C.3.c.1 all variations of the proposed substitute item from that specified, and

6.05.C.3.c.2 available engineering, sales, maintenance, repair, and replacement services; and

6.05.C.3.d shall contain an itemized estimate of all costs or credits that will result directly or indirectly from use of such substitute item, including costs of redesign and claims of other contractors affected by any resulting change.

6.05.D Substitute Construction Methods or Procedures: If a specific means, method, technique, sequence, or procedure of construction is expressly required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, technique, sequence, or procedure of construction approved by Design Professional. Contractor shall submit sufficient information to allow Design Professional, in Design Professional's sole discretion, to determine that the substitute proposed is equivalent to that expressly called for by the Contract Documents. The requirements for review by Design Professional will be similar to those provided in Paragraph 6.05.C.3.

6.05.E Design Professional's Evaluation: Design Professional will be allowed a reasonable time within which to evaluate each proposal or submittal made pursuant to Paragraphs 6.05.A and 6.05.C. Design Professional may require Contractor to furnish additional data about the proposed substitute item. Design Professional will be the sole judge of acceptability. No "or equal" or substitute will be ordered, installed or utilized until Design Professional's review is complete, which will be evidenced by a Change Order in the case of a substitute and an approved Shop Drawing for an "or equal." Design Professional will advise Contractor in writing of any negative determination.

6.05.E.1 The Design Professional will not accept any substitute item unless it yields a net savings to Owner and does not extend Contract Time(s), and seventy-five percent (75%) of the savings in Contract Price and reduction in Contract

Time(s) are credited to Owner. The remaining twenty five percent (25%) of the net savings in Contract Price and/or reduction in Contract Time will be credited to Contractor. If, in Design Professional's judgment, acceptance of a substitute item will result in increased future costs to Owner for operation, maintenance, or replacement, the portion of the net savings in Contract Price which is to be credited to Contractor will be reduced by an amount equal to twenty five percent (25%) of the estimated present worth of such increased future costs to Owner.

6.05.F Special Guarantee: Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any substitute.

6.05.G Design Professional's Cost Reimbursement: Design Professional will record Design Professional's costs in evaluating a substitute proposed or submitted by Contractor pursuant to Paragraphs 6.05.A and 6.05.C Whether or not Design Professional approves a substitute so proposed or submitted by Contractor, Contractor shall reimburse Owner for the charges of Design Professional for evaluating each such proposed substitute. Contractor shall also reimburse Owner for the charges of Design Professional for making changes in the Contract Documents (or in the provisions of any other direct contract with Owner) resulting from the acceptance of each proposed substitute.

6.05.H Contractor's Expense: Contractor shall provide all data in support of any proposed substitute or "or equal" at Contractor's expense.

6.06 Concerning Subcontractors, Suppliers, and Others

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

6.06.B The identity of certain Subcontractors, Manufacturers, Suppliers, individuals or entities (including those who are to furnish the principal items of materials or equipment) are required to be submitted as specified in the Bid Documents for acceptance by Owner, and if Bidder has submitted

a list thereof in accordance with Section 00330 (List of Major Subcontractors and Suppliers), Section 00331 (List of All Subcontractors and Suppliers) and Section 00340 (Schedule of Manufacturers and Suppliers of Major Equipment and Material Items), Owner's acceptance (either in writing or by failing to make written objection thereto by the date indicated for acceptance or objection in the Bid Documents or the Contract Documents) of any Subcontractor, Manufacturer, Supplier, individual or entity so identified may be revoked on the basis of reasonable objection after due investigation, in which case Contractor shall submit an acceptable replacement for the rejected Subcontractor, Supplier, or other individual or entity, and the Contract Price will be adjusted by the difference in the cost occasioned by such replacement, and an appropriate Change Order will be issued. No acceptance by Owner of any such Subcontractor, Supplier, or other individual or entity, whether initially or as a replacement, shall constitute a waiver of any right of Owner or Design Professional to reject work.

6.06.C Contractor shall be fully responsible to Owner for all acts and omissions of the Subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work just as Contractor is responsible for Contractor's own acts and omissions. Nothing in the Contract Documents:

6.06.C.1 shall create for the benefit of any such Subcontractor, Supplier, or other individual or entity any contractual relationship between Owner or Design Professional and any such Subcontractor, Supplier or other individual or entity, nor

6.06.C.2 shall create any obligation on the part of Owner or Design Professional to pay or to see to the payment of any moneys due any such Subcontractor, Supplier, or other individual or entity except as may otherwise be required by Laws and Regulations.

6.06.D Contractor shall be solely responsible for scheduling and coordinating the Work of subcontractors, Suppliers, and other individuals or entities performing or furnishing any of the Work under a direct or indirect contract with Contractor.

6.06.E Contractor shall require all Subcontractors, Suppliers, and such other individuals or entities performing or furnishing any of the Work to communicate with Design Professional through Contractor.

6.06.F The divisions and sections of the Specifications and the identifications of any Drawings shall not control Contractor in dividing the Work among Subcontractors or Suppliers or delineating the Work to be performed by any specific trade.

6.06.G All Work performed for Contractor by a Subcontractor or Supplier will be pursuant to an appropriate agreement between Contractor and the Subcontractor or Supplier which specifically binds the Subcontractor or Supplier to the applicable terms and conditions of the Contract Documents for the benefit of Owner and Design Professional. Whenever any such agreement is with a Subcontractor or Supplier who is listed as an additional insured on the property insurance provided in Article 5, the agreement between the Contractor and the Subcontractor or Supplier will contain provisions whereby the Subcontractor or Supplier waives all rights against Owner, Contractor, Design Professional, and all other individuals or entities identified in the Supplementary Conditions to be listed as insureds or additional insureds (and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them) for all losses and damages caused by, arising out of, relating to, or resulting from any of the perils or causes of loss covered by such policies and any other property insurance applicable to the Work. If the insurers on any such policies require separate waiver forms to be signed by any Subcontractor or Supplier, Contractor will obtain the same.

6.07 Payments to Subcontractors and Suppliers

6.07.A Contractor Payment to Subcontractor or Supplier. Contractor shall pay its Subcontractors or Suppliers within seven (7) calendar days of receipt of each progress payment from the Owner. The Contractor shall pay for the amount of work performed or materials supplied by each Subcontractor or Supplier as accepted and approved by the Owner with each progress payment. In addition, any reduction of retention by the Owner to the Contractor shall result in a corresponding reduction to Subcontractors or Suppliers who have performed satisfactory work. Contractor shall pay Subcontractors or Suppliers the reduced retention within fourteen (14) calendar days of the payment of the reduction of the retention to the Contractor. No Contract between Contractor and its Subcontractors and Suppliers

may materially alter the rights of any Subcontractor or Supplier to receive prompt payment and retention reduction as provided herein.

6.07.B **Prompt Payment:** If the Contractor fails to make payments in accordance with these provisions, the Owner may take any one or more of the following actions and Contractor agrees that the Owner may take such actions:

6.07.B.1 to hold the Contractor in default under this Agreement;

6.07.B.2 withhold future payments including retention until proper payment has been made to Subcontractors or Suppliers in accordance with these provisions;

6.07.B.3 reject all future Bids from the Contractor for a period not to exceed one year from Substantial Completion date of this Project; or

6.07.B.4 terminate Agreement.

6.07.C Alternative Dispute Resolution Between Contractor and Subcontractor or Supplier.

6.07.C.1 If Contractor's payment to a Subcontractor or Supplier is in dispute, Contractor and Subcontractor or Supplier agree to submit the dispute to any of one of the following dispute resolution processes within fourteen (14) calendar days from the date of any party gives notice to the others:

6.07.C.1.a binding arbitration;

6.07.C.1.b a form of alternative dispute resolution (ADR) agreeable to all parties or

6.07.C.1.c a City of Phoenix facilitated mediation.

6.07.C.2 When disputed claim is resolved through ADR or otherwise, the Contractor and Subcontractor or Supplier agrees to implement the resolution within seven (7) calendar days from the resolution date.

6.07.D **Inspection and Audit.** Contractor, its subcontractors and suppliers shall comply with A.R.S. 35-214 and the Owner shall have all rights and remedies to inspect and audit the records and files of Contractor, subcontractor or supplier, as afforded the State of Arizona, in accordance with the provisions of A.R.S. Section 35-214.

6.07.D.1 Records of the Contactor's direct personnel payroll, bond expenses, and reimbursable expenses pertaining to this Project and records of accounts between the City and the Contractor must be kept on the basis of generally

accepted accounting principles and must be made available to the City and its auditors for up to five years following Final Acceptance of the Project.

6.07.D.2 The City, its authorized representative, and/or any federal agency, reserves the right to audit the Contractor's records to verify the accuracy and appropriateness of all cost and pricing data, including data used to negotiate the Contract Documents and any Change Orders.

6.07.D.3 The City reserves the right to decrease the Contract Price and/or payments made on this Agreement and/or request reimbursement from the Contractor following final contract payment on this Agreement if, upon audit of the Contractor's records, the audit discloses the Contractor has provided false, misleading, or inaccurate cost and pricing data.

6.07.D.4 The Contractor shall include a similar provision in all of its contracts with Subcontractors and Suppliers providing services or supplying materials under the Contract Documents to ensure that the City, its authorized representative, and/or the appropriate federal agency has access to the Subcontractors and Suppliers records to verify the accuracy of all cost and pricing data.

6.07.D.5 The City reserves the right to decrease the Contract Price and/or payments made on this Agreement and/or request reimbursement from the Contractor following final contract payment on this Agreement if the above provision is not included in Subcontractors and Suppliers contracts, and one or more Subcontractors or Suppliers refuse to allow the City to audit their records to verify the accuracy and appropriateness of cost and pricing data.

6.07.D.6 If, following an audit of this Agreement, the audit discloses the Contractor has provided false, misleading, or inaccurate cost and pricing data, and the cost discrepancies exceed 1% of the total Agreement billings, the Contractor shall be liable for reimbursement of the reasonable, actual cost of the audit.

6.07.E **Non-Waiver.** Should the Owner fail or delay in exercising or enforcing any right, power, privilege, or remedy under this Section, such failure or delay shall not be deemed a waiver, release, or modification of the requirements of this Section or of any of the terms or provisions thereof.

6.07.F **Inclusion of Provisions in Subcontracts.** Contractor shall include these prompt payment provisions in every subcontract, including procurement of materials and leases of equipment for the Agreement.

6.07.G **No Third-Party Benefits or Rights.** Nothing contained in the Agreement is intended to benefit or confer any rights on any person or entity not a party to the Agreement, and no such person or entity, including but not limited to other Contractors, Subcontractors or Suppliers, may assert any claim, cause of action, or remedy against the Owner hereunder.

6.08 Patent Fees and Royalties

6.08.A Contractor shall pay all license fees and royalties and assume all costs incident to the use in the performance of the Work or the incorporation in the Work of any invention, design, process, product, or device which is the subject of patent rights or copyrights held by others. If a particular invention, design, process, product, or device is specified in the Contract Documents for use in the performance of the Work and if to the actual knowledge of Owner or Design Professional its use is subject to patent rights or copyrights calling for the payment of any license fee or royalty to others, the existence of such rights shall be disclosed by Owner in the Contract Documents.

6.08.B To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Design Professional, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to any infringement of patent rights or copyrights incident to the use in the performance of the Work or resulting from the incorporation in the Work of any invention, design, process, product, or device not specified in the Contract Documents.

6.09 Permits

6.09.A Unless otherwise provided in the Supplementary Conditions, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work which are applicable at the time of opening of Bids,

or, if there are no Bids, on the Effective Date of the Agreement. Owner shall pay all charges of utility owners for connections for providing permanent service to the Work.

6.10 Laws and Regulations

6.10.A Contractor shall give all notices required by and shall comply with all Laws and Regulations applicable to the performance of the Work. Except where otherwise expressly required by applicable Laws and Regulations, neither Owner nor Design Professional shall be responsible for monitoring Contractor's compliance with any Laws or Regulations.

6.10.B If Contractor performs any Work knowing or having reason to know that it is contrary to Laws or Regulations, Contractor shall bear all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to such Work. However, it shall not be Contractor's responsibility to make certain that the Specifications and Drawings are in accordance with Laws and Regulations, but this shall not relieve Contractor of Contractor's obligations under Paragraph 3.03.

6.10.C Contractor shall (a) comply with all Laws and Regulations governing the use of explosives, (b) obtain and pay for any required permits before their use, and (c) furnish a copy of the permits to Design Professional before using explosives. Contractor shall, under the supervision of competent and suitably trained and qualified personnel, exercise the utmost care not to endanger life or damage property in the transportation, storage, handling, use and disposal of explosives. Contractor shall be responsible for and shall defend, indemnify and hold harmless Owner and Design Professional against all claims for injury, damage and other adverse impacts inside and outside the permit area resulting from the use of explosives, including but not limited to all costs, delay and delay costs.

6.10.D Changes in Laws or Regulations not known at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids) having an effect on the cost or time of performance of the Work shall be the subject of an adjustment in Contract Price or Contract Times. If Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any such

adjustment, a Claim may be made therefor as provided in Paragraph 10.05.

6.10.E Fair Treatment of Workers

6.10.E.1 The Contractor shall keep fully informed of all Federal and State laws, County and City ordinances, regulations, codes and all orders and decrees of bodies or tribunals having any jurisdiction or authority, which in any way affect the conduct of the work. He shall at all times observe and comply with all such laws, ordinances, regulations, codes, orders and decrees; this includes, but is not limited to Laws and Regulations ensuring fair and equal treatment for all employees and against unfair employment practices, including OSHA and Fair Labor Standards Act (FSLA). The Contractor shall protect and indemnify the Contracting Agency and its representatives against any claim or liability arising from or based on the violation of such, whether by himself or his employees.

6.10.F No Israel Boycott

6.10.F.1 By entering into this contract, the Engineer/Contractor certifies that they are not currently engaged in and agrees for the duration of the Contract to not engage in, a boycott of Israel.

6.10.G No Forced Labor of Ethnic Uyghurs

6.10.G.1 If this Contract requires Contractor (a company engaging in for-profit activity and having ten or more full-time employees) to acquire or dispose of services, supplies, information technology, goods, or construction, then pursuant to Title 35, Chapter 2, Article 10 of the Arizona Revised Statutes Contractor must certify and agree that it and any contractors, subcontractors, or suppliers it utilizes do not and will not use the forced labor of ethnic Uyghurs in the People's Republic of China or any goods or services produced by such forced labor. Provided these statutory requirements are applicable, Contractor, by entering this Contract, now certifies it is not currently engaged in, and agrees for the duration of the Contract to not engage in, (a) the use of forced labor of ethnic Uyghurs in the People's Republic of China; (b) the use of any goods or services produced by the forced labor of ethnic Uyghurs in the People's Republic of China; or (c) the use of 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.

6.11 Use of Site and Other Areas

6.11.A Limitation on Use of Site and Other Areas

6.11.A.1 Contractor shall confine construction equipment, the storage of materials and equipment, and the operations of workers to the Site and other areas permitted by Laws and Regulations, and as directed in the General Requirements. Contractor shall assume full responsibility for any damage to any such land or area, or to the owner or occupant thereof, or of any adjacent land or areas resulting from the performance of the Work.

6.11.A.2 Should any claim be made by any such owner or occupant because of the performance of the Work, Contractor shall promptly settle with such other party by negotiation or otherwise resolve the claim by other dispute resolution proceeding or at law.

6.11.A.3 To the fullest extent permitted by Laws and Regulations, Contractor shall indemnify and hold harmless Owner and Design Professional, and the officers, directors, members, partners, employees, agents, consultants and subcontractors of each and any of them from and against all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to any claim or action, legal or equitable, brought by any such owner or occupant against Owner, Design Professional, or any other party indemnified hereunder to the extent caused by or based upon Contractor's performance of the Work.

6.11.B Removal of Debris During Performance of the Work: During the progress of the Work Contractor shall keep the Site and other areas free from accumulations of waste materials, rubbish, and other debris. Removal and disposal of such waste materials, rubbish, and other debris shall conform to applicable Laws and Regulations.

6.11.C Cleaning: Prior to Substantial Completion of the Work Contractor shall clean the Site and the Work and make it ready for utilization by Owner. At the completion of the Work Contractor shall remove from the Site all tools, appliances, construction equipment and machinery, and surplus materials and shall restore to original condition all property not designated for alteration by the Contract Documents.

6.11.D Loading Structures: Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the

structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

6.12 Record Documents

6.12.A Contractor shall maintain record documents as indicated in the General Requirements.

6.13 Safety and Protection

6.13.A Contractor shall be solely responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Such responsibility does not relieve Subcontractors of their responsibility for the safety of persons or property in the performance of their work, nor for compliance with applicable safety Laws and Regulations. Contractor shall take all necessary precautions for the safety of, and shall provide the necessary protection to prevent damage, injury or loss to:

6.13.A.1 all persons on the Site or who may be affected by the Work;

6.13.A.2 all the Work and materials and equipment to be incorporated therein, whether in storage on or off the Site; and

6.13.A.3 other property at the Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities, and Underground Facilities not designated for removal, relocation, or replacement in the course of construction.

6.13.B Contractor shall comply with all applicable Laws and Regulations relating to the safety of persons or property, or to the protection of persons or property from damage, injury, or loss; and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall notify owners of adjacent property and of Underground Facilities and other utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation, and replacement of their property.

6.13.C Contractor shall comply with the applicable requirements of Owner's safety programs, if any. The Supplementary Conditions identify any Owner's safety programs that are applicable to the Work.

6.13.D Contractor shall inform Owner and Design Professional of the specific requirements of Contractor's safety program with which Owner's

and Design Professional's employees and representatives must comply while at the site.

6.13.E All damage, injury, or loss to any property referred to in Paragraph 6.13.A.2 or 6.13.A.3 caused, directly or indirectly, in whole or in part, by Contractor, any Subcontractor, Supplier, or any other individual or entity directly or indirectly employed by any of them to perform any of the Work, or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of Owner or Design Professional, or anyone employed by any of them, or anyone for whose acts any of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor or any Subcontractor, Supplier, or other individual or entity directly or indirectly employed by any of them).

6.13.F Contractor's duties and responsibilities for safety and for protection of the Work shall continue until such time as all the Work is completed and Design Professional has issued a notice to Owner and Contractor in accordance with Paragraph 14.07.D that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

6.14 Safety Representative

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

6.14.B The safety representative will also be qualified to manage the hazardous materials management requirements described in the General Requirements.

6.15 Hazard Communication Programs

6.15.A Contractor shall be responsible for coordinating any exchange of material safety data sheets or other hazard communication information required to be made available to or exchanged between or among employers at the Site in accordance with Laws or Regulations. This also applies to the hazardous materials management requirements described in the General Requirements.

6.15.B Contractor shall contact the Owner's Environmental Health and Safety (EHS) Specialist at the Site where Work is to be performed to obtain information regarding the EHS policies and

participate in any required training. Contractor shall comply with all EHS policies in effect during the performance of its Work.

6.16 Emergencies

6.16.A In emergencies affecting the safety or protection of persons or the Work or property at the Site or adjacent thereto, Contractor is obligated to act to prevent threatened damage, injury, or loss. Contractor shall give Design Professional prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby or are required as a result thereof. If Design Professional determines that a change in the Contract Documents is required because of the action taken by Contractor in response to such an emergency, a Work Change Directive or Change Order will be issued.

6.17 Shop Drawings and Samples

6.17.A Unless otherwise indicated in the General Requirements, Contractor shall submit Shop Drawings and Samples to Design Professional, for review and approval. Procedures for submittal, review, approval and resubmittal of Shop Drawings, Samples and other submittals are detailed in the General Requirements.

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

6.17.B.1 Technical submittal(s) consisting of drawings and specifications involving architecture, professional engineering, land surveying or landscape architecture, as defined in A.R.S. Title 32, shall be prepared by or under the direct supervision of a registrant within the specific category involved.

6.17.B.2 Submittal(s) are not Contract Documents. Technical submittal(s) are intended to demonstrate how Contractor intends to conform with the design concept of the Project and the information given in the Contract Documents.

6.17.C Design Professional's Review

6.17.C.1 Design Professional's review and approval will not extend to means, methods, techniques, sequences, or procedures of construction (except where a particular means, method, technique, sequence, or procedure of

construction is specifically and expressly called for by the Contract Documents) or to safety precautions or programs incident thereto. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

6.18 Continuing the Work

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

6.19 Contractor's General Warranty and Guarantee

6.19.A Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective. Design Professional and its Related Entities shall be entitled to rely on representation of Contractor's warranty and guarantee.

6.19.B Contractor's warranty and guarantee hereunder excludes defects or damage caused by:

6.19.B.1 abuse, modification, or improper maintenance or operation by persons other than Contractor, Subcontractors, Suppliers, or any other individual or entity for whom Contractor is responsible; or

6.19.B.2 normal wear and tear under normal usage.

6.19.C Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. None of the following will constitute an acceptance of Work that is not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents:

6.19.C.1 observations by Design Professional;

6.19.C.2 recommendation by Design Professional or payment by Owner of any progress or final payment;

6.19.C.3 the issuance of a certificate of Substantial Completion by Design Professional or any payment related thereto by Owner;

6.19.C.4 use or occupancy of the Work or any part thereof by Owner;

6.19.C.5 any review and approval of a Shop Drawing or Sample submittal or the issuance of a notice of acceptability by Design Professional;

6.19.C.6 any inspection, test, or approval by others; or

6.19.C.7 any correction of defective Work by Owner.

6.19.C.8 expiration of the correction period pursuant to Paragraph 13.07.

6.20 Defense and Indemnification

6.20.A To the maximum extent allowed by law, including Title 34 A.R.S., Contractor ("Indemnitor") agrees to defend, indemnify, and hold harmless the City of Phoenix and its officers, officials (elected or appointed), agents and employees (and any jurisdiction or agency issuing permits for any work included in the project, and its officers, agents and employees) ("Indemnitee") from any and all claims, actions, liabilities, damages, losses or expenses, (including but not limited to court costs, attorney fees, expert fees, and costs of claim processing, investigation and litigation) of any nature or kind whatsoever ("Losses") caused or alleged to be caused, in whole or in part, by the wrongful, negligent or willful acts, or errors or omissions of Indemnitor or any of its owners, officers, directors, members, managers, agents, employees, or subcontractors (Indemnitor's Agents") arising out of or in connection with this Contract. This defense and indemnity obligation includes holding Indemnitee harmless for any Losses or other amount arising out of or recovered under any state's workers' compensation law or arising out of the failure of Indemnitor or Indemnitor's Agents to conform to any federal, state or local law, statute, ordinance, rule, regulation, or court decree. Indemnitor's duty to defend Indemnitee accrues immediately at the time a claim is threatened or a claim is made against Indemnitee, whichever is first. Indemnitor's duty to defend exists regardless of whether Indemnitor is ultimately found liable. Indemnitor must indemnify Indemnitee from and against any and all Losses, except where it is proven that those Losses are solely as a result of Indemnitee's own negligent or willful acts or omissions. Indemnitor is responsible for primary loss investigation, defense and judgment costs where this indemnification applies. In consideration of the City's award of this Contract, Indemnitor agrees to waive all rights of subrogation against Indemnitee for losses arising from or related to any work performed by Indemnitor or Indemnitor's

Agents for the City of Phoenix under this Contract. The obligations of Indemnitor under this provision survive the termination or expiration of this Contract.

6.20.B Delegation of Professional Design Services

6.20.C Contractor will not be required to provide professional design services unless such services are specifically required by the Contract Documents for a portion of the Work or unless such services are required to carry out Contractor's responsibilities for construction means, methods, techniques, sequences and procedures. Contractor shall not be required to provide professional services in violation of applicable law.

6.20.D If professional design services or certifications by a design professional related to systems, materials or equipment are specifically required of Contractor by the Contract Documents, Owner and Design Professional will specify all performance and design criteria that such services must satisfy. Contractor shall cause such services or certifications to be provided by a properly licensed professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings and other submittals prepared by such professional. Shop Drawings and other submittals related to the Work designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to Design Professional.

6.20.E Owner and Design Professional shall be entitled to rely upon the adequacy, accuracy and completeness of the services, certifications or approvals performed by such design professionals, provided Owner and Design Professional have specified to Contractor all performance and design criteria that such services must satisfy.

6.20.F Pursuant to this Paragraph 6.21, Design Professional's review and approval of design calculations and design drawings will be only for the limited purpose of checking for conformance with performance and design criteria given and the design concept expressed in the Contract Documents. Design Professional's review and approval of Shop Drawings and other submittals (except design calculations and design drawings) will be only for the purpose stated in Paragraph 6.17.

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

6.21 Quality Control

6.21.A Contractor shall establish a quality control program:

6.21.A.1 to insure sufficient supervision, examination, inspection and testing of all items of Work at appropriate intervals, including those of Subcontractors and Suppliers; and

6.21.A.2 to control conformance to the applicable Specifications and Drawings with respect to identified products, workmanship, construction, maintenance while idle, finish and functional performance. At minimum Contractor's quality control program shall include checking, approval and coordination of submittal and oversight of all specified tests; and it shall specifically assign to responsible Contractor personnel the obligation to verify and inspect when complete all items of Work which cannot be later located or inspected without uncovering Work. Contractor shall accurately annotate data on the thus obtained record documents.

6.22. Off Duty Police Office Requirements

6.22.A. Off-duty police officers are required for construction projects as defined in the most recent edition of the City of Phoenix Traffic Barricade Manual and TRACS permit. The Contractor must competitively procure off-duty police with vendors who are Authorized Traffic Coordinators with the City of Phoenix Police Department or Phoenix Police Department off-duty detail. The following requirements must be included in the procurement:

6.22.A.2.a Hourly fees charged

6.22.A.2.b Administrative fees (administrative fees to be charged as a part of the hourly rate, not billed separately)

6.22.A.2.c Pay applications requesting reimbursement for Off Duty Police hours worked will be accompanied with itemized documentation indicating officer name, date worked, hours worked, time of day worked and location.

6.22.A.2.d For audit purposes, contractor's files will contain documentation from the successful off duty vendor that the above items are accounted for in the vendor's price proposal.

ARTICLE 7 - OTHER WORK AT THE SITE

7.01 Related Work at Site

7.01.A Owner may perform other work related to the Project at the Site with Owner's employees, or through other direct contracts therefor, or have

other work performed by utility owners. If such other work is not noted in the Contract Documents, then:

7.01.A.1 written notice thereof will be given to Contractor prior to starting any such other work; and

7.01.A.2 if Owner and Contractor are unable to agree on entitlement to or on the amount or extent, if any, of any adjustment in the Contract Price or Contract Times that should be allowed as a result of such other work, a Claim may be made therefor as provided in Paragraph 10.05.

7.01.B Contractor shall afford each other contractor who is a party to such a direct contract, each utility owner and Owner, if Owner is performing other work with Owner's employees, proper and safe access to the Site, provide a reasonable opportunity for the introduction and storage of materials and equipment and the execution of such other work, and properly coordinate the Work with theirs. Contractor shall do all cutting, fitting, and patching of the Work that may be required to properly connect or otherwise make its several parts come together and properly integrate with such other work. Contractor shall not endanger any work of others by cutting, excavating, or otherwise altering such work; provided, however, that Contractor may cut or alter others' Work with the written consent of Design Professional and the others whose work will be affected. The duties and responsibilities of Contractor under this Paragraph are for the benefit of such utility owners and other contractors to the extent that there are comparable provisions for the benefit of Contractor in said direct contracts between Owner and such utility owners and other contractors.

7.01.C If the proper execution or results of any part of Contractor's Work depends upon work performed by others under this Article 7, Contractor shall inspect such other work and promptly report to Design Professional in writing any delays, defects, or deficiencies in such other work that render it unavailable or unsuitable for the proper execution and results of Contractor's Work. Contractor's failure to so report will constitute an acceptance of such other work as fit and proper for integration with Contractor's Work except for latent defects and deficiencies in such other work.

7.02 Coordination

7.02.A If Owner intends to contract with others for the performance of other work on the Project at the Site, the following will be set forth in Supplementary Conditions:

7.02.A.1 the individual or entity who will have authority and responsibility for coordination of the activities among the various contractors will be identified;

7.02.A.2 the specific matters to be covered by such authority and responsibility will be itemized; and

7.02.A.3 the extent of such authority and responsibilities will be provided.

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

7.03 Legal Relationships

7.03.A Paragraphs 7.01.A and 7.02 are not applicable for utilities not under the control of Owner.

7.03.B Each other direct contract of Owner under Paragraph 7.01.A shall provide that the other contractor is liable to Owner and Contractor for the reasonable direct delay and disruption costs incurred by Contractor as a result of the other contractor's actions or inactions.

7.04 Mutual Duties and Responsibilities

7.04.A If Contractor causes damage to the Work or property of others, Contractor shall promptly attempt to settle with that party or otherwise resolve the claim. Contractor shall defend, indemnify and hold harmless Owner and Design Professional from and against all claims, as provided in Paragraph 6.20.A, arising out of or resulting from damage by Contractor to the Work or property of others or from Contractor's performance of the Work.

7.04.B If another party causes damage to the Work or property of Contractor, Contractor shall promptly attempt to settle with that party or otherwise resolve the claim. Contractor shall not begin any action against Owner or Design Professional, their consultants, agents or any of their directors, officers, shareholders, agents or employees, or permit any action against them to be maintained in Contractor's name or for Contractor's benefit in any court or tribunal, which action seeks to impose liability or recover damages from Owner or Design Professional for such claim.

7.04.C If Contractor becomes involved in settling or otherwise resolving claims with other persons performing work under the circumstances covered in Paragraphs 7.04.A or 7.04.B, or because of any other similar controversy, including damage to the

Work or other work or a dispute about responsibility for clean-up or any other issue, neither Owner, Design Professional, nor any of their respective consultants, directors, officers, stockholders, employees or agents will be involved in any way in such actions (unless subpoenaed). If Owner incurs costs contrary to the provisions of this Article, Contractor shall reimburse Owner for those costs.

ARTICLE 8 - OWNER'S RESPONSIBILITIES

8.01 Communications to Contractor

8.01.A Except as otherwise provided in these General Conditions, Owner shall issue all communications to Contractor through Design Professional.

8.02 Replacement of Individual or Entity

8.02.A In case of termination of the employment of Design Professional, Owner shall appoint a design professional to whom Contractor makes no reasonable objection, whose status under the Contract Documents shall be that of the former Design Professional.

8.02.B If Design Professional reasonably objects to any of Contractor's personnel because they are unfit, unskilled, disorderly or counter-productive to the Work, Contractor shall promptly correct the problem and, if required, remove such personnel from the Work. Contractor shall defend, indemnify and hold Owner and Design Professional harmless from and against all claims, losses and expenses (including attorneys' fees and costs of defense and appeal, if any) arising from the enforcement of this clause.

8.03 Furnish Data

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

8.04 Pay When Due

8.04.A Owner shall make payments to Contractor when they are due as provided in Paragraphs 14.02.B and 14.07.E.1.

8.05 Lands and Easements; Reports and Tests

8.05.A Owner's duties with respect to providing lands and easements and providing engineering surveys to establish reference points are set forth in Paragraphs 4.01 and 4.07. Paragraph 4.02 refers to Owner's identifying and making available to Contractor copies of reports of explorations and tests of subsurface conditions and drawings of

physical conditions relating to existing surface or subsurface structures at the Site.

8.06 Change Orders

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

8.07 Inspections, Tests, and Approvals

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

8.08 Limitations on Owner's Responsibilities

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

8.08.B Neither (a) Owner's authority to review Contractor's Progress Schedules (as set forth in Article 6), nor (b) Owner's decision to raise or not raise objections about Progress schedule submittal, shall create or impose any duty or responsibility on Owner to exercise any such authority or decision for the benefit of Contractor, any Subcontractor or Supplier or any other person.

8.08.C Neither (a) Owner's authority to review the required certificates and policies of insurance, nor (b) Owner's decision to object or not to object to the certificates or policies, shall create or impose any duty or responsibility on Owner to exercise any such authority or decision for the benefit of Contractor, any Subcontractor or Supplier or any other person.

8.09 Undisclosed Hazardous Environmental Condition

8.09.A Owner's responsibility in respect to an undisclosed Hazardous Environmental Condition is set forth in Paragraph 4.08.

8.10 Compliance with Safety Program

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

ARTICLE 9 - DESIGN PROFESSIONAL'S STATUS DURING CONSTRUCTION

9.01 Owner's Representative

9.01.A Design Professional will be Owner's representative during the construction period. The duties and responsibilities and the limitations of authority of Design Professional as Owner's representative during construction are set forth in the Contract Documents and will not be changed without written consent of Owner.

9.02 Visits to Site

9.02.A Design Professional will make visits to the Site at intervals appropriate to the various stages of construction as Design Professional deems necessary in order to observe as an experienced and qualified design professional the progress that has been made and the quality of the various aspects of Contractor's executed Work. Based on information obtained during such visits and observations, Design Professional, for the benefit of Owner, will determine, in general, if the Work is proceeding in accordance with the Contract Documents. Design Professional will not be required to make exhaustive or continuous inspections on the Site to check the quality or quantity of the Work. Design Professional's efforts will be directed toward providing for Owner a greater degree of confidence that the completed Work will conform generally to the Contract Documents. On the basis of such visits and observations, Design Professional will keep Owner informed of the progress of the Work and will endeavor to guard Owner against defective Work.

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

9.03 Project Representative

9.03.A If Owner and Design Professional agree, Design Professional will furnish a Resident Project Representative to assist Design Professional in

providing more extensive observation of the Work. If Owner designates another representative or agent to represent Owner at the Site who is not Design Professional's consultant, agent or employee, they will be identified, and the responsibilities and authority and limitations thereon of such other individual or entity will be as provided in the Supplementary Conditions.

9.04 Authorized Variations in Work

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

9.05 Rejecting Defective Work

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

9.06 Shop Drawings, Change Orders and Payments

9.06.A In connection with Design Professional's authority, and limitations thereof, as to Shop Drawings and Samples, see Paragraph 6.17.

9.06.B In connection with Design Professional's authority, and limitations thereof, as to design calculations and design drawings submitted in response to a delegation of professional design services, if any, see Paragraph 6.21.

9.06.C In connection with Design Professional's authority as to Change Orders, see Articles 10, 11, and 12.

9.06.D In connection with Design Professional's authority as to Applications for Payment, see Article 14.

9.07 Determinations for Unit Price Work

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

9.08 Decisions on Requirements of Contract Documents and Acceptability of Work

9.08.A Design Professional will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work thereunder. Design Professional will issue such written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise) as Design Professional may determine necessary, which shall be consistent with the intent of and reasonably inferable from Contract Documents. All matters in question and other matters between Owner and Contractor arising prior to the date final payment is due relating to the acceptability of the Work, and the interpretation of the requirements of the Contract Documents pertaining to the performance of the Work, will be referred initially to Design Professional in writing within 30 days of the event giving rise to the question.

9.08.B Design Professional will, with reasonable promptness, render a written decision on the issue referred. If Owner or Contractor believes that any such decision entitles them to an adjustment in the Contract Price or Contract Times or both, a Claim may be made under Paragraph 10.05. The date of Design Professional's decision shall be the date of the event giving rise to the issues referenced for the purposes of Paragraph 10.05.B.

9.08.C Design Professional's written decision on the issue referred will be final and binding on Owner and Contractor, subject to the provisions of Paragraph 10.05.

9.08.D When functioning as interpreter and judge under this Paragraph 9.08, Design Professional will not show partiality to Owner or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity.

9.09 Limitations on Design Professional's Authority and Responsibilities

9.09.A Neither Design Professional's authority or responsibility under this Article 9 or under any other provision of the Contract Documents nor any decision made by Design Professional in good faith either to exercise or not exercise such authority or responsibility or the undertaking, exercise, or performance of any authority or responsibility by Design Professional shall create, impose, or give rise to any duty in contract, tort, or otherwise owed by Design Professional to Contractor, any Subcontractor, any Supplier, any other individual or entity, or to any surety for or employee or agent of any of them.

9.09.B Design Professional will not supervise, direct, control, or have authority over or be responsible for Contractor's means, methods, techniques, sequences, or procedures of construction, or the safety precautions and programs incident thereto, or for any failure of Contractor to comply with Laws and Regulations applicable to the performance of the Work. Design Professional will not be responsible for Contractor's failure to perform the Work in accordance with the Contract Documents.

9.09.C Design Professional will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other individual or entity performing any of the Work.

9.09.D Design Professional's review of the final Application for Payment and accompanying documentation and all maintenance and operating instructions, schedules, guarantees, Bonds, certificates of inspection, tests and approvals, and other documentation required to be delivered by Paragraph 14.07.C will only be to determine generally that their content complies with the requirements of, and in the case of certificates of inspections, tests, and approvals that the results certified indicate compliance with the Contract Documents.

9.09.E The limitations upon authority and responsibility set forth in this Paragraph 9.09 shall also apply to, the Resident Project Representative, if any, and assistants, if any.

9.10 Compliance with Safety Program

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

ARTICLE 10 - CHANGES IN THE WORK; CLAIMS

10.01 Authorized Changes in the Work

10.01.A Without invalidating the Contract and without notice to any surety, Owner may, at any time or from time to time, order additions, deletions, or revisions in the Work by a Change Order, a Written Amendment, or a Work Change Directive. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided).

10.01.A.1 Contractor may propose modifications to the Work for the purpose of reducing the total cost of construction. Such a proposal shall be identified as an Alternatives Evaluation Proposal and shall be submitted in accordance with Article 6.7 of these General Conditions, "Substitutes and Or-Equal Items."

10.01.A.2 Owner may in its sole discretion accept or reject an Alternatives Evaluation Proposal. The Contract Price is not to be based on the anticipated approval of an Alternatives Evaluation Proposal.

10.01.A.3 If Owner determines that an Alternatives Evaluation Proposal is to be accepted, Contractor will be credited with 25% of the net savings in Contract Price, less certain costs as further defined in Article 6.7 of these General Conditions.

10.01.B If Owner and Contractor are unable to agree on entitlement to, or on the amount or extent, if any, of an adjustment in the Contract Price or Contract Times, or both, that should be allowed as a result of a Work Change Directive, a Claim may be made therefor as provided in Paragraph 10.05.

10.01.C No proposal or Claim by Contractor based on changes in the Work, differing site conditions, quantity variations or any other matter shall be allowed if made after final payment.

10.02 Unauthorized Changes in the Work

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

10.03 Execution of Change Orders

10.03.A Owner and Contractor shall execute appropriate Change Orders recommended by Design Professional covering:

10.03.A.1 changes in the Work which are:

10.03.A.1.a ordered by Owner pursuant to Paragraph 10.01.A,

10.03.A.1.b required because of acceptance of defective Work under Paragraph 13.08.A or Owner's correction of defective Work under Paragraph 13.09, or

10.03.A.1.c agreed to by the parties;

10.03.A.2 changes in the Contract Price or Contract Times which are agreed to by the parties, including any undisputed sum or amount of time for Work actually performed in accordance with a Work Change Directive; and

10.03.A.3 changes in the Contract Price or Contract Times which embody the substance of any written decision rendered by Design Professional pursuant to Paragraph 10.05; provided that, in lieu of executing any such Change Order, an appeal may be taken from any such decision in accordance with the provisions of the Contract Documents and applicable Laws and Regulations, but during any such appeal, Contractor shall carry on the Work and adhere to the Progress Schedule as provided in Paragraph 6.18.A.

10.03.B A Change Order duly signed by Owner and Contractor, without Contractor's reservation of the right to Claim additional adjustments in Contract Price or Contract Time, constitutes an all-inclusive settlement for all related changes and for all related direct, indirect, supplemental, consequential and cumulative costs and delays; Contractor's signature also constitutes a release and waiver of any and all rights to file a Claim based on the changes covered by the Change Order.

10.03.C A Change Order duly signed by Owner and Contractor, with Contractor's reservation of the right

to Claim additional adjustments, shall become final and binding on Contractor, without consideration of the reservation, unless Contractor delivers to Owner written notice of Claim within thirty (30) days after Contractor signs that Change Order.

10.04 Notification to Surety

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

10.05 Claims

10.05.A Design Professional's Decision Required: All Claims, except those waived pursuant to Paragraph 14.08, shall be referred to the Design Professional for decision. A decision by Design Professional shall be required as a condition precedent to any exercise by Owner or Contractor of any rights or remedies either may otherwise have under the Contract Documents or by Laws and Regulations in respect of such Claims.

10.05.B Notice: Written notice stating the general nature of each Claim, shall be delivered by the claimant to Design Professional and the other party to the Contract promptly (but in no event later than 30 days) after the start of the event giving rise thereto. The responsibility to substantiate a Claim shall rest with the party making the Claim. Notice of the amount or extent of the Claim, with supporting data shall be delivered to the Design Professional and the other party to the Contract within 60 days after the start of such event (unless Design Professional allows additional time for claimant to submit additional or more accurate data in support of such Claim). A Claim for an adjustment in Contract Price shall be prepared in accordance with the provisions of Paragraph 12.01.B. A Claim for an adjustment in Contract Times shall be prepared in accordance with the provisions of Paragraph 12.02.B. Each Claim shall be accompanied by claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant believes it is entitled as a result of said event. The opposing party shall submit any response to Design Professional and the claimant within 30 days after receipt of the claimant's last submittal (unless Design Professional allows additional time).

10.05.C Design Professional's Action: Design Professional will review each Claim and, within 30 days after receipt of the last submittal of the claimant or the last submittal of the opposing party, if any, take one of the following actions in writing:

10.05.C.1 deny the Claim in whole or in part;

10.05.C.2 approve the Claim; or

10.05.C.3 notify the parties that the Design Professional is unable to resolve the Claim if, in the Design Professional's sole discretion, it would be inappropriate for the Design Professional to do so. For purposes of further resolution of the Claim, such notice shall be deemed a denial.

10.05.D In the event that Design Professional does not take action on a Claim within said 30 days, the Claim shall be deemed denied.

10.05.E Design Professional's written action under Paragraph 10.05.C or denial pursuant to Paragraphs 10.05.C.3 or 10.05.D will be final and binding upon Owner and Contractor, unless Owner or Contractor invoke the dispute resolution procedure set forth in Article 16 within 30 days of such action or denial.

10.05.F No Claim for an adjustment in Contract Price or Contract Times will be valid if not submitted in accordance with this Paragraph 10.05.

10.06 Owner's Right to Audit

10.06.A Owner reserves the right to decrease adjustments made in any Change Order if, upon audit of Contractor's records, the audit discloses Contractor provided false or inaccurate cost and pricing data in negotiating the Change Order. In enforcing this provision, the parties shall follow the procedures provided in Paragraph 10.07.

10.07 Audit Procedure

10.07.A Unless exempted from this clause by meeting one of the following conditions:

10.07.A.1 the pricing is based on adequate competition;

10.07.A.2 prices are set by law;

10.07.A.3 a commercial item is being acquired;

10.07.A.4 a waiver has been granted;

10.07.B A change in the approved cost for a change order may be required due to inaccuracies in the pricing where the value of the change order, including profit, exceeds \$550,000 and the change

increased the contract value by a significant amount. A reduction in the contract amount shall be issued if one of the following conditions applies:

10.07.B.1 the furnished pricing was incomplete, inaccurate or not current,

10.07.B.2 a subcontractor furnished pricing that was incomplete, inaccurate or not current,

10.07.B.3 any party furnished any data that is not accurate.

10.07.B.4 the contractor did not submit a Certificate of Current Cost or Pricing Data.

10.07.C Any resulting reduction due to data from a subcontractor who was not awarded the work will be in the amount only by which the actual cost was less than the prospective subcontractor.

10.07.D If a reduction is required, the contractor may not raise the following as a defense:

10.07.D.1 the contractor or subcontractor was a sole source supplier or otherwise in a superior bargaining position and thus would not have modified the contract even if accurate pricing had been submitted.

10.07.D.2 the Owner should have known the pricing was inaccurate

10.07.D.3 the contract was based on a total cost and no agreement was made regarding the cost of individual items.

10.07.E The reduction may be offset if

10.07.E.1 the contractor certifies that it is entitled to the offset, and

10.07.E.2 the contractor can prove that the price was available before the date of the change but was not submitted by that date

10.07.F An offset will not be allowed if:

10.07.F.1 the contractor knew the data was incorrect.

10.07.F.2 the owner demonstrates that the price would not have increased by the amount to be offset even if data were available.

10.07.G If any reduction is for work already paid to contractor, contractor shall be liable to and shall pay to owner at the time such overpayment is repaid:

10.07.G.1 simple interest on the amount of the repayment computed from the date of the

overpayment to the date of repayment at a rate of the current federal short-term rate plus 3%, and

10.07.G.2 A penalty equal to the amount of the overpayment if the contractor knowingly submitted incorrect data.

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

11.01 Cost of the Work

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

11.01.A.1 Payroll costs for employees in the direct employ of Contractor in the performance of the Work under schedules of job classifications agreed upon by Owner and Contractor. Such employees shall include, without limitation, superintendents, foremen, and other personnel employed full time on the Work. Payroll costs for employees not employed full time on the Work shall be apportioned on the basis of their time spent on the Work. Payroll costs shall include, but not be limited to, salaries and wages plus the cost of fringe benefits, which shall include social security contributions, unemployment, excise, and payroll taxes, workers' compensation, health and retirement benefits, bonuses, sick leave, vacation and holiday pay applicable thereto. The expenses of performing Work outside of regular working hours, on Saturday, Sunday, or legal holidays, shall be included in the above to the extent authorized by Owner.

11.01.A.2 Cost of all materials and equipment furnished and incorporated in the Work, including costs of transportation and storage thereof, and Suppliers' field services required in connection therewith. All cash discounts shall accrue to Contractor unless Owner deposits funds

with Contractor with which to make payments, in which case the cash discounts shall accrue to Owner. All trade discounts, rebates and refunds and returns from sale of surplus materials and equipment shall accrue to Owner, and Contractor shall make provisions so that they may be obtained.

11.01.A.3 Payments made by Contractor to Subcontractors for Work performed by Subcontractors. If required by Owner, Contractor shall obtain competitive Bids from Subcontractors acceptable to Owner and Contractor and shall deliver such Bids to Owner, who will then determine, with the advice of Design Professional, which Bids, if any, will be acceptable. If any subcontract provides that the Subcontractor is to be paid on the basis of Cost of the Work plus a fee, the Subcontractor's Cost of the Work and fee shall be determined in the same manner as Contractor's Cost of the Work and fee as provided in this Paragraph 11.01.

11.01.A.4 Costs of special consultants (including but not limited to engineers, architects, testing laboratories, surveyors, attorneys, and accountants) employed for services specifically related to the Work.

11.01.A.5 Supplemental costs including the following:

11.01.A.5.a The proportion of necessary transportation, travel, and subsistence expenses of Contractor's employees incurred in discharge of duties connected with the Work.

11.01.A.5.b Cost, including transportation and maintenance, of all materials, supplies, equipment, machinery, appliances, office, and temporary facilities at the Site, and hand tools not owned by the workers, which are consumed in the performance of the Work, and cost, less market value, of such items used but not consumed which remain the property of Contractor.

11.01.A.5.c Rentals of all construction equipment and machinery, and the parts thereof whether rented from Contractor or others in accordance with rental agreements, competitive in the local Phoenix metropolitan area, approved by Owner with the advice of Design Professional, and the costs of transportation, loading, unloading, assembly, dismantling, and removal thereof. All such costs shall be in accordance with the terms of said rental agreements. The rental of any such equipment, machinery, or parts shall cease when the use thereof is no longer necessary for the Work.

11.01.A.5.d Sales, consumer, use, and other similar taxes related to the Work, and for which Contractor is liable, as imposed by Laws and Regulations.

11.01.A.5.e Deposits lost for causes other than negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, and royalty payments and fees for permits and licenses.

11.01.A.5.f Losses and damages (and related expenses) caused by damage to the Work, not compensated by insurance or otherwise, sustained by Contractor in connection with the performance of the Work (except losses and damages within the deductible amounts of property insurance established in accordance with Article 5), provided such losses and damages have resulted from causes other than the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable. Such losses shall include settlements made with the written consent and approval of Owner. No such losses, damages, and expenses shall be included in the Cost of the Work for the purpose of determining Contractor's fee.

11.01.A.5.g The cost of utilities, fuel, and sanitary facilities at the Site.

11.01.A.5.h Minor expenses such as telegrams, long distance telephone calls, telephone service at the Site, express and courier services, and similar petty cash items in connection with the Work.

11.01.A.5.i The costs of premiums for all bonds and insurance Contractor is required by the Contract Documents to purchase and maintain.

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

11.01.B.1 Payroll costs and other compensation of Contractor's officers, executives, principals (of partnerships and sole proprietorships), general managers, safety managers, engineers, architects, estimators, attorneys, auditors, accountants, purchasing and contracting agents, expeditors, timekeepers, clerks, and other personnel employed by Contractor, whether at the Site or in Contractor's principal or branch office for general administration of the Work and not specifically included in the agreed upon schedule of job classifications referred to in Paragraph 11.01.A.1 or specifically covered by Paragraph 11.01.A.4, all of which are to be

considered administrative costs covered by the Contractor's fee.

11.01.B.2 Expenses of Contractor's principal and branch offices other than Contractor's office at the Site.

11.01.B.3 Any part of Contractor's capital expenses, including interest on Contractor's capital employed for the Work and charges against Contractor for delinquent payments.

11.01.B.4 Costs due to the negligence of Contractor, any Subcontractor, or anyone directly or indirectly employed by any of them or for whose acts any of them may be liable, including but not limited to, the correction of defective Work, disposal of materials or equipment wrongly supplied, and making good any damage to property.

11.01.B.5 Acceleration costs to overcome suspension of Work or other delays which warrant extensions in Contract Time but exclude increases in Contract Price; escalation costs for any part of the Work not delayed beyond the late dates in the Progress Schedule; or delay costs not expressly allowed in this Article.

11.01.B.6 Other overhead or general expense costs of any kind and the costs of any item not specifically and expressly included in Paragraphs 11.01.A.

11.01.C Contractor's Fee: When all the Work is performed on the basis of cost-plus, Contractor's fee shall be determined as set forth in Paragraph 12.01.C unless otherwise set forth in the Agreement. When the value of any Work covered by a Change Order or when a Claim for an adjustment in Contract Price is determined on the basis of Cost of the Work, Contractor's fee shall be determined as set forth in Paragraph 12.01.C.

11.02 Allowances

11.02.A It is understood that Contractor has included in the Contract Price all allowances so named in the Contract Documents and shall cause the Work so covered to be performed for such sums and by such persons or entities as may be acceptable to Owner and Design Professional.

11.02.B Cash Allowances

11.02.B.1 Contractor agrees that the allowances include all costs to the Contractor of materials, equipment, taxes, unloading, handling on the Site, labor, installation costs, overhead,

profit, and other expenses required to furnish and install the Work described by the allowances.

11.02.C Contingency Allowance

11.02.C.1 Contractor agrees that a contingency allowance, if any, is for the sole use of Owner to cover unanticipated costs.

11.02.D Prior to final payment, an appropriate Change Order will be issued as recommended by Design Professional to reflect actual amounts due Contractor on account of Work covered by allowances, and the Contract Price shall be correspondingly adjusted.

11.03 Unit Price Work

11.03.A Where the Contract Documents provide that all or part of the Work is to be Unit Price Work, initially the Contract Price will be deemed to include for all Unit Price Work an amount equal to the sum of the unit price for each separately identified item of Unit Price Work times the estimated quantity of each item as indicated in the Agreement.

11.03.B The estimated quantities of items of Unit Price Work are not guaranteed and are solely for the purpose of comparison of Bids and determining an initial Contract Price. Determinations of the actual quantities and classifications of Unit Price Work performed by Contractor will be made by Design Professional subject to the provisions of Paragraph 9.07.

11.03.C Each unit price will be deemed to include an amount considered by Contractor to be adequate to cover Contractor's overhead and profit for each separately identified item.

11.03.D Owner or Contractor may make a Claim for an adjustment in the Contract Price in accordance with Paragraph 10.05 if:

11.03.D.1 the quantity of any item of Unit Price Work performed by Contractor differs materially and significantly from the estimated quantity of such item indicated in the Agreement; and

11.03.D.2 there is no corresponding adjustment with respect to any other item of Work; and

11.03.D.3 Contractor believes that Contractor is entitled to an increase in Contract Price as a result of having incurred additional expense or Owner believes that Owner is entitled to a decrease in Contract Price and the parties are unable to

agree as to the amount of any such increase or decrease.

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

12.01 Change of Contract Price

12.01.A The Contract Price may only be changed by a Change Order. Any Claim for an adjustment in the Contract Price shall be based on written notice submitted by the party making the Claim to the Design Professional and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

12.01.B The value of any Work covered by a Change Order or of any Claim for an adjustment in the Contract Price will be determined as follows:

12.01.B.1 where the Work involved is covered by unit prices contained in the Contract Documents, by application of such unit prices to the quantities of the items involved (subject to the provisions of Paragraph 11.03); or

12.01.B.2 where the Work is not covered by unit prices contained in the Contract Documents, by a mutually agreed lump sum, itemized and supported by substantiating data, (which may include an allowance for overhead and profit not necessarily in accordance with Paragraph 12.01.C.2);

12.01.B.3 where the Work involved is not covered by unit prices contained in the Contract Documents and agreement to a lump sum is not reached under Paragraph 12.01.B.2, on the basis of the Cost of the Work (determined as provided in Paragraph 11.01) plus a Contractor's fee for overhead and profit (determined as provided in Paragraph 12.01.C).

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

12.01.C.1 a mutually acceptable fixed fee; or

12.01.C.2 if a fixed fee is not agreed upon, then a fee based on the following percentages of the various portions of the Cost of the Work:

12.01.C.2.a for costs incurred under Paragraphs 11.01.A.1 and 11.01.A.2, the Contractor's fee shall be 15 percent;

12.01.C.2.b for costs incurred under Paragraph 11.01.A.3, the Contractor's fee shall be five percent;

12.01.C.2.c where one or more tiers of subcontracts are on the basis of Cost of the Work plus a fee and no fixed fee is agreed upon, the intent of Paragraphs 12.01.C.2.a and 12.01.C.2.b is that the Subcontractor who actually performs the Work, at whatever tier, will be paid a fee of 15 percent of the costs incurred by such Subcontractor under Paragraphs 11.01.A.1 and 11.01.A.2 and that any higher tier Subcontractor and Contractor will each be paid a fee of five percent of the amount paid to the next lower tier Subcontractor;

12.01.C.2.d no fee shall be payable on the basis of costs itemized under Paragraphs 11.01.A.4, 11.01.A.5, and 11.01.B;

12.01.C.2.e the amount of credit to be allowed by Contractor to Owner for any change which results in a net decrease in cost will be the amount of the actual net decrease in cost plus a deduction in Contractor's fee by an amount equal to five percent of such net decrease; and

12.01.C.2.f when both additions and credits are involved in any one change, the adjustment in Contractor's fee shall be computed on the basis of the net change in accordance with Paragraphs 12.01.C.2.a through 12.01.C.2.e, inclusive.

12.01.D Contractor will establish and maintain records related to the cost of any change in accordance with generally accepted accounting practices and submit in a form acceptable to Design Professional an itemized cost breakdown together with supporting data.

12.02 Change of Contract Times

12.02.A The Contract Times may only be changed by a Change Order or Written Amendment. Any Claim for an adjustment in the Contract Times shall be based on written notice submitted by the party making the Claim to the Design Professional and the other party to the Contract in accordance with the provisions of Paragraph 10.05.

12.02.B Any adjustment of the Contract Times covered by a Change Order or any Claim for an adjustment in the Contract Times will be determined in accordance with the provisions of this Article 12.

12.03 Delays

12.03.A Notwithstanding anything to the contrary in the Contract Documents, Contractor assumes all risks of delays, disruptions and hindrances, and Contractor shall not make any Claim for adjustment

in Contract Price or for damages (or any other kind of compensation) for any delays, disruptions or hindrances from any cause whatsoever, including acts and omissions of Owner or Design Professional, except as provided in Paragraphs 12.03.A.1 and 12.03.A.2

12.03.A.1 Owner and Contractor shall negotiate for the recovery of damages related to expenses incurred by Contractor for delay if, but only if, (a) Owner is responsible for the delay; and (b) the delay is unreasonable under the circumstances; and (c) the delay was not within the contemplation of Owner and Contractor; and (d) Contractor gives Owner notice and submits a Claim in the manner and within the times specified in Article 10. Contractor shall make every effort to avoid the consequences and mitigate damages from any delay.

12.03.A.2 No delay resulting from the negotiations or resolution of changes in the Work, differing site conditions or variation in quantities shall be unreasonable under the circumstances unless the delay exceeds two days plus the time required by Contractor to deliver a related proposal. Such delays are contemplated by Contractor and Owner.

12.03.B Where Contractor is prevented from completing any part of the Work within the Contract Times due to delay beyond the control of Contractor, the Contract Times will be extended in an amount equal to the time lost due to such delay if a Claim is made therefor as provided in Paragraph 12.02.A. An extension in Contract Time will not be justified unless Contractor, demonstrates delay in completing all or a specified part of the Work arising from unforeseeable causes beyond the control and without the fault or negligence of Contractor, and the delay is unreasonable under the circumstances. Examples of events which may justify an extension of Contract Time, subject to the requirements of the Contract Documents, include: acts of God, the public enemy, or acts or neglect by Owner, acts or neglect of utility owners or other contractors performing other work as contemplated by Article 7; acts of the U.S. Government, the State or another Political Subdivision; fires, floods, epidemics, quarantine restrictions; strikes, freight embargoes abnormal weather, including storms, tornados, etc. (abnormal in the sense of expectation, frequency or severity compared with the prior 5 year average); unusually severe shortages of construction materials, considering all feasible sources of supply; newly discovered Underground Utilities;

objection, for Owner's convenience, to a nominated Subcontractor; an emergency; incidents with archaeological features suspension of Work; changes in the Work, differing site conditions or variation in quantities of Unit Price Work. Delays attributable to and within the control of a Subcontractor or Supplier shall be deemed to be delays within the control of Contractor.

12.03.C If Contractor is prevented from completing any part of the Work within the Contract Times (or Milestones) for unforeseeable causes beyond the control of both Owner and Contractor, an extension of the Contract Times (or Milestones) in an amount equal to the time lost due to such delay shall be Contractor's sole and exclusive remedy for the delay. In no event shall Owner be liable to Contractor, any Subcontractor, any Manufacturer, any Supplier, any person, any firm, any corporation, or to any surety for or employee or agent of any of them, for damages arising out of or resulting from (a) delays caused by or within the control of Contractor, or (b) delays beyond the control of both parties as specified in Paragraph 12.03.B.

12.03.D No delay in completing the Work, or any specified part of the Work, for which the Owner is responsible, shall be unreasonable under the circumstances or justify an increase in Contract Time or Contract Price, unless, and then only to the extent that, the delay extends completion of the Work, or specified part of the Work, beyond the corresponding Contract Time. Notwithstanding the first sentence of this Paragraph 12.03.D, if the Progress Schedule depicts Total Float whether expressly disclosed or implied by the use of float suppression techniques, the Total Float is owned jointly by Contractor and Owner.

12.03.E Owner, Design Professional and the Related Entities of each of them shall not be liable to Contractor for any claims, costs, losses, or damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) sustained by Contractor on or in connection with any other project or anticipated project.

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

13.01 Notice of Defects

13.01.A Prompt notice of all defective Work of which Owner or Design Professional has actual

knowledge will be given to Contractor. Defective Work may be rejected, corrected, or accepted as provided in this Article 13.

13.02 Access to Work

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

13.03 Tests and Inspections

13.03.A Contractor shall give Design Professional timely notice of readiness of the Work for all required inspections, tests, or approvals and shall cooperate with inspection and testing personnel to facilitate required inspections or tests.

13.03.B Owner shall employ and pay for the services of an independent testing laboratory to perform all inspections, tests, or approvals required by the Contract Documents except:

13.03.B.1 for inspections, tests, or approvals covered by Paragraphs 13.03.C and 13.03.D below; or

13.03.B.2 that costs incurred in connection with tests or inspections conducted pursuant to Paragraph 13.04.B shall be paid as provided in Paragraph 13.04.C; and

13.03.B.3 as otherwise specifically provided in the Contract Documents.

13.03.C If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) specifically to be inspected, tested, or approved by an employee or other representative of such public body, Contractor shall assume full responsibility for arranging and obtaining such inspections, tests, or approvals, pay all costs in connection therewith, and furnish Design Professional the required certificates of inspection or approval.

13.03.D Contractor shall be responsible for arranging and obtaining and shall pay all costs in connection with any inspections, tests, or approvals required for Owner's and Design Professional's acceptance of materials or equipment to be

incorporated in the Work; or acceptance of materials, mix designs, or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. Such inspections, tests, or approvals shall be performed by organizations acceptable to Owner and Design Professional.

13.03.E If any Work (or the work of others) that is to be inspected, tested, or approved is covered by Contractor without written concurrence of Design Professional, Contractor shall, if requested by Design Professional uncover such Work for observation.

13.03.F Uncovering Work as provided in Paragraph 13.03.E shall be at Contractor's expense unless Contractor has given Design Professional timely notice of Contractor's intention to cover the same and Design Professional has not acted with reasonable promptness in response to such notice.

13.04 Uncovering Work

13.04.A If any Work is covered contrary to the written request of Design Professional, it must, if requested by Design Professional, be uncovered for Design Professional's observation and replaced at Contractor's expense.

13.04.B If Design Professional considers it necessary or advisable that covered Work be observed by Design Professional or inspected or tested by others, Contractor, at Design Professional's request, shall uncover, expose, or otherwise make available for observation, inspection, or testing as Design Professional may require, that portion of the Work in question, furnishing all necessary labor, material, and equipment.

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

13.04.D If, the uncovered Work is not found to be defective, Contractor shall be allowed an increase

in the Contract Price or an extension of the Contract Times, or both, directly attributable to such uncovering, exposure, observation, inspection, testing, replacement, and reconstruction. If the parties are unable to agree as to the amount or extent thereof, Contractor may make a Claim therefor as provided in Paragraph 10.05.

13.05 Owner May Stop Work

13.05.A If Work is defective, or Contractor fails to provide sufficient, skilled workers or suitable materials or equipment, or otherwise fails to perform Work in compliance with the Contract Documents, Owner may order Contractor to stop all or part of the Work until any problem is corrected. Contractor shall (a) remain responsible for recovering schedule, (b) not be entitled to any increase in Contract Time or Contract Price, and reimburse Owner for all direct, indirect or consequential costs incurred by Owner resulting from any such stop Work order. Owner's authority to stop all or part of the Work shall not create or impose any duty or responsibility on Owner to exercise any such authority for the benefit of Contractor or any other person.

13.06 Correction or Removal of Defective Work

13.06.A Promptly after receipt of written notice, Contractor shall correct all defective Work, whether or not fabricated, installed, or completed, or, if the Work has been rejected by Design Professional, remove it from the Project and replace it with Work that is not defective. Contractor shall pay all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to such correction or removal (including but not limited to all costs of repair or replacement of work of others).

13.06.B When correcting defective Work under the terms of this Paragraph 13.06 or Paragraph 13.07, Contractor shall take no action that would void or otherwise impair Owner's special warranty and guarantee, if any, on said Work.

13.07 Correction Period

13.07.A If within one year after the date of Substantial Completion (or such longer period of time as may be prescribed by the terms of any applicable special guarantee required by the Contract Documents) or by any specific provision of the Contract Documents, any Work is found to be

defective, or if the repair of any damages to the land or areas made available for Contractor's use by Owner or permitted by Laws and Regulations as contemplated in Paragraph 6.11.A is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions:

13.07.A.1 repair such defective land or areas; or

13.07.A.2 correct such defective Work; or

13.07.A.3 if the defective Work has been rejected by Owner, remove it from the Project and replace it with Work that is not defective, and

13.07.A.4 satisfactorily correct or repair or remove and replace any damage to other Work, to the work of others or other land or areas resulting therefrom.

13.07.B If Contractor does not promptly comply with the terms of Owner's written instructions, or in an emergency where delay would cause serious risk of loss or damage, Owner may have the defective Work corrected or repaired or may have the rejected Work removed and replaced. All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) arising out of or relating to such correction or repair or such removal and replacement (including but not limited to all costs of repair or replacement of work of others) will be paid by Contractor.

13.07.C In special circumstances where a particular item of equipment is placed in continuous service before Substantial Completion of all the Work, the correction period for that item may start to run from an earlier date if so, provided in the Specifications or by Written Amendment.

13.07.D Where defective Work (and damage to other Work resulting therefrom) has been corrected or removed and replaced under this Paragraph 13.07, the correction period hereunder with respect to such Work will be extended for an additional period of one year after such correction or removal and replacement has been satisfactorily completed.

13.07.E The specified warranties and guarantees and Contractor's obligations for correction of Work specified in this Article are in addition to, and not in limitation of, any other specific remedies provided in the Contract Documents or by Law. Nothing contained in this Paragraph, or this Article shall be construed as establishing a period of limitations for,

or limiting the obligations of, Contractor under the Contract Documents.

13.08 Acceptance of Defective Work

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

13.09 Owner May Correct Defective Work

13.09.A If Contractor fails within a reasonable time after written notice from Design Professional to correct defective Work or to remove and replace rejected Work as required by Design Professional in accordance with Paragraph 13.06.A, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, Owner may, after seven days written notice to Contractor, correct or remedy any such deficiency.

13.09.B In exercising the rights and remedies under this Paragraph 13.09, Owner shall proceed expeditiously. In connection with such corrective or remedial action, Owner may exclude Contractor from all or part of the Site, take possession of all or part of the Work and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equipment and machinery at the Site, and incorporate in the Work all materials and equipment stored at the Site or for

which Owner has paid Contractor but which are stored elsewhere. Contractor shall allow Owner, Owner's representatives, agents and employees, Owner's other contractors, and Design Professional and Design Professional's consultants access to the Site to enable Owner to exercise the rights and remedies under this Paragraph.

13.09.C All claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) incurred or sustained by Owner in exercising the rights and remedies under this Paragraph 13.09 will be charged against Contractor, and a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and Owner shall be entitled to an appropriate decrease in the Contract Price. If the parties are unable to agree as to the amount of the adjustment, Owner may make a Claim therefor as provided in Paragraph 10.05. Such claims, costs, losses and damages will include but not be limited to all costs of repair, or replacement of work of others destroyed or damaged by correction, removal, or replacement of Contractor's defective Work.

13.09.D Contractor shall not be allowed an extension of the Contract Times because of any delay in the performance of the Work attributable to the exercise by Owner of Owner's rights and remedies under this Paragraph 13.09.

ARTICLE 14 - PAYMENTS TO CONTRACTOR AND COMPLETION

14.01 Schedule of Values

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

14.01.B Whenever the Bid Schedule on the Bid Form lists an item of Work entitled "Mobilization Pay Item", such mobilization pay item shall be intended to cover, in part at least:

14.01.B.1 reasonable costs of establishing those temporary offices specified in the Technical Specifications;

14.01.B.2 reasonable cost of transporting to the site and the unloading and assembly of

construction equipment that arrives on site promptly after the Date of Commencement of the Contract Time;

14.01.B.3 fees for permits required to commence the Work;

14.01.B.4 premiums for Performance Bond, Payment Bond and any other performance Bonds required by the Contract Documents;

14.01.B.5 premiums for policies of insurance purchased by the Contractor to comply with the requirements of the Contract Documents;

14.01.B.6 and reasonable costs of demobilization including vacating and clearing the site.

14.01.C Except when seeking progress payment under the mobilization pay item for payroll or other similar costs, the basis of measurement for payment shall be proof of actual payment. Payment shall be based on the requirements of the Contract Documents governing progress payments, subject to the following:

14.01.C.1 Up to forty percent (40%) of the payment earned under this item may be requested for payment with the Application for Payment following receipt by the Owner of a sufficiently responsive initial Progress Schedule (meaning sufficiently responsive based on the requirements of the Contract Documents and the Technical Specifications).

14.01.C.2 Up to eighty percent (80%) of the payment earned under this item may be requested for payment with the Application for Payment following return to the Contractor of the revision of the initial Progress Schedule Submittal marked "Resubmittal Not Required".

14.01.C.3 The balance of the payment earned under the "Mobilization Pay Item" may be requested for payment with the final Application for Payment. Such payment is intended to cover demobilization costs.

14.02 Progress Payments

14.02.A Applications for Payments

14.02.A.1 At least 21 days before the date established in the Agreement for each progress payment (but not more often than once a month), Contractor shall submit to Design Professional for review an Application for Payment filled out and signed by Contractor covering the Work completed as of the date of the Application and accompanied

by such supporting documentation as is required by the Contract Documents.

14.02.A.2 with each Application for Payment, Contractor shall submit written consent of the Surety for payment of the amount requested in the Application for Payment.

14.02.A.3 Beginning with the second Application for Payment, each Application shall include an affidavit of Contractor stating that all previous progress payments received on account of the Work have been applied on account to discharge Contractor's legitimate obligations associated with prior Applications for Payment.

14.02.A.4 SBE Goal Compliance

14.02.A.4.a In addition, with each Application for Payment, Contractor shall submit (in a format acceptable to the Owner) the required information demonstrating its compliance with the SBE goals for this Agreement.

14.02.A.5 Stored Materials and Equipment

14.02.A.5.a If payment is requested on the basis of materials and equipment not incorporated in the Work but delivered and suitably stored at the Site or at another location agreed to in writing, the Application for Payment shall also be accompanied by a bill of sale, invoice, or other documentation warranting that Owner has received the materials and equipment free and clear of all Liens and evidence that the materials and equipment are covered by appropriate property insurance or other arrangements to protect Owner's interest therein, all of which must be satisfactory to Owner.

14.02.A.6 Retainage

14.02.A.6.a The amount of retainage with respect to progress payments will be as stipulated below:

14.02.A.6.b Until the aggregate value of the duly certified and approved Applications for Payment equals fifty percent (50%) of the Contract Price (i.e. 50% completion), Owner will make payments in an amount equal to 90% of Work completed (i.e. Owner will retain 10% of each estimate as additional guarantee for complete performance of the Work), less the aggregate of payments previously made and less such deductions as Design Professional or Owner determines are appropriate to cover claims requiring a greater sum to be retained (as provided in Paragraph 14.02.C and elsewhere in the Contract Documents);

14.02.A.6.c Upon fifty percent (50%) completion, one-half of the amounts retained under the 10% retainage provision shall be paid to Contractor, provided Contractor is making satisfactory progress on the Work and there is no specific cause or claim requiring a greater amount to be retained. After fifty percent (50%) completion, Owner will retain five percent (5%) providing Contractor is making satisfactory progress, coupled with such deductions as Design Professional or Owner determines are appropriate to cover claims requiring a greater sum to be retained.

14.02.A.6.d Prior to reduction in or partial release of retainage, Contractor shall submit AIA Document G707A (Consent of Surety to Reduction in or Partial Release of Retainage) certifying the Surety agrees that such reduction in or partial release of retainage shall not relieve the Surety of any of its obligations under the Performance and Payment Bonds.

14.02.A.6.e If at any time Owner, with the advice of Design Professional, determines satisfactory progress is not being made, ten percent (10%) retainage shall be reinstated for all subsequent payments, in accordance with ARS, Title 34 Chapter 2.

14.02.A.6.f Except as qualified in Paragraph 14.04.A.6.C, upon final completion and acceptance of the Work on which separate final completion and acceptance and Contract Price are specified and upon compliance with all other terms and conditions of the Contract Documents, payment may be made in full, including retainage withheld, less such deductions as Design Professional may recommend or Owner may withhold to cover claims requiring a greater sum to be retained and liquidated damages.

14.02.A.6.g In lieu of retention, the Contractor may provide as a substitute, an assignment of money market accounts, demand deposit accounts, or time certificates of deposit (CDs) from a bank licensed by Arizona, securities guaranteed by the United States, securities of the United States, the State of Arizona, Arizona counties, Arizona municipalities, Arizona school districts, or shares of savings and loan institutions authorized to transact business in Arizona. These securities are referred to as "Qualified Securities."

14.02.A.6.h Qualified Securities deposited in lieu of retention must be deposited into a separate account with a bank having a branch located in the City of Phoenix and be assigned exclusively for the

benefit of the City of Phoenix pursuant to the City's form of escrow and/or deposit agreement.

14.02.A.6.i Escrow Agreement and Deposit Agreement forms may be obtained from the Contracts Specialist assigned to the project.

14.02.B Review of Applications

14.02.B.1 Design Professional will, within seven (7) days after receipt of each Application for Payment, either certify, approve and present the Application to Owner, or return the Application to Contractor indicating in writing Design Professional's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application. Fourteen (14) days after presentation of the Application for Payment to Owner, the amount recommended will, subject to the provisions of Paragraph 14.02.B.6 of the General Conditions, become due and when due will be paid by Owner to Contractor.

14.02.B.2 All payments will be available to the Contractor at the Finance Department, Accounts Division, Customer Service-Accounts Payable Section, on the fourteenth (14th) day, unless Contractor arranges with the Finance Department to mail payments. Mailed payments shall be deemed paid on the date deposited in the mail as established by the U.S. Postal Service postmark. If payment is not made when due, simple interest, as provided in ARS Title 34 Chapter 2 as amended, shall be paid by Owner to Contractor (excluding any Fee to Contractor)

14.02.B.3 Design Professional's recommendation of any payment requested in an Application for Payment will constitute a representation by Design Professional to Owner, based on Design Professional's observations on the Site of the executed Work as an experienced and qualified design professional and on Design Professional's review of the Application for Payment and the accompanying data and schedules, that to the best of Design Professional's knowledge, information and belief:

14.02.B.3.a the Work has progressed to the point indicated;

14.02.B.3.b the quality of the Work is generally in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of

quantities and classifications for Unit Price Work under Paragraph 9.07, and to any other qualifications stated in the recommendation); and

14.02.B.3.c the conditions precedent to Contractor's being entitled to such payment appear to have been fulfilled in so far as it is Design Professional's responsibility to observe the Work.

14.02.B.3.d the Record Drawings have been redlined by the Contractor to the same limit as the finished Work claimed on the Application for Payment.

14.02.B.4 By recommending any such payment Design Professional will not thereby be deemed to have represented that:

14.02.B.4.a inspections made to check the quality or the quantity of the Work as it has been performed have been exhaustive, extended to every aspect of the Work in progress, or involved detailed inspections of the Work beyond the responsibilities specifically assigned to Design Professional in the Contract Documents; or

14.02.B.4.b that there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by Owner or entitle Owner to withhold payment to Contractor.

14.02.B.5 Neither Design Professional's review of Contractor's Work for the purposes of recommending payments nor Design Professional's recommendation of any payment, including final payment, will impose responsibility on Design Professional:

14.02.B.5.a to make any examination to ascertain how or for what purposes Contractor has used the moneys paid on account of the Contract Price, or

14.02.B.5.b to determine that title to any of the Work, materials, or equipment has passed to Owner free and clear of any Liens.

14.02.B.6 Design Professional may refuse to recommend the whole or any part of any payment if, in Design Professional's opinion, it would be incorrect to make the representations to Owner stated in Paragraph 14.02.B.1. Design Professional may also refuse to recommend any such payment or, because of subsequently discovered evidence or the results of subsequent inspections or tests, revise or revoke any such payment recommendation previously made, to such extent as may be necessary in Design Professional's opinion to protect Owner from loss because:

14.02.B.6.a the Work is defective, or completed Work has been damaged, requiring correction or replacement;

14.02.B.6.b the Contract Price has been reduced by Written Amendment or Change Order.

14.02.B.6.c Owner has been required to correct defective Work or complete Work in accordance with Paragraph 13.09; or

14.02.B.6.d Design Professional has actual knowledge of the occurrence of any of the events enumerated in Paragraph 15.02.A.

14.02.B.6.e the Record Drawings have not been redlined by the Contractor to the same limit as the finished Work claimed on the Application for Payment.

14.02.C Reduction in Payment

14.02.C.1 Owner may refuse to make payment of the full amount recommended by Design Professional because:

14.02.C.1.a claims have been made against Owner on account of Contractor's performance or furnishing of the Work;

14.02.C.1.b Liens have been filed in connection with the Work, except where Contractor has delivered a specific bond satisfactory to Owner to secure the satisfaction and discharge of such Liens;

14.02.C.1.c there are other items entitling Owner to a set off against the amount recommended; or

14.02.C.1.d Owner has actual knowledge of the occurrence of any of the events enumerated in Paragraphs 14.02.B.6.a through 14.02.B.6.c or Paragraph 15.02.A.

14.02.C.1.e Either the Contractor has failed to submit the SBE Utilization Report with any Application for Payment or has failed to meet the SBE utilization goals as established in the Agreement (Section 00500, Article 11).

14.02.C.1.f Owner may deduct from each progress payment and final payment an amount equal to Owner's estimate of the liquidated damages then due or that would become due based on Owner's estimate of late completion of the Work, provided Contractor fails to submit and implement a recovery schedule as detailed in the General Requirements.

14.02.C.2 If Owner refuses to make payment of the full amount recommended by Design Professional, Owner will give Contractor immediate written notice (with a copy to Design Professional)

stating the reasons for such action and promptly pay Contractor any amount remaining after deduction of the amount so withheld. Owner shall promptly pay Contractor the amount so withheld, or any adjustment thereto agreed to by Owner and Contractor, when Contractor corrects to Owner's satisfaction the reasons for such action.

14.02.C.3 If it is subsequently determined that Owner's refusal of payment was not justified, the amount wrongfully withheld shall be treated as an amount due as determined by Paragraph 14.02.C.1.

14.03 Contractor's Warranty of Title

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

14.04 Substantial Completion

14.04.A When Contractor considers the entire Work ready for its intended use Contractor shall notify Owner and Design Professional in writing that the entire Work is substantially complete, in accordance with the General Requirements, (except for items specifically listed by Contractor as incomplete) and request that Design Professional issue a certificate of Substantial Completion.

14.04.B Within a reasonable time thereafter, Owner, Contractor and Design Professional shall make an inspection of the Work to determine the status of completion. If Design Professional does not consider the Work substantially complete, Design Professional will notify Contractor in writing giving the reasons therefor.

14.04.C If Design Professional considers the Work substantially complete, including all applicable ADA requirements, Design Professional will deliver to Owner a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be, attached to the certificate, a tentative list of items (typically referred to as a "punch list") to be completed or corrected before final payment. The punch list will be prepared and issued by the Design Professional. Owner shall have seven days after receipt of the tentative certificate during which to make written objection to Design Professional as to any provisions of the certificate or attached punch list. If, after considering such objections, Design Professional concludes that the Work is not

substantially complete, Design Professional will within 14 days after submission of the tentative certificate to Owner notify Contractor in writing, stating the reasons therefor. If, after consideration of Owner's objections, Design Professional considers the Work substantially complete, Design Professional will within said 14 days execute and deliver to Owner and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Design Professional believes justified after consideration of any objections from Owner. The Contractor shall have seven days after receipt of the tentative certificate to prepare and submit to the Design Professional a punch list schedule showing orderly completion of punch list items occurring prior to final acceptance date.

14.04.D At the time of delivery of the tentative certificate of Substantial Completion, Design Professional will deliver to Owner and Contractor a written recommendation as to division of responsibilities pending final payment between Owner and Contractor with respect to security, operation, safety, and protection of the Work, maintenance, heat, utilities, insurance, and warranties and guarantees. Unless Owner and Contractor agree otherwise in writing and so inform Design Professional in writing prior to Design Professional's issuing the definitive certificate of Substantial Completion, Design Professional's aforesaid recommendation will be binding on Owner and Contractor until final payment.

14.04.E Owner shall have the right to exclude Contractor from the Site after the date of Substantial Completion subject to allowing Contractor reasonable access to complete or correct items on the tentative list.

14.04.F The Owner and Design Professional have thirty (30) days from the date of substantial completion to add incorrect or incomplete items to the punch list. The Contractor is required to complete all of these items prior to final acceptance. After the expiration of the thirty (30) day period, the Owner may continue to add items to the punch list, but the Contractor must only endeavor to complete them by the final acceptance date. Any such items added after the 30-day period that is not completed prior to final acceptance must be completed during the warranty period.

14.05 Partial Utilization

14.05.A Prior to Substantial Completion of all the Work, Owner may use or occupy any substantially completed part of the Work which has specifically been identified in the Contract Documents, or which Owner, Design Professional, and Contractor agree constitutes a separately functioning and usable part of the Work that can be used by Owner for its intended purpose without significant interference with Contractor's performance of the remainder of the Work, subject to the following conditions.

14.05.A.1 Owner at any time may request Contractor in writing to permit Owner to use or occupy any such part of the Work which Owner believes to be ready for its intended use and substantially complete. If and when Contractor agrees that such part of the Work is substantially complete, Contractor will certify to Owner and Design Professional that such part of the Work is substantially complete and request Design Professional to issue a certificate of Substantial Completion for that part of the Work.

14.05.A.2 Contractor at any time may notify Owner and Design Professional in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Design Professional to issue a certificate of Substantial Completion for that part of the Work.

14.05.A.3 Within a reasonable time after either such request, Owner, Contractor, and Design Professional shall make an inspection of that part of the Work to determine its status of completion. If Design Professional does not consider that part of the Work to be substantially complete, Design Professional will notify Owner and Contractor in writing giving the reasons therefor. If Design Professional considers that part of the Work to be substantially complete, the provisions of Paragraph 14.04 will apply with respect to certification of Substantial Completion of that part of the Work and the division of responsibility in respect thereof and access thereto.

14.05.A.4 No use or occupancy or separate operation of part of the Work may occur prior to compliance with the requirements of Article 5 regarding property insurance.

14.06 Final Inspection

14.06.A Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Design Professional will promptly make a final inspection with Owner and Contractor and will notify Contractor in writing of all particulars in

which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies.

14.07 Final Payment

14.07.A Upon written notice from Contractor that Contractor considers the entire Work, or a specified part of the Work for which final acceptance is specified in the Contract Documents, complete and ready for final payment, Design Professional will make a corresponding final inspection with Owner and Contractor and will notify Contractor in writing of all instances of incomplete or defective Work revealed by the final inspection. Contractor shall immediately undertake all necessary measures to correct the deficiencies.

14.07.B Contractor may apply for final payment and acceptance.

14.07.B.1 after completing correction of the deficiencies to satisfaction of Design Professional and delivering all maintenance and operation instructions, warranties and guarantees, certificates of inspection, revised record documents (reflecting revisions made after Substantial Completion), required Bonds and all other required documents, and

14.07.B.2 after Design Professional has consented to review the Work for final acceptance.

14.07.C The final Application for Payment and acceptance shall enclose.

14.07.C.1 evidence of insurance (including, but not limited to completed operations insurance) and an affidavit certifying that the insurance coverage will not be canceled, adversely changed or renewal refused except as provided under Article 5,

14.07.C.2 AIA Document G707 (Consent of Surety to Final Payment) certifying the Surety agrees that final payment shall not relieve the Surety of any of its obligations under the Performance and Payments Bonds,

14.07.C.3 a "Contractor's Affidavit Regarding Settlement of Claims" (available from Owner) and complete and legally effective releases or waivers acceptable to Owner in the full amount of the Contract Price, or if any Subcontractor or Supplier refuses or fails to furnish such release or waiver, a Bond or other security acceptable to Owner to indemnify Owner against any payment claim, and

14.07.C.4 a list of all pending property damage and personal injury or death insurance claims arising out of or resulting from the Work, identifying the claimant and the nature of the claim.

14.07.D If based on Design Professional's observation of the Work, final inspection, and review of the final Application for Payment and acceptance,

14.07.D.1 Design Professional is satisfied that the Work, or a part of the Work for which separate final acceptance is specified in the Contract Documents, has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Design Professional will, within thirty (30) days after receipt of the final Application, furnish to Owner and Contractor the Design Professional's recommendation of final payment and acceptance.

14.07.D.2 If Design Professional is not satisfied, Design Professional will return that final Application for Payment to Contractor, indicating in writing the reasons for not recommending final payment and acceptance, in which case Contractor shall make the necessary corrections and resubmit the Application.

14.07.E Owner's Acceptance of Application:

14.07.E.1 If Owner concurs with Design Professional's recommendation of final payment and acceptance, Owner will, within fifteen (15) days, file a written notice of completion and acceptance of the Work, or separable part of the Work for which final acceptance is specified, and notify Contractor and Design Professional of Owner's acceptance. Within sixty (60) days of receipt of Design Professional's recommendation of final payment, Owner shall pay to Contractor the balance of the Contract Price, subject to any withholdings and those other provisions governing final payment specified in the Agreement.

14.07.E.2 If Owner does not concur with Design Professional's determination, Owner will return the Application to Contractor, through Design Professional, indicating in writing the reasons for refusing final payment and acceptance. Contractor shall promptly make the necessary corrections and resubmit the Application to Design Professional. Owner's written determination shall bind Contractor, unless Contractor delivers to Owner, through Design Professional, written notice of a Claim as provided in Paragraph 10.05, after receipt of that determination.

14.07.E.3 If recommended by Design Professional, Owner may, upon receipt of Contractor's final Application for Payment and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted, if final completion of the Work is significantly delayed through no fault of Contractor. If the balance to be held by Owner for Work not fully completed or corrected is less than the retainage on that Work, the affidavits specified in Paragraph 14.07.C and the release or waiver, or Bonds, shall be furnished as required and submitted by Contractor. Payment of the balance due shall be made under the provisions for final payment but shall not constitute a waiver of Claims.

14.07.F Owner shall pay with reasonable promptness any amounts deducted from the final payment, upon resolution of the Claims for which the amounts were withheld.

14.08 Waiver of Claims

14.08.A Final payment does not constitute a waiver by Owner of any rights relating to Contractor's continuing obligations under the Contract Documents, nor does it constitute a waiver of any Claims by Owner against Contractor arising from unaudited payments, defective Work appearing after final inspection or failure by Contractor to comply with the Contract Documents or the terms of any special warranties or guarantees provided by the Contract Documents or by Laws or Regulations.

14.08.B Final payment constitutes a waiver of all Claims by Contractor against Owner other than those Claims previously filed in writing with Owner on a timely basis and still unsettled.

ARTICLE 15 - SUSPENSION OF WORK AND TERMINATION

15.01 Owner May Suspend Work

15.01.A At any time and without cause, Owner may suspend the Work or any portion thereof for a period of not more than 90 consecutive days by notice in writing to Contractor and Design Professional which will fix the date on which Work will be resumed. Contractor shall resume the Work on the date so fixed.

15.01.B Contractor shall be allowed an adjustment in the Contract Price or an extension of the Contract Times, or both, directly attributable to any such suspension if Contractor makes an approved Claim therefor as provided in Paragraph 10.05, except that Contractor shall not be entitled to recover profit

for suspensions of Work. No adjustment in Contract Price will be made for delays in Work which would have been deferred, stopped, slowed, suspended, interrupted or extended due to any other cause.

15.02 Owner May Terminate for Cause

15.02.A The occurrence of any one or more of the following events will justify termination for cause:

15.02.A.1 Contractor's persistent failure to perform the Work in accordance with the Contract Documents (including, but not limited to, failure to supply sufficient skilled workers or suitable materials or equipment or failure to adhere to the Progress Schedule);

15.02.A.2 Contractor's disregard of Laws or Regulations of any public body having jurisdiction;

15.02.A.3 Contractor's disregard of the authority of Design Professional;

15.02.A.4 Contractor's violation in any substantial way of any provisions of the Contract Documents;

15.02.A.5 if the Contractor fails to meet the SBE utilization goals as set forth in the Agreement (Section 00500, Article 11).

15.02.B Unless superceded by the termination procedures of the performance bond obtained in accordance with Article 5, if one or more of the events identified in Paragraph 15.02.A occur, Owner may, after giving Contractor (and surety) seven days written notice of its intent to terminate the services of Contractor:

15.02.B.1 exclude Contractor from the Site, and take possession of the Work,

15.02.B.2 incorporate in the Work all materials and equipment stored at the Site or for which Owner has paid Contractor but which are stored elsewhere, and

15.02.B.3 complete the Work as Owner may deem expedient.

15.02.C If Owner proceeds as provided in Paragraph 15.02.B, Contractor shall not be entitled to receive any further payment until the Work is completed. If the unpaid balance of the Contract Price exceeds all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) sustained by Owner arising out of

or relating to completing the Work, such excess will be paid to Contractor. If such claims, costs, losses, and damages exceed such unpaid balance, Contractor shall pay the difference to Owner. Such claims, costs, losses, and damages incurred by Owner will be reviewed by Design Professional as to their reasonableness and, when so approved by Design Professional, incorporated in a Change Order. When exercising any rights or remedies under this Paragraph Owner shall not be required to obtain the lowest price for the Work performed.

15.02.D Notwithstanding Paragraphs 15.02.B and 15.02.C, Contractor's services will not be terminated if Contractor begins within seven days of receipt of notice of intent to terminate to correct its failure to perform and proceeds diligently to cure such failure within no more than 30 days of receipt of said notice.

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

15.03 Owner May Terminate For Convenience

15.03.A Upon seven days written notice to Contractor and Design Professional, Owner may, without cause and without prejudice to any other right or remedy of Owner, terminate the Contract. In such case, Contractor shall be paid for (without duplication of any items):

15.03.A.1 completed and acceptable Work executed in accordance with the Contract Documents prior to the effective date of termination, including fair and reasonable sums for overhead and profit on such Work;

15.03.A.2 expenses sustained prior to the effective date of termination in performing services and furnishing labor, materials, or equipment as required by the Contract Documents in connection with uncompleted Work, plus fair and reasonable sums for overhead and profit on such expenses;

15.03.A.3 all claims, costs, losses, and damages (including but not limited to all fees and charges of engineers, architects, attorneys, and other professionals and all court or other dispute resolution costs) incurred in settlement of terminated contracts with Subcontractors, Suppliers, and others; and

15.03.A.4 reasonable expenses directly attributable to termination.

15.03.A.5 If it is determined, after notice of termination of the services of Contractor for any of the causes listed in Paragraph 15.02 of the General Conditions that Contractor was not in default, the termination shall be deemed to have been for the convenience of Owner. In such event Contractor may recover payment in accordance with Paragraph 15.03 of the General Conditions.

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

15.04 Contractor May Stop Work or Terminate

15.04.A If, through no act or fault of Contractor, (i) the Work is suspended for more than 90 consecutive days by Owner or under an order of court or other public authority, or (ii) Design Professional fails to act on any Application for Payment within 30 days after it is submitted, or (iii) Owner fails for 30 days to pay Contractor any sum finally determined to be due, then Contractor may, upon seven days written notice to Owner and Design Professional, and provided Owner or Design Professional do not remedy such suspension or failure within that time, terminate the Contract and recover from Owner payment on the same terms as provided in Paragraph 15.03.

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

ARTICLE 16 - DISPUTE RESOLUTION

16.01 Methods and Procedures

16.01.A Either Owner or Contractor may request mediation of any Claim submitted to Design Professional for a decision under Paragraph 10.05 before such decision becomes final and binding. The mediation will be governed by the Construction Industry Mediation Rules of the American

Arbitration Association in effect as of the Effective Date of the Agreement. The request for mediation shall be submitted in writing to the American Arbitration Association and the other party to the Contract. Timely submission of the request shall stay the effect of Paragraph 10.05.E.

16.01.B Owner and Contractor shall participate in the mediation process in good faith. The process shall be concluded within 60 days of filing of the request. The date of termination of the mediation shall be determined by application of the mediation rules referenced above.

16.01.C If the Claim is not resolved by mediation, Design Professional's action under Paragraph 10.05.C or a denial pursuant to Paragraphs 10.05.C.3 or 10.05.D shall become final and binding 30 days after termination of the mediation unless, within that time period, Owner or Contractor:

16.01.C.1 elects in writing to invoke any dispute resolution process provided for in the Supplementary Conditions, or

16.01.C.2 agrees with the other party to submit the Claim to another dispute resolution process, or

16.01.C.3 gives written notice to the other party of the intent to submit the Claim to a court of competent jurisdiction.

16.02 Certification of Contractor Claims

16.02.A For all Contractor claims alleging an increase in Contract Price or Contract Time, Contractor shall submit an affidavit executed by an officer or partner in charge at Contractor's plant or location involved, or by a responsible senior officer or general or managing partner of Contractor, certifying that the claim is made in good faith; the amount claimed accurately reflects the adjustments in Contract Price or Contract Time for which Contractor believes Owner is liable; the claim covers all costs and delays to which Contractor is entitled from the Occurrence of the claimed event; and that supporting cost and pricing data are current, accurate, complete and represent Contractor's best knowledge and belief.

16.03 Venue: Service of Process

16.03.A Contractor consents and submits to jurisdiction and venue of, and will not commence any proceeding elsewhere than, the Superior Court of Arizona in and for Maricopa County only, regardless of residence or domicile, for any action

at law or suit in equity arising out of or relating to the bidding, award, performance or completion of the Work; payment for Work performed; termination; or any other claim based on the Contract Documents. Contractor consents and submits to service of process at the address specified in the Agreement.

16.03.B Paragraph 16.03.A shall apply to all Sub agreements and all agreements between Contractor and Contractor's sureties and insurers, altering that Paragraph only to identify properly the contracting parties.

ARTICLE 17 - MISCELLANEOUS

17.01 Giving Notice

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

17.01.A.1 delivered in person to the individual or to a member of the firm or to an officer of the corporation for whom it is intended, or

17.01.A.2 delivered at or sent by registered or certified mail, postage prepaid, to the last business address known to the giver of the notice.

17.02 Computation of Times

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

17.03 Cumulative Remedies

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

17.04 Survival of Obligations

17.04.A All representations, indemnifications, warranties, and guarantees made in, required by,

or given in accordance with the Contract Documents, as well as all continuing obligations indicated in the Contract Documents, will survive final payment, completion, and acceptance of the Work or termination or completion of the Contract or termination of the services of Contractor.

17.05 Controlling Law

17.05.A This Contract is to be governed by the law of the State of Arizona.

17.06 Headings

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

17.07 Professional Fees and Court Costs Included:

17.07.A Whenever reference is made to "claims, costs, losses and damages," it shall include in each case, but not be limited to, all fees and charges of engineers, architects, attorneys and other professionals and all court or other dispute resolution costs.

17.08 Project Staffing

17.08A **Key Personnel:** Before starting work, Contractor must submit detailed résumés of key personnel involved in that work for City's approval (which City will not unreasonably withhold). If Contractor later desires to change key personnel involved in that work, Contractor must submit detailed résumés of the new personnel for City's approval (which City will not unreasonably withhold).

17.08B **Qualified Staff:** Contractor must maintain an adequate and competent staff of qualified persons—as City may determine in its sole discretion—during performance of this Master Agreement. If City in its sole discretion determines that any of Contractor's staff is objectionable, Contractor must take prompt corrective action or replace that staff with new personnel, subject to City's approval.

17.08C **Third-Party Employment Brokers:** Contractor and Subcontractors will not utilize a third-party labor broker for any construction worker under this Agreement. The Contractor and Subcontractors must be the employers of record for its construction staff under this Agreement.

---END OF SECTION 00700---

SECTION 00800 - SUPPLEMENTARY CONDITIONS

Add the following new paragraph to the General Conditions:

SC-1.01.A.19.a. The Design Professional's Consultant is identified as:

Wilson Engineers, LLC
Gannet Fleming, Inc.

Add the following new paragraphs to the General Conditions identifying the additional insured:

SC-2.01.B.1. Additional insured to be named in the insurance policies to be provided by the Contractor are identified:

SC-2.01.B.1.a. City of Phoenix
SC-2.01.B.1.b. Wilson Engineers, LLC
SC-2.01.B.1.c. Gannett Fleming, Inc

Add the following new paragraphs to the General Conditions regarding electronic data:

SC-3.08.A.1. The following electronic data may be relied upon in lieu of hard copies:

SC3.08.A.1.a. Geotechnical Evaluation
NW Wastewater MP Package 4B 51st Ave Sewer

Add the following new Paragraphs following Paragraph 4.05.A.2.d in the General Conditions, which concerns information on Underground Facilities and as so amended Paragraphs 4.05.A thru 4.05.A.2.d, remain in effect.

SC-4.05.A.3. City's Quarter Section
Maps (water, sewer, storm drain, right-of-way)

Add the following new paragraph following Paragraph 5.05.A.4. of the General Conditions:

Amend the last sentence of Paragraph 5.05.C.1 of the General Conditions to read as follows:

"Such notice shall be sent directly to the Water Services Department's Project Manager at the address indicated below via certified mail, return receipt requested:

City of Phoenix
200 W. Washington St, 8th Floor
Phoenix, AZ 85003

Amend the last sentence of Paragraph 5.05.E3. of the General Conditions to read as follows:

"All certificates required by this Contract shall be sent directly to the Water Services Department's Project Manager at the address indicated below:

City of Phoenix
200 W. Washington St, 8th Floor
Phoenix, AZ 85003

Amend Paragraph 6.02.C of the General Conditions to read as follows:

SC-6.02.C The combined premium time charges of Design Professional and Owner shall be defined as \$150 per hour for each hour exceeding a 10-hour workday or a 50-hour work week.

Add a new paragraph immediately after Paragraph 6.09.A. of the General Conditions, which is to read as follows:

SC-6.09.A.1 Owner has secured or will secure the following permits, approvals and licenses and has paid or will pay any associated charges and fees:

SC-6.09.A.1.a. Approval to Construct from
MCESD
SC-6.09.A.1.b. Land Use/ Consent
Document from Central Arizona Project

Add a new paragraphs immediately after Paragraph 6.13.C. of the General Conditions, which is to read as follows:

SC-6.13.C.1 Following are those Owner's safety programs or requirements:

SC-6.13.C.1.a. Confined Space Entry

Replace Paragraph 7.02.B with the following:

"Other work being performed at the Site during this Project, consisting of, _____ shall be coordinated

for the Owner by _____"

Add the following paragraph after Paragraph 7.02.B of the General Conditions:

SC-7.02.C. Other contracts currently active or which may be active during the performance of the Work on this Project are identified below:

SC-7.02.C.1. Northwest Wastewater Master Plan Package 4A 51st Avenue Sewer (North of the CAP)

--- END OF SECTION 00800--



CITY OF PHOENIX

WATER SERVICES DEPARTMENT

**NORTHWEST WASTEWATER MASTER PLAN PACKAGE 4B
51st AVE GRAVITY SEWER
PROJECT NO. WS90500307**

TECHNICAL SPECIFICATIONS

Volume 2 of 3

100% Submittal

October 2023

MAYOR

Kate Gallego

CITY COUNCIL

**District 1 – Ann O’Brien
District 2 – Jim Waring
District 3 – Debra Stark
District 4 – Laura Pastor**

**District 5 – Betty Guardado
District 6 – Kevin Robinson
District 7 – Yassamin Ansari
District 8 – Kesha Hodge Washington**

CITY MANAGER

Jeff Barton

CITY ENGINEER

ERIC FROBERG, P.E.

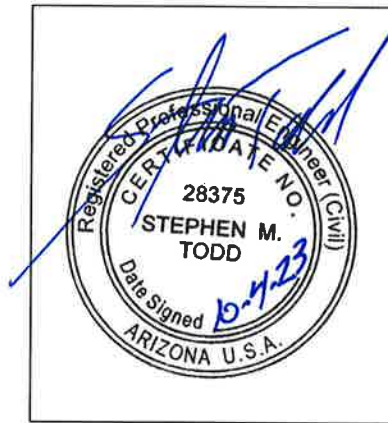
WATER SERVICES DIRECTOR

TROY HAYES, P.E.

CITY OF PHOENIX: Water Services Department
 PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
 PROJECT NUMBER: WS90500307 & WS90501004

TECHNICAL SPECIFICATIONS

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 51st AVE GRAVITY SEWER
 CITY PROJECT NO WS90500307 & WS90501004



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CITY OF PHOENIX: Water Services Department
 PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
 PROJECT NUMBER: WS90500307 & WS90501004

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02310	TUNNEL EXCAVATION AND PRIMARY LINER
02315	STRUCTURAL EXCAVATION AND BACKFILL
02318	CRUSHED STONE AND GRAVEL
02531	MANHOLES
02532	POLYMER CONCRETE MANHOLES
02742	BITUMINOUS PAVING
DIVISION 3 - CONCRETE	
03100	CONCRETE FORMWORK
03200	CONCRETE REINFORCEMENT
03251	CONCRETE JOINTS
03252	ANCHORAGE IN CONCRETE
03300	CAST-IN-PLACE CONCRETE
03600	GROUT
DIVISION 5 - METALS	
05051	ANCHOR BOLTS, TOGGLE BOLTS AND CONCRETE INSERTS
DIVISION 9 - FINISHES	
09910	SPECIAL FINISHES
DIVISION 15 - MECHANICAL	
15050	PIPING SYSTEMS
15051	BURIED PIPING INSTALLATION
15064	VITRIFIED CLAY PIPE
15070	HDPE PRESSURE PIPE
15120	PIPING SPECIALTIES AND ACCESSORIES
15121	WALL PIPES, FLOOR PIPES AND PIPE SLEEVES
DIVISION 33 - CENTRAL ARIZONA PROJECT SPECIFICATIONS	
33020	TRENCHLESS INSTALLATION OF STEEL CASING
33025	GROUTING OF STEEL CASING

++ END OF SECTION ++

SECTION 01110

SUMMARY OF WORK

PART 1 - GENERAL

1.1 LOCATION AND DESCRIPTION OF WORK

- A. The Work is located at the intersection of North Stetson Valley Parkway and the CAP Canal to West Pinnacle Peak Road and North 47th Avenue
- B. The Contract Documents include the following:
 - 1. Volume 1 of 3 Division 0.
 - 2. Volume 2 of 3 Technical Specifications.
 - 3. Volume 3 of 3 Contract Drawings, Gravity Sewer and Force Mains
- C. The Contract Documents for the Work to be performed include the following, but are not limited to:
 - 1. The Construction of 36-inch gravity sewer pipe with junction structure, pipe and junction structure appurtenances.
- D. Hazardous Environmental Condition: The responsibility for clean-up of Hazardous Environmental Conditions, in which conditions are described in reports referenced in the Supplementary Conditions, is within the Scope of Work, belongs to CONTRACTOR and shall be coordinated with the General Conditions, Supplementary Conditions and Section 01413, CONTRACTOR'S Hazardous Materials Management Program.

1.2 CONTRACT

- A. The Work shall be constructed under one prime contract.

1.3 SEQUENCE AND PROGRESS OF WORK

- A. CONTRACTOR shall submit a Construction Schedule covering the entire Work in accordance with Section 01321 - Progress Schedule.
- B. CONTRACTOR shall incorporate the requirements of Section 01111, Schedule of Completion, and Section 01143, Coordination with OWNER'S Operations, into the Construction Schedule. CONTRACTOR'S construction schedule may use a different sequence from that shown or specified, if techniques and methods known will result in cost and time savings to the OWNER, still achieve the required objective and maintain the same or greater level of treatment. The ENGINEER'S determination on the acceptability of any alternative sequence from that shown or specified shall be final.

1.4 CONTRACTOR'S USE OF PREMISES

- A. CONTRACTOR shall coordinate use of the premises, for his storage and the operations of his workmen, with OWNER, ENGINEER and utility service companies.
- B. The full use of the premises for storage, the operations of workmen and for all other construction activities will not be available to CONTRACTOR. Must operate entirely within the space allowed to him.
- C. CONTRACTOR shall be solely responsibility for obtaining and paying all costs in connection with any additional work area, storage sites, access to the site, or temporary right-of-way which may be required for proper completion of the Work.
- D. It shall be understood that responsibility for protection and safe-keeping of equipment and materials on or near the site will be entirely that of CONTRACTOR and that no claim shall be made against the OWNER or his authorized representatives by reason of any act. It shall be further understood that should any occasion arise necessitating access to the sites occupied by these stored materials or equipment, the ENGINEER shall direct CONTRACTOR owning or responsible for the stored materials and equipment to immediately move the same. No materials or equipment may be placed upon the property of the OWNER, other than within the limits of the property designated for the Northwest Wastewater Master Plan Package 4B as shown on the Drawings. All stored materials shall be labeled according to the appropriate contractor or subcontractor with the manufacturer's label as well. Appropriate safety data sheets (e.g., SDS) shall be provided.
- E. Project is subject to the Guidelines for Handling Sonoran Desert Tortoises encountered on Development Projects as published by the Arizona Game and Fish Department, most recent version. CONTRACTOR must follow the requirements set forth in the guidelines.
- F. The CONTRACTOR shall be responsible for the protection and mitigation of all endangered, threatened and/or protected species as identified by WestLand Resources Inc.
- G. The CONTRACTOR shall be responsible for native plant salvage and seeding. A salvage plan from WestLand Resource Inc. will be made available to CONTRACTOR upon completion of Native Plant Survey.
- H. CONTRACTOR shall be required to share use of the premises with other contractors whose services the OWNER has obtained or will obtain for construction of other facilities on the site.

1.5 EASEMENTS AND RIGHT-OF-WAY

- A. Easements and rights-of-way determined by the OWNER to be required to perform the Work will be provided by OWNER. Confine construction operations within the limits indicated on the Drawings. Use due care in placing construction tools, equipment, excavated materials, and pipeline materials and supplies in order to avoid damage to property and interference with traffic. Do not enter any private property outside the designated construction easement boundaries without written permission from the ENGINEER and the owner of the property. Any private property or rights-of-way owned by others than the OWNER, which CONTRACTOR wishes to utilize during the performance of the Work, shall be provided by CONTRACTOR.
- B. Within Maricopa County Rights-of-Way: Permits will be obtained by CONTRACTOR. All Work performed and all operations of CONTRACTOR, its employees, or subcontractors within the limits of County rights-of-way shall conform to the requirements and be under the control of the authority owning, or having jurisdiction over and control of, the right-of-way.

1.6 NOTICES TO OWNERS AND AUTHORITIES OF PROPERTIES ADJACENT TO THE WORK

- A. Notify OWNER of adjacent properties and utilities when prosecution of the Work may affect them.
- B. When it is necessary to temporarily obstruct access to property, or when any utility service connection must be interrupted, give notices sufficiently in advance to enable the affected persons to provide for their needs. Conform notices to any applicable local ordinance and, whether delivered orally or in writing, include appropriate information concerning the interruption and instructions on how to limit inconvenience caused thereby.
- C. Utilities and other concerned agencies shall be notified at least forty-eight (48) hours prior to cutting or closing streets or other traffic areas or excavating near underground utilities or pole lines.

1.7 DOCUMENTS AVAILABLE TO CONTACTOR

- A. The following documents are available at the CONTRACTOR'S request:
 - 1. Guidelines for Handling Sonoran Desert Tortoises Encountered on Development Projects as published by the Arizona Game and Fish Department, most recent version.
 - 2. A copy of WestLand Resources, Inc. documentation for the Northwest Water and Wastewater Master Plan for environmental services.
 - 3. A copy of the geotechnical report.

1.8 SALVAGE OF EQUIPMENT AND MATERIALS

- A. Existing equipment and materials removed, and not shown or specified to be reused as a part of the Work, shall be first reviewed by the City Staff to determine if they shall be salvaged under item 1.8.C herein or become the CONTRACTOR'S property. The contact person for coordinating the items to be salvaged or removed will be: Marcel Begay (602) 534-6997. The following items shall remain OWNER'S property:
- B. Existing equipment and materials removed by CONTRACTOR shall not be reused in the Work, except where so specified or indicated.
- C. Carefully remove, in a manner to prevent damage, all equipment and materials specified or indicated to be salvaged and reused or to remain the property of OWNER. Store and protect salvaged items specified or indicated to be reused in the Work. Replace in kind or with new items any items damaged in removal, storage, or handling through carelessness or improper procedures.
- D. Furnish and install new items, with ENGINEER'S approval, instead of those specified by OWNER or indicated to be salvaged and reused, in which case such removed items will become CONTRACTOR'S property.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01111

SCHEDULE OF COMPLETION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Commence the Work promptly upon the date established in the Notice to Proceed and shall pursue it to completion in accordance with the Agreement (Section 00500) as described in this Section.
- B. The Schedule of Completion describes selected project components only and is not intended to describe all project Work or constraints, interrelationships, or sequentially required Work.
- C. Completion of certain activities are directly related to treatment capacities at the Union Hills Water Treatment Plant. A listing of shutdowns, consisting of all plant or facility shutdowns, is included in Section 01143, Coordination with OWNER'S Operations.
- D. Contract times, as well as liquidated damages for failure to Substantially Complete the Schedule of Completion specified in this Section, are defined in the Agreement (Section 00500).

1.2 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 - 1. Comply with the requirements of Section 01332, Shop Drawing Procedures.
 - 2. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
 - 3. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to

include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

1.3 SCHEDULE OF COMPLETION

- A. Submit Shop Drawings in accordance with Section 01332, Shop Drawing Procedures, and the individual specification Sections. Submit early Shop Drawings as noted and as required to meet the Schedule of Completion.
- B. The Schedule of Completion for the Northwest Wastewater Master Plan Package 4B be as follows:

SCHEDULE OF COMPLETION		
Areas	Work	Completion Calendar Days/Date
51 st Ave Gravity Sewer	Installation of Gravity Sewer Mains and sewer appurtenances	See front end Specifications Volume 1 for Substantial and final Completion Days

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01140

WORK RESTRICTIONS

PART 1 - GENERAL

1.1 USE OF PREMISES

- A. Limit use of premises to Work in areas indicated. Do not disturb portions of site beyond areas in which Work is indicated.
 - 1. Limits: Confine construction operations to designated areas located intersection of North Stetson Valley Parkway and the CAP canal to West Pinnacle Peak Road and North 47th Avenue in Phoenix, Arizona as determined by OWNER and/or shown on the drawings. Confine storage of materials and support facilities to designated areas as shown on the drawings or as determined by the OWNER. Do not enter areas of the site where no Work is to be conducted.
 - 2. Driveways and Entrances: At all times, keep driveways and entrances serving premises clear and available to OWNER, OWNER'S employees, and emergency vehicles. Coordinate with the requirements of Section 01550, Access Roads and Parking Areas. Do not use these areas for parking or storage of materials.
 - a. Schedule deliveries to minimize use of driveways and entrances.
 - b. Schedule deliveries to minimize space and time requirements for on-site storage of materials and equipment.

- B. Promptly repair damage to premises caused by construction operations. Upon completion of the Work, restore premises to original condition.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01143

COORDINATION WITH OWNER'S OPERATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The intent of this Section is to provide CONTRACTOR a sequence to perform the Work in such a manner that satisfactory continuous operation of the facilities is maintained throughout the construction period.
- B. The sequences of Work and Schedule of Completion are specified under Section 01110, Summary of Work, and Section 01111, Schedule of Completion. The sequences have been assembled to maintain facility operations during construction.
- C. Except for the shutdown durations specified in this Section, CONTRACTOR'S means and methods shall be implemented such that the existing facility, shall remain in continuous satisfactory operation during the entire construction period. Work shall be so scheduled and conducted by CONTRACTOR such that it shall not impede facility operation, compromise facility security, create potential hazards to operating equipment and operations personnel, reduce the quality of the facility effluent or cause odor or other nuisances. In performing the Work shown and specified, plan and schedule the Work to meet both the constraints outlined in this Section and the facility's operating requirements.
- D. Work not specifically covered in Section 01110, Summary of Work; and Section 01111, Schedule of Completion or in the following paragraphs may, in general, be done at anytime during normal work hours during the Contract period, subject to the operating requirements outlined in this Section. All references to days in this Section are consecutive calendar days.
- E. The option of providing additional temporary facilities that may eliminate a constraint shall be allowed provided it is done without additional cost to the OWNER, presents no safety hazards, and that all requirements of these Specifications are fulfilled.
- F. CONTRACTOR shall be responsible for coordinating all shutdowns with the OWNER and ENGINEER. Whenever possible, combine discrete shutdown procedures identified in this Section or by CONTRACTOR into a single shutdown when the duration of the shutdowns or the Work requirements allow such combining to occur on a work area. The intent of combining procedures is to minimize the impacts upon facility operations by limiting the number of shutdowns required.

- G. CONTRACTOR shall not shut-off or disconnect any operating system of the facility, unless approved by the ENGINEER, in writing. All facility equipment operations and shutdowns shall be executed by the OWNER, unless otherwise noted. Seal OWNER operated gates and valves to prevent unnecessary leakage. After CONTRACTOR'S Work has been completed, remove the seal to the satisfaction of the ENGINEER.
- H. This Section of the Specifications contains several references to equipment, piping, material and appurtenances to be removed or reinstalled. Refer to the Drawings, Section 02220, Demolitions, and other applicable Sections, for definition of the equipment, piping, material and appurtenances to be removed, turned over to the OWNER and stored on site, or to become the property of CONTRACTOR and removed from the site.
- I. CONTRACTOR shall be responsible for supplying all temporary pipelines, valves, pumps, meters, spare parts, electrical, controls, any other appurtenances, and labor required for the installation and operation of temporary bypass lines, pumping systems, or conveyance systems required to maintain operations of the facility during construction activities. All pumps shall be provided with magnetic flowmeters capable of providing a 4 to 20 mADC output signal. Man all pumps continuously (24 hours per day) when in service. Submit to the ENGINEER, for information only, the design for all temporary lines, pumping, or conveyance systems at least seven days prior to the commencement of the Work.
- J. Unless otherwise specified, dewater process tanks and pipelines at the beginning of each shutdown. CONTRACTOR shall be responsible for washing down and cleaning all tanks, basins, pipelines and other Work areas. CONTRACTOR shall also be responsible for the proper removal and disposal of all washdown, cleaning and storm water that accumulates in the Work areas. Approximate depth of sludge, grit and other debris which can be expected to accumulate in the bottom of basins and pipelines is 18-inches. CONTRACTOR shall be responsible for removing this material and proper disposal off-site.

1.2 GENERAL CONSTRAINTS

- A. Article 1.3, below, and Section 01111, Schedule of Completion, specify the sequence and shutdown durations, where applicable, for facility areas which are to be taken out of service. The operational status of new or existing units other than the designated units shall not be interrupted by CONTRACTOR during the specified time periods. New units may only be used after the specified testing is completed and the units are accepted for use by the ENGINEER, in writing.
- B. The following constraints shall be applied to all equipment and appurtenant utility systems on the facility site.
 - 1. Load limits on Access Roads: Existing and new underground facilities, such as electrical duct banks, pipelines, etc., in, under and crossing roads, have been designed for a maximum wheel load of 16,000-pounds. CONTRACTOR shall not

exceed this weight limit and shall provide means of protecting any underground facilities.

2. Access to Site: An unobstructed traffic route through all facility gates shall be maintained at all times.
3. Safety Barriers: Place safety barriers around unsafe areas located around operational areas throughout the facility.
4. Personnel Access: City personnel shall have access to all areas which remain in operation throughout the construction period.
5. Plumbing Facilities: Sanitary facilities in the existing structures shall be operational at all times for Operating Personnel, unless otherwise specified in Article 1.5, below. All other building plumbing systems, such as roof and floor drains, pumping, etc., shall be maintained for all structures.
6. Storm drainage: Storm drainage on the site shall be operational at all times, unless otherwise specified in Article 1.3, below.
7. The OWNER will assist CONTRACTOR in dewatering process tanks, basins and other process Work areas. It is CONTRACTOR'S responsibility to maintain a clean and dry Work area by pumping and properly disposing of all washdown and cleaning water and stormwater that accumulates in the Work areas.
8. Draining Process Pipes and Conduits:
 - a. Unless otherwise specified, the contents of pipes and conduits undergoing modifications shall be properly disposed of using hoses, piping, pumps, or other applicable means.
 - b. If a drain is not available on the pipe to be drained, then a wet tap shall be made by CONTRACTOR using a tapping saddle and valve approved by the ENGINEER. No uncontrolled spillage of a pipe's contents shall be allowed.
 - c. Any spillage shall be brought to the ENGINEER'S attention immediately in writing. Wash down any spillage to floor drains, sumps and sump pump discharge piping and then flush out the system to prevent clogging and septic odors. If spillage is not suitable for drainage system, e.g. chemical spills, etc, as determined by the ENGINEER, remove spillage by other method such as Vactor truck, as approved by the ENGINEER.
9. Dead End Valves or Pipe: Provide blind flanges on all valves or pipes which dead-end a line on a temporary or permanent basis. Blind flanges shall be braced and blocked, as required or as directed by the ENGINEER in the field.
10. Schedule all start-ups for Tuesday through Thursday. No start-ups will be allowed on Monday, Friday, Saturday, and Sunday.

1.3 SHUTDOWNS

A. General:

1. A shutdown shall be defined as a portion of the normal operation of a facility unit or conduit that has to be suspended or taken out of service in order to perform the specified Work. For each shutdown, compile an inventory of labor and materials required to perform tasks, provide an estimate of the time required (including time for the OWNER to take down and start-up the facility unit or conduit), and a written

description of steps required to complete all tasks. The inventory, the estimate, and written procedures shall be submitted to the ENGINEER for review fourteen calendar days prior to the proposed start date of the shutdown. Request, in writing from the ENGINEER, approval for each shutdown a minimum of seven calendar days prior to the proposed shutdown date. No shutdown shall be initiated until the inventory of materials and labor is verified by the ENGINEER on site at least one week prior to the proposed start date.

2. The Work required herein and any other Work required by the ENGINEER which may interrupt the normal facility operations shall be accomplished at such times that will be convenient to the OWNER.
 3. Have on hand and located in close proximity to the Work area, all tools, equipment, spare parts and materials, both temporary and permanent, necessary to complete each Work category without interruption. Adequate numbers of personnel shall be scheduled for each shutdown, so that the Work shall be accomplished within the specified time frame. Prefabrication of all piping and other assemblies shall be completed, to the greatest degree possible, prior to any shutdowns. The ENGINEER shall be satisfied that CONTRACTOR has complied with these requirements, to the fullest extent possible, before shutdowns will be authorized.
 4. If CONTRACTOR'S procedures cause an unscheduled shutdown of the facilities, perform Work as necessary to immediately re-establish satisfactory operation. Notify the ENGINEER, in writing, immediately of any unscheduled shutdown. Permit OWNER'S personnel to work with CONTRACTOR'S personnel, as required, to maintain the facility in continuous satisfactory operation. Unscheduled shutdowns or interruptions of continued safe and satisfactory operation of the facilities that result in fines levied by the U.S. Environmental Protection Agency, Arizona Department of Environmental Quality, Maricopa County Health Department Bureau of Air Pollution Control, or the Maricopa County Department of Environmental Management shall be the responsibility of CONTRACTOR if it is demonstrated that CONTRACTOR was negligent in the Work or did not exercise proper precautions in the conduct of the Work.
 5. The scheduled shutdowns during the period of CONTRACTOR'S Work will be as shown in Part 3. All Work requiring the facility to be out-of-service shall be performed during the scheduled shutdowns shown. It should be noted operations staff shall continue to perform administrative, operation and maintenance functions during shutdowns. The CONTRACTOR shall submit a list of all scheduled shutdowns to the OWNER 60 days prior to the first shutdown required.
 6. Electrical Ductbank Installation: Shutdown and relocation of conflicting utilities alignments with electrical ductbank will only be allowed for certain types of process pipelines. Any shutdown and relocations shall follow a strict time schedule in order to minimize impact to facility operations.
- B. Shutdowns of Electrical Systems: CONTRACTOR shall lock out and tag circuit breakers and switches operated by the OWNER and shall check cables and wires to be sure that they are de-energized to ground potential before Work begins. Upon completion of the

Work, remove the locks and tags and notify the ENGINEER that the facilities are available for use.

1.4 OVERTIME

- A. All overtime Work by CONTRACTOR necessary to conform to the requirements of this Section shall be performed by CONTRACTOR, at no additional cost to the OWNER and shall be performed in accordance with the General Conditions. Make no claims for extra compensation as a result thereof.

1.5 METHOD OF PLANNED OPERATIONS SCHEDULE

- A. In order to maintain a continuous facility operation during construction, a Method of Planned Operations (MOPOs) Schedule is included at the end of this Section.
- B. Within each MOPO item's procedural steps, time and scheduling constraints and milestone dates may be outlined and are intended to assist CONTRACTOR in developing a sequence of Work and timing in order to maintain continuous operation of the facility.
- C. Develop a detailed description of the complete sequence of construction for all the MOPO events contained herein. The sequences shall be submitted to the ENGINEER for review and approval fourteen days following the Notice to Proceed.
- D. The procedures contained herein were developed based upon available information. This list does not address all required tie-ins, but only those anticipated to be of significant impact to facility operations.
- E. Is required to make all tie-ins, connections, and replacements necessary to perform the Work.
- F. Is advised that Work in multiple areas of the facility, gravity sewer and force main system shall be performed simultaneously in order to complete the entire scope of the Work within the allotted Contract time.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

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CITY OF PHOENIX: Water Services Department
 PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
 PROJECT NUMBER: WS90500307 & WS90501004

PROCESS/MECHANICAL

1.0 Piping Modifications

MOPO No.	DWG. NO.	ITEM DESCRIPTION	PROCESS UNITS OPERATING PRIOR TO SHUTDOWN	PROCESS UNITS OPERATING DURING SHUTDOWN	PROCESS UNITS OUT-OF-SERVICE DURING SHUTDOWN	IMPACT ON OTHER PROCESS UNITS	PROCEDURE	CONSTRAINTS AND REMARKS	DURATION OF SHUTDOWN
		Connect 36" gravity sewer to existing sewer on West Pinnacle Peak Road and North 47 th Avenue					Manhole Junction Structure shall be created for existing sewer on West Pinnacle Peak Road and North 47 th Avenue and new 36" gravity sewer		

++ END OF SECTION ++

SECTION 01271

MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The items listed below, beginning with Article 1.4, refer to and are the same pay items listed in the Bid Form. They constitute all of the pay items for the completion of the Work. No direct or separate payment shall be made for providing miscellaneous temporary or accessory works, plant services, CONTRACTOR'S or ENGINEER'S field offices, layout surveys, job signs, sanitary requirements, testing, safety devices, approval and Record Drawings, water supplies, power, traffic maintenance, removal of waste, watchmen, bonds, insurance, or all other requirements of the General Conditions, Supplementary Conditions, and the Contract Requirements. Compensation for all such services, items and materials shall be included in the prices stipulated for the lump sum and unit price pay items listed herein.
- B. Each lump sum and unit bid price shall be deemed to include an amount considered by CONTRACTOR to be adequate to cover CONTRACTOR'S overhead and profit for each separately identified item.

1.2 ENGINEER'S ESTIMATE OF QUANTITIES

- A. ENGINEER'S estimated quantities for unit price pay items, as listed in the Bid Form, are approximate only and are included solely for the purpose of comparison of Bids. OWNER does not expressly or by implication agree that the nature of the materials encountered below the surface of the ground or the actual quantities of material encountered or required shall correspond therewith and reserves the right to increase or decrease any quantity or to eliminate any quantity as OWNER may deem necessary. Not entitled to any adjustment in a unit bid price as a result of any change in an estimated quantity and agrees to accept the aforesaid unit bid prices as complete and total compensation for any additions or deductions caused by changes or alterations in the Work directed by OWNER.

1.3 RELATED PROVISIONS

- A. Payments to CONTRACTOR: Refer to General Conditions and Agreement.

- B. Changes in Contract Price: Refer to General Conditions.
- C. Pay Application: Refer to Section 01331, Reference Forms.

1.4 GENERAL

- A. **Bid Item No. 1 – “36” VCP SANITARY SEWER** shall include the installation and materials for the 36” vitrified clay pipe. The VCP shall be per Section 15064. Installation costs shall include, and is not limited to, excavation, shoring, backfill, and disposal of unsuitable material off-site.
 - 1. Measurement and Payment: The unit price per foot will be full payment for Bid Item No. 1 for completing the Work, as shown and specified.
- B. **Bid Item No. 2 – “60” LINED SEWER MANHOLE** shall include the installation and materials for the straight run manholes. This shall include all structural elements per structural sheet S-105, manhole requirements per Section 02531, the interior coating per Section 09910, and all testing per Section 01453.
 - 1. Measurement and Payment: The unit price per each will be full payment for Bid Item No. 2 for completing the Work, as shown and specified.
- C. **Bid Item No. 3 – “DEFLECTION MANHOLE LESS THAN 10 DEGREES”** shall include the installation and materials for the manholes at deflections less than 10 degrees. This shall include all structural elements per structural sheet S-102, manhole requirements per Section 02531, the interior coating per Section 09910, and all testing per Section 01453.
 - 1. Measurement and Payment: The unit price per each will be full payment for Bid Item No. 3 for completing the Work, as shown and specified.
- D. **Bid Item No. 4 – “DEFLECTION MANHOLE MORE THAN 10 DEGREES”** shall include the installation and materials for the manholes at deflections more than 10 degrees. This shall include all structural elements per structural sheet S-103, manhole requirements per Section 02531, the interior coating per Section 09910, and all testing per Section 01453.
 - 1. Measurement and Payment: The unit price per each will be full payment for Bid Item No. 4 for completing the Work, as shown and specified.
- E. **Bid Item No. 5 – “JUNCTION STRUCTURE NO. 1”** shall include the installation and materials for the junction structure near Pinnacle Peak Road and 47th Avenue. This shall include all structural elements per structural sheet S-100, the interior coating per Section 09910, and all testing per Section 01453.
 - 1. Measurement and Payment: The unit price per each will be full payment for Bid Item No. 5 for completing the Work, as shown and specified.

- F. **Bid Item No. 6 – “72” STEEL CASING**” shall include the installation and materials for the 72” steel casing as seen on sheet C-26.
1. Measurement and Payment: The unit price per foot will be full payment for Bid Item No. 6 for completing the Work, as shown and specified.
- G. **Bid Item No. 7 – Not used.**
- H. **Bid Item No. 8 – “JACK AND BORE PIT**” shall include the installation and material costs for the excavation, shoring, and jack and bore equipment.
1. Measurement and Payment: The lump sum price will be full payment for Bid Item No. 8 for completing the Work, as shown and specified.
- I. **Bid Item No. 9 – “RECEIVING PIT**” shall include the installation and material costs for the excavation and shoring.
1. Measurement and Payment: The lump sum price will be full payment for Bid Item No. 9 for completing the Work, as shown and specified.
- J. **Bid Item No. 10 – “MOBILIZATION/DEMobilIZATION**” shall include the mobilization and demobilization required for the project and any coordination with the City of Phoenix related to shutdowns for waterline realignments. This bid item shall also include any additional costs necessary to complete all work shown in the Plans and/or Specifications that is not specifically included in one of the other project bid items.
1. Measurement and Payment: The lump sum price will be full payment for Bid Item No. 10 for completing the Work, as shown and specified.
- K. **Bid Item No. 11 – “TRAFFIC CONTROL ALLOWANCE**” shall include temporary barricades, permit fees, message boards, signs, vehicle and pedestrian control devices, flagmen, and uniformed off-duty law enforcement officers.
1. Measurement and Payment: The allowance for this bid item will not exceed \$350,000 with no markup which shall be full compensation for the item complete in place.
- L. **Bid Item No. 12 – “OWNER’S ALLOWANCE**” shall be used for construction services that are deemed necessary by the City that are currently not included within the contract documents. Use of this allowance shall be as determined by the City’s sole discretion.
1. Measurement and Payment: The allowance for this bid item will not exceed \$750,000 with no markup which shall be full compensation for the item complete in place.

- M. **Bid Item No. 13 – “TYPE B DROP SEWER CONNECTION”** shall include the installation and materials for Type B sewer drop connections per MAG Standard Detail 426.
1. Measurement and Payment: The unit price per each will be full payment for Bid Item No. 13 for completing the Work, as shown and specified.
- N. **Bid Item No. 14 – “VERTICALLY REALIGN WATERLINE”** shall include the installation and materials for the demolition and relocation of the waterline per City of Phoenix Standard Detail P1370.
1. Measurement and Payment: The unit price per each will be full payment for Bid Item No. 14 for completing the Work, as shown and specified.
- O. **Bid Item No. 15 – “CONCRETE ENCASE PIPE”** shall include the installation and materials for the concrete encasement of the pipe crossings per MAG Standard Detail 404.
1. Measurement and Payment: The unit price per each will be full payment for Bid Item No. 15 for completing the Work, as shown and specified.
- P. **Bid Item No. 16 – “REMOVE AND REPLACE AC PAVEMENT”** shall include the sawcut removal, materials, and installation for the asphalt concrete as indicated on the design plans per MAG Standard Specification 336 and Detail 200-1, Type A.
1. Measurement and Payment: The unit price per square foot will be full payment for Bid Item No. 16 for completing the Work, as shown and specified.
- Q. **Bid Item No. 17 – “REMOVE AND REPLACE CURB AND GUTTER”** shall include the removal, materials, and installation for the curb and gutters as indicated on the design plans per MAG Standard Detail 220-1, Type A.
1. Measurement and Payment: The unit price per foot will be full payment for Bid Item No. 17 for completing the Work, as shown and specified.
- R. **Bid Item No. 18 – “REMOVE AND REPLACE DRIVEWAY”** shall include the removal, materials, and installation for the driveway as indicated on design plan sheet C-7 per City of Phoenix Standard Detail P1243.
1. Measurement and Payment: The unit price per square foot will be full payment for Bid Item No. 18 for completing the Work, as shown and specified.
- S. **Bid Item No. 19 – Not used.**
- T. **Bid Item No. 20 – “REPLACE CONCRETE COLLAR”** shall include the demolition, installation, and materials for replacing the concrete collar of existing manholes disturbed due to project construction.
1. Measurement and Payment: The unit price per each will be full payment for Bid Item No. 20 for completing the Work, as shown and specified.

- U. **Bid Item No. 21 – “REPLACE LANDSCAPING”** shall include the removal, installation, and material costs for the removal and replacement of existing landscaping disturbed due to project construction.
1. Measurement and Payment: The allowance for this bid item will not exceed \$100,000 with no markup which shall be full compensation for the item complete in place.
- V. **Bid Item No. 22 – “VCP STUB OUT AND PLUG”** shall include the installation and material costs for the VCP stub out and plug per MAG Standard Detail 427.
1. Measurement and Payment: The unit price per each will be full payment for Bid Item No. 22 for completing the Work, as shown and specified.
- W. **Bid Item No. 23– “DEFLECTION MANHOLE MORE THAN 40 DEGREES”** shall include the installation and materials for the manholes at deflections more than 40 degrees. This shall include all structural elements per structural sheet S-104, manhole requirements per Section 02531, the interior coating per Section 09910, and all testing per Section 01453.
1. Measurement and Payment: The unit price per each will be full payment for Bid Item No. 23 for completing the Work, as shown and specified.
- X. **Bid Item No. 24 – “ACP WATERLINE REPLACEMENT”** shall include the installation and materials for the demolition and replacement of the 12” or less diameter asbestos cement waterlines crossed in this project per City of Phoenix Standard Specification 601.2.8. Removal and disposal of asbestos cement pipe shall be in accordance with all applicable federal, state, and local regulations.
1. Measurement and Payment: The unit price per each will be full payment for Bid Item No. 24 for completing the Work, as shown and specified.
- Y. **Bid Item No. 25 – “CUT AND PLUG WATER”** shall include the demolition costs for the existing waterline and the installation and material costs for the plug per COP Standard Detail P1343.
1. Measurement and Payment: The unit price per each will be full payment for Bid Item No. 25 for completing the Work, as shown and specified.
- Z. **Bid Alternative – “CAP CROSSING”** shall include the installation and materials for project components past STA 245+45.20. This includes, but is not limited to, VCP pipe and trenching, the jack and bore underneath the CAP canal, 36” HDPE pipe, 60” steel casing, and excavation of the access pit, jack and bore pit, and receiving pit.
1. Measurement and Payment: The lump sum price will be full payment for the Bid Add Alternative for completing the Work, as shown and specified.

CITY OF PHOENIX: Water Services Department
PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
PROJECT NUMBER: WS90500307 & WS90501004

AA. **Bid Alternative – “POLYMER CONCRETE MANHOLES”** shall be alternative to Bid Items 2, 3, 4, and 23. This bid alternative shall include the installation and materials for the project manholes, which shall meet the requirements of Section 02532, as an alternative to the manhole structural design within the Plans.

1. Measurement and Payment: The unit price per each will be full payment for the Bid Alternative for completing the Work, as shown and specified.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01301

PRE-CONSTRUCTION CONFERENCE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Date, Time and Location: Conference will be held after notice of award of the Contract. ENGINEER will fix the date, time and location of the meeting, within seven (7) days of notice of award.
- B. ENGINEER shall prepare agenda, preside at meeting, and prepare and distribute a transcript of proceedings to all parties.
- C. Provide data required, contribute appropriate items for discussion, and be prepared to discuss all items on agenda.
- D. Unless previously submitted to ENGINEER, bring to the conference a preliminary schedule of each of the following:
 - 1. Progress Schedule.
 - 2. Shop Drawing and Sample submittals.
 - 3. Safety plan.

1.2 REQUIRED ATTENDANCE

- A. Conference shall be attended by CONTRACTOR'S Project Manager, its superintendent and its major subcontractors and major equipment suppliers as CONTRACTOR deems appropriate.
- B. OWNER'S representative.
- C. ENGINEER.
- D. Representatives of governmental agencies having any degree of control or responsibility, if available.
- E. Utility company representatives.
- F. Power System STUDY FIRM Representatives.

1.3 PURPOSE

- A. The purpose of the Pre-construction conference is to designate responsible personnel and establish working relationships. Matters requiring coordination will be discussed

and procedures for handling such matters will be established. A complete agenda will be furnished to CONTRACTOR prior to the Pre-construction conference date. However, be prepared to discuss all of the following; but will not necessarily be limited to the following:

1. Designation of responsible personnel.
2. Subcontractors.
3. Coordination with other contractors and projects.
4. Progress schedule.
5. Processing of Shop Drawing Submittals.
6. Schedule of Shop Drawing submittals.
7. Processing of Field Orders, Requests for Information and Clarification and Change Orders.
8. Requirements for copies of Contract Documents.
9. Insurance in force.
10. Processing and Schedule of Payments.
11. Use of premises.
12. CONTRACTOR responsibility for safety and first aid procedures.
13. Site Security.
14. Housekeeping.
15. Field Offices.
16. Maintaining Record Drawings.
17. Letter of Notice to Proceed.
18. Permits.
19. Emergency Telephone Numbers.
20. Operation and Maintenance Manuals.
21. Temporary Utilities.
22. I&C Inspection & Testing Services Coordination
23. Electrical Arc Flash Coordination per Section 16050.
24. Any other project related items.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01311

PROJECT COORDINATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. As more fully set forth in of the General Conditions, CONTRACTOR shall be solely responsible for coordination of all of the Work. The CONTRACTOR shall supervise, direct and cooperate fully with all subcontractors, manufacturers, fabricators, suppliers, distributors, installers, testing agencies and all others whose services, materials, or equipment are required to ensure completion of the Work within the Contract Time.
- B. As more fully set forth in of the General Conditions, the CONTRACTOR shall cooperate with and coordinate the Work with the work of any other contractor, utility service companies or OWNER'S employees performing work at the site.
- C. The CONTRACTOR shall not be responsible for damage done by contractors not under CONTRACTOR'S jurisdiction and shall not be liable for any such loss or damage, unless it is through the negligence of CONTRACTOR.
- D. The CONTRACTOR shall coordinate the Work with the work of others to assure compliance with schedules.
- E. The CONTRACTOR shall attend and participate in all project coordination or progress meetings and report on the progress of all Work and compliance with schedules.
- F. The CONTRACTOR shall maintain sufficient competent personnel, drafting and CADD equipment and supplies at the site for the purpose of preparing layout, coordination and Record Drawings. These drawings shall supplement the Contract Documents, and the working and Shop Drawings as necessary to correlate the Work of various trades. Where such drawings are to be prepared by the mechanical, electrical, plumbing, or heating and ventilating subcontractors, the CONTRACTOR shall ensure that each subcontractor maintains the required personnel and facilities at the site.
- G. It is the duty of the CONTRACTOR to determine that all necessary permits have been obtained. The CONTRACTOR, at his own expense, obtain, maintain and close all the required permits which have not been furnished. The CONTRACTOR to have all copies of permits onsite for OWNER review.

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PROJECT NUMBER: WS90500307 & WS90501004

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01312

PROGRESS MEETINGS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Date and Time:
 - 1. Regular Meetings: Weekly on a day and time agreeable to OWNER, ENGINEER and CONTRACTOR.
 - 2. Other Meetings: As needed and/or required in other specific specification sections.
- B. Place: CONTRACTOR'S field office at the project site, or other mutually agreed upon location.
- C. The CONTRACTOR shall conduct weekly progress meetings, the ENGINEER shall record and distribute minutes of the meeting to all attendees and others as requested. At a minimum, the agenda will include: Requests for Information (RFI) and submittal status, past week's progress and a 3-week look-ahead schedule to include upcoming inspections, current issues, long lead items, critical issues and the next scheduled meeting date.
- D. CONTRACTOR shall provide data required and be prepared to discuss all items on agenda.

1.2 MINIMUM ATTENDANCE

- A. CONTRACTOR:
 - 1. When needed for the discussion of a particular agenda item, CONTRACTOR shall require representatives of subcontractors or suppliers to attend a meeting.
- B. ENGINEER and sub-consultants.
- C. OWNER'S representative, if required.
- D. Others, as appropriate.
- E. Representatives present for each party shall be authorized to act on their behalf.

1.3 AGENDA

- A. Agenda will include, but will not necessarily be limited to, the following:
 - 1. Transcript of previous meeting
 - 2. Progress since last meeting;

- a. CONTRACTOR’S three week schedule. Schedule shall show intended work three weeks ahead as well as completed work since the last progress meeting.
- b. Subcontractors’ three week schedule (may be combined with CONTRACTOR’S schedule).
3. Completion status.
4. Planned progress for next period including a 3-week look-ahead schedule to include upcoming inspections.
5. Document and track to correction and closure any problems, conflicts, issues, and observations that are voiced by anyone of the project team.
6. Status of Shop Drawings, RFI and RFAs.
7. Change Orders.
8. Pay Requests.
9. Quality Standards and Control.
10. Schedules, updated Project Schedules, including off-site fabrication and delivery schedules; corrective measures, if required.
11. Coordination between parties.
12. Permits.
13. Safety concerns.
14. Construction Photographs.
15. Record Drawings.
16. Warranty Requests.
17. Punch List Status.
18. Other business.
19. Next meeting date.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01321

PROGRESS SCHEDULE (CPM)

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section describes the Progress Schedule requirements to ensure that interim milestone dates will be met and completion of the Work will be accomplished within the time established. ENGINEER'S opinions concerning the various scheduling documents and reports are not controlling CONTRACTOR'S independent judgement concerning means, methods, and sequences of construction CONTRACTOR employs. Sole responsibility for meeting the Contract time(s) given in these Contract Documents, belongs to CONTRACTOR.
- B. No later than 14 calendar days after the Notice to Proceed, submit a Preliminary Progress Schedule. The Preliminary Progress Schedule shall be referenced to time. The balance of Work leading to Substantial Completion of the Project shall be included, in a summary format.
- C. No later than 30 calendar days after the Notice to Proceed, submit to the ENGINEER a 90-day Bar Chart Schedule prepared in accordance with Article 1.1 through 1.6, herein. The 90-day Bar Chart Schedule shall detail the first 90 calendar days of the Project.
- D. No later than 60 calendar days after the Notice to Proceed, submit to the ENGINEER a full Progress Schedule prepared in accordance with Articles 1.1 through 1.7, herein. Upon review and acceptance, the CONTRACTOR'S submitted full progress schedule, described in this paragraph, will be deemed to be the "Baseline Schedule". (The use of the term "Baseline Schedule" refers to the early dates; the late dates are for the purpose of calculating float, and do not represent the schedule). This Baseline Schedule shall be used by the CONTRACTOR for planning, scheduling and executing the Work and for monitoring and reporting progress to the ENGINEER. No changes to the Baseline Schedule may be made by the CONTRACTOR without the approval of the ENGINEER.
- E. To ensure completion of the Work within the contract times established, all of CONTRACTOR'S activities shall be scheduled and monitored by use of a Critical Path Method (CPM) Progress Schedule. Provide a CPM Schedule for Work done under this Contract, in accordance with this Section, and the sequence and progress of Work requirements included under Section 01110, Summary of Work, Section 01111, Schedule of Completion and Section 01143, Coordination with OWNER'S Operations, the Supplementary Conditions and the Construction Sequence Diagram.

- F. The Progress Schedule shall be prepared by CONTRACTOR using the Critical Path Method (CPM) utilizing the latest version of Primavera Project Planner software with Primavision (Primavera Project Planner and Primavision are U.S. registered trademarks of Primavera Systems, Inc., Bala Cynwyd, PA), or approved equal as determined by the OWNER and ENGINEER, conforming to the requirements hereinafter described.

1.2 SCHEDULING CONSULTANT

- A. Engage, at his expense, a Scheduling Consultant or a qualified Contractor's employee who has experience and is skilled in the time and cost application of CPM network techniques using Primavera on sewer line construction projects to assist in the preparation of the Project Schedule. Prior to engaging a Scheduling Consultant or a qualified Contractor's employee, Submit to the ENGINEER:
1. The name and address of the proposed Scheduling Consultant or qualified CONTRACTOR'S employee and the names of those persons who would be dedicated to this Project.
 2. Sufficient information to show that the proposed Scheduling Consultant or qualified CONTRACTOR'S employee and the persons dedicated to this Project, have the qualifications to meet the Progress Schedule requirements.
- B. The ENGINEER shall have the right to approve or disapprove the proposed Scheduling Consultant or qualified contractor's employee and will notify CONTRACTOR of his decision within 7 calendar days from receipt of information. In case of rejection, CONTRACTOR shall submit qualifications of another consultant within 14 calendar days for renewed considerations. Such approval or disapproval does not release CONTRACTOR from his obligations under this Contract.

1.3 LOGIC DIAGRAM

- A. CONTRACTOR'S Scheduling Consultant or qualified contractor's employee shall prepare and submit a complete reproducible set of pure logic diagrams as generated by Primavera on 24-inch by 36-inch, or 11-inch by 17-inch drawings. The logic diagrams shall be grouped by Area and show the order and interdependence of activities and the sequence and quantities in which the Work is to be accomplished. Interrelationships to or from activities outside the area shown will be depicted by an activity symbol with activity number and description shown from the Primavera program. The basic concept of Precedence Diagramming Method (PDM) network scheduling shall be followed to show how the start of a given activity is dependent on the completion of preceding activities and how its completion may affect the start of following activities. The level of schedule detail shall define the day-to-day activities of the construction Work. No construction activity duration shall be longer than Ten (10) working days without prior approval.

- B. The critical path shall be distinguished from other paths on the network. The logic diagrams shall be banded by major work systems, including one system for procurement and by specific area within each system. Logic diagrams shall include the following:
1. Activity number.
 2. Activity description.
 3. Activity duration (work days).
 4. Critical path denoted.
 5. Slack or float of each activity.
 6. System designation.
 7. Area code.
 8. Responsibility code (e.g., CONTRACTOR, subcontractors, trades, operations, suppliers, ENGINEER, or other party responsible for accomplishment of an activity).
 9. Shift number (if more than one shift per day is to be employed).
- C. In addition to construction activities, network activities shall include the submittal and approval of samples of materials, shop and working drawings, and fabrication of special materials. It shall include all documents and proofs of compliance required by the Contract Documents for Final Inspection and Acceptance of the Work.
- D. The Schedule Document shall include a System and Acceptance schedule within the project CPM schedule. This schedule will identify all equipment and systems that require testing, training and acceptance by the City of Phoenix. The durations and sequences of the systems testing and acceptance must be as specified in the various sections of the contract specification. Each system will contain, but will not be limited to, all of the following activities and constraints:
1. Interface between the construction activities and their respective system.
 2. CONTRACTOR'S pre-testing work.
 3. Submittal and Approval of the CONTRACTOR'S Pre-testing Data and checklist, as appropriate.
 4. Sufficient notification time to the City of Phoenix prior to system testing.
 5. Submittal and Approval of the Preliminary and Final As-Built Drawings.
 6. Submittal and Approval of the Preliminary and Final O&M Manuals.
 7. Submittal and Approval of Testing Procedures.
 8. All other systems that are required to be tested and accepted prior to the specific system being tested.
 9. System Testing by the City of Phoenix.
 10. Other outside agencies, utilities, etc., that are required to test, witness and accept the system.
 11. Submittal and Approval of the Training Syllabus, Training Manual, and Training Video.
 12. Performance of Training.
- E. All activities of the ENGINEER/OWNER that affect progress and special dates required by the Contract shall be shown.

1.4 MATHEMATICAL TABULATIONS

- A. The mathematical tabulation of the network diagram shall include tabulation of each activity shown on the detailed network diagram.
- B. The information listed below shall be furnished as a minimum for each activity. All submittal and updates shall consist of Three (3) copies of the reports described below and two sets of compact discs (CD's) containing Primavera schedule backups. The minimum required information includes:
1. Activity number.
 2. Activity description.
 3. Activity duration (work days).
 4. Earliest start date (calendar date).
 5. Earliest finish date (calendar date).
 6. Latest start date (calendar date).
 7. Latest finish date (calendar date).
 8. Slack or float of each activity.
 9. Quantities involved for each construction activity with man-hour requirements and dollar values.
 10. Critical path activities denoted.
 11. Work days calendar which extends for not less than the length of the contract, plus six months.
- C. The mathematical tabulation shall be in the form of computer-generated reports. The reports shall be bound in booklet form, indexed, and separated by tabbed dividers. Computer-generated reports, of the following sorts, provided by CONTRACTOR:
1. Milestone Report.
 2. Critical Path Activities Report by Early Start.
 3. Area Schedule Report for each System by Area/Early Start/Total Float.
 4. Responsibility Schedule Report for each System by Responsibility/Early Start/Total Float.
 5. 60-Day Look-Ahead Report by Area for Each System, then by activity number (with update line).
 6. Man-hour Resource Reports:
 - a. Man-hour Summary by Responsibility.
 - b. Monthly Projected Man-hour Flow Report (Tabular) with Manpower Resource Graphic on 24-inch by 36-inch, or 11-inch by 17-inch Sheet.
 - c. Man-hour Summary by Area.
 - d. Detailed Man-hour by Area/by Activity Report.

1.5 NARRATIVE REPORT

- A. Prepare, and include with his original Progress Schedule submission, a narrative report describing the contract requirements and objectives and CONTRACTOR'S plan and schedule for achieving those requirements and objectives. The narrative shall describe

the methods of operation, the resources to be employed, time frames for the construction of each of the major systems on the project, and time frames for accomplishment of the specified milestones and project completion.

- B. It shall also include, but not be limited to:
1. A justification and identification of activities that were worked out of sequence.
 2. A description of problem areas.
 3. Current and/or anticipated delaying factors and their potential impact.
 4. An explanation of corrective action (recovery plan) either taken or proposed for all critical areas.
 5. A listing of all intermediate contractual milestones with their respective float and schedule analysis.
 6. Define activities that were not started or completed as scheduled and provide explanation.
 7. Identify and discuss planned manpower versus actual manpower usage and provide projections by Subcontractor.
 8. Identify outstanding “Requests for Information (RFI’s)” and discuss their schedule impact.

1.6 MAN-HOURS LOADING REPORTS

- A. After acceptance of the original Progress Schedule, assign labor resources to each construction activity within each responsibility code in man-hours. Resource schedule reports will be required and resource leveling may be employed as required.

1.7 PROGRESS SCHEDULE SUBMITTAL

- A. No later than 30 calendar days after the Notice to Proceed, submit to the ENGINEER a 90-day Bar Chart Schedule. During this period CONTRACTOR and the Scheduling Consultant shall meet with the ENGINEER and the OWNER for a minimum of two day workshop sessions to review technical requirements and schedule development methods and procedures. The 90-day Bar Chart Schedule will be reviewed by the ENGINEER within 14 calendar days of receipt or request for adjustment. A meeting, or meetings, may be required with CONTRACTOR’S Scheduling Consultant during this period in order to expedite acceptance or adjustment. Any adjustments required after this period shall be made and resubmitted by CONTRACTOR within 90 calendar days.
- B. No later than 60 calendar days after the Notice to Proceed, 14 calendar days after the complete Progress Schedule has been accepted by the ENGINEER, CONTRACTOR submit to the ENGINEER a full Progress Schedule prepared in accordance with Articles 1.1 through 1.5, above. During this period the ENGINEER, CONTRACTOR and CONTRACTOR’S Scheduling Consultant shall meet biweekly to review the progress of the development of the full Progress Schedule. Lack of progress in the development of the Progress Schedule shall be cause for suspension of any Progress Payment. The complete Progress Schedule will be reviewed by the ENGINEER within 14 calendar

- days of receipt or request for adjustment. A meeting, or meetings, may be required with CONTRACTOR'S Scheduling Consultant during this period in order to expedite acceptance or adjustment. Any adjustments required after this period shall be made and resubmitted by CONTRACTOR within 7 calendar days.
- C. No later than 14 calendar days after the complete Progress Schedule has been accepted by the ENGINEER, CONTRACTOR submit to the ENGINEER a CPM Progress Schedule with man-hours in accordance with Articles 1.4 and 1.6, above. The Progress Schedule shall be reviewed by the ENGINEER within 14 calendar days of receipt or request for adjustment. Any adjustments required after this period shall be made and resubmitted by CONTRACTOR within 7 calendar days.
- D. If, in the preparation of the Progress Schedule, CONTRACTOR reflects a completion date or milestone date different than that specified in the Contract, this in no way voids the dates set therein. The dates as specified in the Contract govern. Where the Progress Schedule reflects a completion date or milestone date earlier than specified, the ENGINEER may accept such schedule with CONTRACTOR specifically understanding that no claim for additional Contract Time or compensation shall be brought against the OWNER as the result of failure to complete the Work by the earlier date shown on the Progress Schedule.

1.8 FAILURE TO SUBMIT

- A. Should CONTRACTOR fail to submit the Progress Schedule in the form indicated within the required time frames shall be cause for suspension of any Progress Payment.

1.9 UPDATING THE PROGRESS SCHEDULE

- A. Updates:
1. Monthly updates to the mathematical tabulation are the CONTRACTOR'S responsibility. The updated mathematical tabulation shall include the following data for each activity:
 - a. Actual start date (for started activities).
 - b. Actual finish date (for completed activities).
 - c. Percent complete.
 - d. Current projected early/late start/finish dates (for activities not started).
 - e. Current early/late finish dates (for uncompleted activities).
 - f. Current Total float.
 - g. Critical path activities noted.
 2. CONTRACTOR'S Schedule Update shall include a narrative report which shall include a description of the current progress/status of each area of the project, a description of the progress for the period, a description of the critical path, a discussion of current or potential delays, Change Orders (pending or approved), or other problems.

3. Provide the ENGINEER with five updated hard copies of schedule data and two software backup copies on CD's. Network diagrams shall be submitted with the tabulation if there are any proposed revisions to network logic, interim milestones, contract completion, or as directed by the ENGINEER. The updated tabulations shall reflect the current status of activities, as outlined on the baseline network diagram. The updated tabulation reports shall reflect all changes in dates, remaining durations, and float time. If any delays have occurred, these shall be noted for time consideration.
- B. Monthly Schedule Meeting:
1. Recording the start and completion dates of each scheduled work activity with the remaining duration for activities started but not completed, including procurement activities is the CONTRACTOR'S responsibility. On one day each month, at least one week prior to the monthly progress meeting, CONTRACTOR and the Scheduling Consultant shall meet with the ENGINEER to tour the site and review and updated information gathered by CONTRACTOR during the month. After acceptance of CONTRACTOR'S updated data, CONTRACTOR'S Scheduling Consultant shall use this information to update the mathematical tabulations and to generate a Monthly Schedule Update.
- C. Network Revisions:
1. Conditions may develop that require revisions to logic or durations of the original network. If during the progress of the Work events develop that necessitate changes in the original Progress Schedule, propose such changes so as to depict the current mode of operation and provide the ENGINEER with a revised network diagram. Any revision to the original logic or original durations must be accepted by the ENGINEER, in writing. After acceptance, logic/duration revisions will be incorporated into the Progress Schedule and will be addressed in the monthly narrative report by means of both a description of the revisions and a listing of those network elements affected by such change. All changes resulting from Change Order(s), additions or deletions, will be fully incorporated into the Progress Schedule on the first update after the Change Order approval, including all adjustments to the man-hours.
 2. Revisions and additions to the accepted network diagrams and mathematical tabulations shall be submitted in three (3) copies of the reports, two (2) software back-up copies on CD of the schedule and a reproducible set of the 24-inch by 36-inch pure logic diagrams.
 3. The list of revisions and additions will include the following, when applicable:
 - a. Addition and deletion of activities.
 - b. Addition and deletion of relationships.
 - c. Changes to activity descriptions and durations.
 - d. Changes to relationship types and lag codes.
 - e. Changes to contract milestone dates and approved constraint dates.
 - f. Changes to dollar values resulting from approved Change Orders.
 - g. All other revisions to the network logic.

1.10 TIME IMPACT ANALYSIS FOR CHANGE ORDERS, DELAYS, AND TIME EXTENSIONS

- A. Change Orders, Delays, and Time Extensions:
1. When a Change Order(s) is (are) proposed by the ENGINEER or CONTRACTOR, or delays are experienced, submit a Time Impact Analysis (TIA) illustrating the influence of each Change Order or delay on any specified intermediate milestone date(s) or contract completion date. Each TIA shall include a sketch (fragnet) demonstrating how CONTRACTOR proposes to incorporate the change(s) or delay(s) into the current Progress Schedule. The fragnet will include all logic changes and additions required as a result of said Change Order(s) or delay(s).
 2. This fragnet will show all CPM Logic revisions for the Work in question and its relationship to other activities in the network plan. Additionally, the analysis shall demonstrate the time impact, based on the date the change was given to CONTRACTOR, the status of construction at that point in time, and the activity duration of all affected activities. The activity duration used in this analysis shall be those included in the latest update of the Progress Schedule, closest to the time of delay as adjusted by mutual agreement in writing.
- B. Submission:
1. Each Time Impact Analysis shall be submitted within 21 calendar days after a delay occurs or a notice of change or Change Order is given to CONTRACTOR. In cases where CONTRACTOR does not submit a Time Impact Analysis for a specific change or delay within the specified period of time, it shall be mutually agreed that no time extension is required.
- C. Evaluation:
1. Final evaluation of each Time Impact Analysis by the ENGINEER shall be made within 14 calendar days after receipt, unless subsequent meetings and negotiations are necessary. Adjustments in the Contract time for performance shall be made only by written Change Order. Upon acceptance by the ENGINEER, fragnets illustrating the influence of changes and delays shall be incorporated into the current schedule by CONTRACTOR during the first update after agreement is reached.
 2. The time difference between the Early Finish date and the Late Finish date is defined as “float.” The “float” belongs to the Project and may be used by CONTRACTOR or the OWNER to benefit the Project. Changes or delays that influence activities in the network with “float” and do not extend the Critical Path (the sequence of activities with zero days float) shall not be justification for an extension of Contract time for performance.

1.11 RECOVERY SCHEDULE

- A. In the event that the Progress Schedule update mathematical analysis indicates that the Project, or progress towards any interim milestone requirement, falls 20 or more work

- days behind schedule and there is no excusable delay or change to support a time extension, prepare and submit a Recovery Schedule for acceptance by the ENGINEER. Also, revise logic or durations to cause the mathematical analysis to show the Project on schedule. The Recovery Schedule shall be submitted five (5) calendar days after the Progress Schedule Update is submitted.
- B. Provide additional manpower, equipment, or materials or work additional shifts, or expedite procurement to complete activities within the accepted intermediate or Contract completion dates, at no additional cost the OWNER. Upon acceptance of the Recovery Schedule by the ENGINEER, incorporate the Recovery Schedule into the current Progress Schedule.
- C. Lack of Action:
1. CONTRACTOR'S refusal, failure, or neglect to take appropriate recovery action or to submit a written recovery statement shall constitute reasonable evidence that CONTRACTOR is not prosecuting the Work, or separable part, with the diligence that will ensure its completion within the applicable Contract time. Such lack of action shall constitute sufficient basis for the ENGINEER to recommend the withholding of some or all of any payment due, or shall be considered grounds for termination by the OWNER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01323

CONSTRUCTION PHOTOGRAPHS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall retain a professional photographer or an acceptable person, as determined by the ENGINEER, to perform the services specified below.
- B. Obtain ENGINEER'S approval of the photographer selected prior to taking first photographs. Submit qualifications and experience record of photographer to ENGINEER.

1.2 PHOTOGRAPHS

- A. The minimum number of color digital photographs required will be 50 per month.
- B. Take a minimum of 200 color digital photographs of the completed or substantially completed Work at Project Completion. These photographs shall be submitted with the Final Application for Payment. These photographs are not part of the photographs required under Paragraph 1.2.A., above.
- C. The CONTRACTOR shall take color digital photographs daily of all underground work in progress; work being done that will be exposed above ground shall be photographed on a weekly basis. Photographs shall be taken in such a way to include an area or directional landmark. A minimum of ten overall general project photographs depicting the overall project activities shall be taken monthly. A photograph log shall be maintained throughout the project with the following information for each photo: photograph number, a brief description, date, job title, location or station of pipeline (if applicable), and direction of the view in the photograph. The CONTRACTOR shall submit a plan that illustrates how the photograph log will be organized for approval by the OWNER.
- D. Color digital photographs shall be taken and downloaded weekly. Photos shall be grouped into folders and the folders shall be named with the date they were taken and a brief description of the photo subject. For example: '2016-01-31 Roadway Demolition.'
- E. ENGINEER will approve the views to be taken and select the time at which they will be taken. All photographs need to be viewable (digital), otherwise they will not be allowed off-site (refer to paragraph 1.4.A). Views will vary depending on the Progress Schedule.

- F. Submit aerial photographs of the site in digital format with Initial and Final Application for Payment. One oblique photograph shall be taken from each cardinal direction (North, South, East, and West). Provide 2 copies of each. One copy for the ENGINEERS use and the other to be turned over to the OWNER.
- G. A minimum of 20 color photograph prints shall be submitted with the pay application during each pay period; see Section 1.3 below.

1.3 PHOTOGRAPH FORMAT

- A. Furnish all photographs in digital format.
- B. For prints, being submitted with monthly payapp, provide in word format, sized at 5-inch by 7-inch.
- C. Provide all digital photographs on USB drive. The file format shall be “jpg”. The digital photographs shall be provided in addition to the standard photographs required under Paragraph 1.3.B, above. Provide a file for all required under paragraphs 1.2.A and B.
- D. Provide interior and exterior photographs of each buried structure prior to burial. Provide a minimum of four internal views and four external views of each structure. One view shall be provided of each wall, detail, floor and top of structure.
- E. Place the following information on the print or in the digital file name for each photograph:
 - 1. Date photograph was taken.
 - 2. Description of view shown in photograph.

1.4 PRE-CONSTRUCTION PHOTOGRAPHS

- A. General
 - 1. It is the CONTRACTOR’s responsibility to provide 150 pre-construction photographs and video, so as to resolve any disputes which may arise regarding the considerations prior to and subsequent to construction.
 - 2. If a dispute arises where no Pre-construction photographs were provided, the disputed area shall be restored to the extent directed by the ENGINEER and to the complete satisfaction of the ENGINEER.
 - 3. Prior to the start of any construction activities the CONTRACTOR shall furnish (2) sets of color pre-construction photographs and video for approval; one for the ENGINEER and one for the City of Phoenix.
 - 4. Pre-construction photographs taken by CONTRACTOR will not be considered as part of the required number of construction photographs required in Paragraph 1.2, above.
 - 5. A high quality video of the site in digital format shall be made and submitted by the CONTRACTOR.

CITY OF PHOENIX: Water Services Department
PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
PROJECT NUMBER: WS90500307 & WS90501004

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01330

SUBMITTALS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Submittal of documents described in the General Conditions, Supplementary Conditions and hereinafter are required prior to, during and at the end of the construction period. The submittals shall conform to the requirements described in this Section and all referenced Sections or Articles.
- B. The ENGINEER will set up and maintain a project portal for use as a centralized location for storing and conveying project information and for team communication. The portal shall be utilized by the OWNER, ENGINEER and CONTRACTOR for document tracking. The CONTRACTOR shall submit electronic copies of any submittal less than 50 megabytes by uploading the electronic files to the portal. Submittals in excess of 50 megabytes shall be submitted in hardcopy form. Hard copies shall also be submitted as specifically required elsewhere in the Contract Documents or as requested by the ENGINEER. Operations and Maintenance manuals shall be submitted as hard copies.

1.2 GENERAL SUBMITTAL REQUIREMENTS

- A. A submittal shall be made for each complete system. Piecemeal submittals will not be accepted.
- B. Submittals requiring ENGINEER review only will be processed within 14 calendar days after receipt from CONTRACTOR. Submittals requiring ENGINEER and OWNER review will be processed within 21 calendar days after receipt from CONTRACTOR.
- C. CONTRACTOR shall maintain a file of all approved submittal documents at the work site.
- D. CONTRACTOR shall show his executed internal review and approval marking. Submittals which are received from sources other than through CONTRACTOR'S Office or which have not undergone CONTRACTOR review will be returned "Rejected".

1.3 PROCEDURE

- A. Submittals within 7 days after the Notice to Proceed: Submit the following items within 7 days after the Notice to Proceed. Location of information concerning each submittal is referenced and a copy of each required form is included in Section 01331, Reference Forms.

1. Preliminary Schedule of Shop Drawings and Sample Submittal in accordance with the General Conditions and Section 01332, Shop Drawing Procedures. See Appendix A for a list of anticipated Shop Drawings. This list does not alleviate CONTRACTOR from obligations of requirements of each individual Technical Specifications.
 2. Preliminary Progress Schedule: Prepare and submit in accordance with Section 01321 - Progress Schedule.
- B. Submittals within 30 days after the Notice to Proceed: Submit the following items within 30 days after the Notice to Proceed. Location of information concerning each submittal is referenced and a copy of each required form is included in Section 01331, Reference Forms.
1. Submittal Schedule: Prepare and submit schedule of all Shop Drawings in accordance with Section 01332, Shop Drawing Procedures.
 2. Monthly payment schedule.
 3. Maintenance of Plant Operations Schedule, in accordance with Section 01143, Coordination with OWNER'S Operations.
 4. Ninety-day Bar Chart Schedule: Prepare and submit a 90-day Bar Chart Schedule within 14 days, in accordance with Section 01321 - Progress Schedule - CPM.
- C. Submit the following items within 30 days after the Notice to Proceed. Location of information concerning each submittal is referenced and a copy of each required form is included in Section 01331, Reference Forms.
1. Progress Schedule: Prepare and submit a Progress Schedule within 30 days, in accordance with Section 01321 - Progress Schedule - CPM.
- D. Submit the following items at the Pre-construction Conference: Refer to Sections 01332, Shop Drawing Procedures, Section 01521 – ENGINEER'S Field Office, and Section 01510 - Temporary Construction Facilities.
- E. Submittals Prior to Beginning the Work: Refer to the General Conditions and Supplementary Conditions of the Contract Documents.
- F. Submittals During Construction: During progress of the construction, provide the following submittals in a timely manner to prevent any delay in the Work schedule:
1. Updates to Progress Schedule: Provide an assessment of Work progress in relation to the Progress Schedule in accordance with Section 01321 - Progress Schedule - CPM.
 2. Shop Drawings, Product Data and Samples: Submit Shop Drawings, product data and samples in accordance with Section 01332, Shop Drawing Procedures, and as required in various Sections of the Contract Documents.
 3. Each Shop Drawing Submittal shall include a hard copy of the relevant Specification Section and shall be clearly marked to indicate whether the requirements for equipment and/or services in the Specification Section are met by writing "accept" or "deviate" next to each Paragraph. If clarifications are needed to any of the

Paragraphs in the Specification Sections due to deviations, they shall be addressed next to the Paragraph as such and explained further with any additional information necessary. If any exceptions and/or deviations are proposed to any of the Specifications, they shall be clearly noted as such in the Submittal, and an explanation of any deviation and/or exception shall be provided. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected.

4. CONTRACTOR shall initially submit to ENGINEER a minimum of three hard copies and one soft copies of all Submittals that are on 11-inch by 17-inch or smaller sheets, and also for all submittals on sheets larger than 11-inch by 17-inch. Soft copies shall be in CD format and shall include all information provided in hard copy. Text shall be in electronic ASCII format. Drawings and figures shall be in version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
5. Progress Payments: Submit applications for partial payments as specified in the General Conditions. MBE/WBE Utilization Form, included in Section 01331, Reference Forms, shall be submitted with each progress payment.
6. Request for Information: Submit a Request for Information, included in Section 01331, Reference Forms, when any of the following are required: an interpretation of the Specifications; additional details; information not shown on the Drawings or in the Specifications; or clarification of discrepancies is needed. Retain one copy and submit three hard copies and one electronic PDF format copy to the ENGINEER for response. Once the RFI is commented on by the ENGINEER, an electronic PDF format copy will be forwarded to the OWNER. ENGINEER will process RFI's within 7 calendar days after receipt from CONTRACTOR.
7. Change Orders: Forms shown in Section 01331, Reference Forms. A proposal for a Change Order may be submitted by CONTRACTOR in accordance with the General Conditions. The Change Order Proposal included in Section 01331, Reference Forms, must be in writing and must include sufficient information to assess the need for a change in the Work, the Contract time or the Contract amount. Whenever the ENGINEER determines the need for a Change Order, a Request for Change Order Proposal Form included in Section 01331, Reference Forms, will be issued to CONTRACTOR. Upon receipt of a Request for Change Order Proposal Form or when CONTRACTOR determines the need for a Change Order, prepare and submit three copies of a Change Order Proposal. The Change Order Proposal must be approved by CONTRACTOR, ENGINEER, and OWNER. When a Change Order Proposal has been accepted, a Work Change Directive shall be submitted. Each Work Change Directive shall include a Change Order Pricing Sheet, included in Section 01331, Reference Forms. After the Work Change Directive has been accepted by the OWNER, a Change Order included in Section 01331, Reference Forms, will be prepared and executed.
8. Not authorized to begin work on a Change Order until it is fully executed. Any Work done by CONTRACTOR prior to execution of a Change Order is entirely at his own risk.
9. CONTRACTOR'S Daily Report: Shown in Section 01331, Reference Forms: Submit four copies of CONTRACTOR'S Daily Report. CONTRACTOR and each

subcontractor shall prepare and submit a daily report on forms shown in Section 01331, Reference Forms. The report shall contain, as a minimum, information on the location and description of the Work being performed, size, quantity and description of materials and equipment installed or delivered, coordination or scheduling concerns, requests for clarifications, and any discrepancies noted in the Contract Documents or on the as-built conditions. The report shall also contain CONTRACTOR'S daily workforce count by craft, general weather conditions, any Work performed other than during established working hours, and any other pertinent items relative to the Work, and as required by ENGINEER. The report is due at the ENGINEER'S office by 9:00 a.m. on the following Work day and shall be signed by a responsible member of CONTRACTOR'S staff.

10. Submittal Schedule: Shown in Section 01331, Reference Forms. Submit an updated Shop Drawing, Product Data and Sample Submittal Schedule with each Progress Payment Request. Three updated Submittal Schedules shall be submitted with each month's Progress Payment Request.
 11. Construction Photographs: Submit Construction Photographs with each month's Progress Payment Request as specified in Section 01323, Construction Photographs.
 12. Operation and Maintenance Manuals and Lesson Plans: Submit Equipment Operation and Maintenance Manuals for approval, by the ENGINEER, within 30 days after approval of Equipment Shop Drawing. Submit Equipment Training Lesson Plans for approval, by the ENGINEER, 60 days prior to commencement of training. Submit Operation and Maintenance Data and Lesson Plans in accordance with Section 01781, Operation and Maintenance Data and Section 01821, Instruction of Operations and Maintenance Personnel.
 13. Submit test procedures for Start-up, Burn-in, Field Operations Checks and Commissioning a minimum of 7 days prior to commencement of the first scheduled test date. The CONTRACTOR should allow up to 5 days for ENGINEER'S review
- G. Submittal at Substantial Completion: Submit all Operations and Maintenance Data for each item of Work commissioned into operation.
- H. Submittal At Project Closeout: With a written Notice of Completion, submit the following items in the proper form as a condition of Final Acceptance of the Work:
1. Project Record Documents: Submit in accordance with Section 01782, Record Documents.
 2. Guarantees, Warranties and Bonds: Submit as required in the General Conditions and listed in various Sections of the Specifications, and Section 01781, Operation and Maintenance Data.
 3. Operations and Maintenance Data: Submit all remaining product data, field test data and manuals as specified in various Sections of the Specifications, and Section 01781, Operation and Maintenance Data.
 4. Survey notes.
 5. Construction photographs of all completed Work, in accordance with Section 01323, Construction Photographs.

CITY OF PHOENIX: Water Services Department
PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
PROJECT NUMBER: WS90500307 & WS90501004

I. Unit Responsibility:

1. The CONTRACTOR shall submit the unit responsibility form shown in Section 01331, Reference Forms, with applicable equipment as required in those sections.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

(The remainder of this page was intentionally left blank)

Appendix A

Submittal Listing: The following is a list of anticipated submittals for the project: This list does not alleviate Contractor from obligations of requirements of each individual Technical Specifications.

No.	Description	Specification
1.	Progress Schedule (CPM)	01321
2.	Shop Drawing Schedule	01331
3.	Stormwater Pollution Prevention Plan	01412
4.	Confined Space Entry Plan	01415
5.	Special Inspections	01416
6.	Testing of Hydraulic Structures	01453
7.	ENGINEER'S Field Office	01521
8.	CONTRACTOR'S Field Office	01522
9.	Access Roads and Parking Areas	01550
10.	Project Identification and Signs	01580
11.	Survey Submittal	01722
12.	Cutting and Patching	01723
13.	Installation Data	01731
14.	Starting and Placing Equipment in Operation	01751
15.	Testing, Startup, and Commissioning Performance Plan	01752
16.	Operation and Maintenance Data	01781
17.	Record Documents	01782
18.	Spare Parts List	01783
19.	Preventative Maintenance Data	01785
20.	Preventive and Unscheduled Maintenance Plan	01810
21.	Commissioning Plan	01810
22.	OWNER'S Personnel Training Schedule and Plan	01810
23.	Demolition Methods	02220
24.	Structural Excavation and Backfill	02315
25.	Structural Excavation and Backfill Test Reports	02315
26.	Crushed Stone Samples and Test Reports	02318
27.	Manhole Design	02531
28.	Plant Salvage	02906
29.	Seeding	02921
30.	Samples Formwork	03100
31.	Fabrication and Erection Drawings	03100
32.	Concrete Reinforcement	03200
33.	Fabrication and Bending Drawings	03200
34.	Mill Certifications	03200

CITY OF PHOENIX: Water Services Department
PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
PROJECT NUMBER: WS90500307 & WS90501004

No.	Description	Specification
35.	Waterstops and Expansion Joints	03251
36.	Bonding Agent and Joint Sealer	03251
37.	Layout of Construction and Expansion Joints	03251
38.	Concrete Joints	03251
39.	Anchorage in Concrete	03252
40.	Concrete Mix Design	03300
41.	Grout Mix Design	03600
42.	Anchor Bolts, Toggle Bolts, and Concrete Inserts	05051
43.	Anchor Bolts, Adhesive Anchors, and Concrete Inserts	05051
44.	Special Finishes	09910
45.	Piping Systems	15050
46.	Buried Piping Installation	15051
47.	Exposed Piping Installation	15052
48.	Vitrified Clay Pipe	15064
49.	Wall Pipes, Floor Pipes and Pipe Sleeves	15121

++ END OF SECTION ++

SECTION 01331

REFERENCE FORMS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section contains the required forms for CONTRACTOR use in documenting testing Work and other Work required under this Contract. This Section supplements but does not supersede specific testing requirements found elsewhere in the Contract Documents.
- B. The forms listed below are included in this Section are referenced from other Sections in the Contract Documents. Forms will include, but will not necessarily be limited to the following:

<u>Form No.</u>	<u>Title</u>
00800-A	Certificate of Substantial Completion
00800-B	Contractor's Affidavit Regarding Settlement of Claims
01143-A	Extended Construction Work Hours Permit Application
01330-A	Schedule of Values
01330-B	Shop Drawings, Product Data and Sample Submittal Schedule
01330-C	Authorized Signatures Form
01330-D	Application for Payment
01330-E	MBE/WBE Utilization Form
01330-F	Request for Change Order Proposal
01330-G	Change Order Proposal
01330-H	Work Change Directive
01330-I	Change Order Pricing Sheet
01330-J	Change Order
01330-K	Request for Information
01330-L	Request for Alteration
01330-M	Contractor's Daily Construction Report
01330-N	TV Inspection Request
01330-O	Contractor Submittal Review Checklist
01330-P	Submittal Review Form
01330-Q	Contractor Contingency Usage Form
01332-A	Submittal Transmittal Form
01332-B	Shop Drawing Review Checklist
01415-A	Confined Space Data Sheet
01415-B	Confined Space Entry Permit
01415-C	Confined Space Hot Work Permit

CITY OF PHOENIX: Water Services Department
PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
PROJECT NUMBER: WS90500307 & WS90501004

01600-A	Equipment Information Form Instructions
01600-A	Equipment Information Form
01600-B	Unit Responsibility Certification Form
01600-C	Equipment Manufacturer Vendor Installer Information Form
01620-A	Manufacturer's Installation Certification Form
01620-B	Delivery Inspection Form
01752-A	Equipment Test Report
01781-A	Operation & Maintenance Manual Review Checklist
01781-B	Operations & Maintenance Manual Data Review Checklist
01783-A	Spare Parts Receiver Form
01785-A	Preventive Maintenance Data Submittal Form
01821-A	Manufacturer's Instruction Certification Form
01821-B	Training Request Form
11000-A	Motor Data Form
15142-A	Request for Bacteriological Samples
16000-A	Wire and Cable Resistance Test Data Form
16000-B	Installed Motor Test Data Form
16000-C	Dry Transformer Test Data Form
16000-D	Motor Control Center Test Form
16000-E	Medium Voltage Motor Starter Test Form
16000-F	Medium Voltage Switchgear Test Form
16000-G	Protective Relay Test Form
16000-H	Low Voltage Switchgear Test Form
16000-I	Medium Voltage Load Interrupter Switch Test Form
16000-J	Liquid-Filled Transformer Test Form
16000-K	Automatic Transfer Switch Test Form
16000-L	Neutral Grounding Resistor Test
16000-M	Conduit and Wire Termination Sheet
16000-N	Ground Test Point Data Form
16215-A	Power Study Coordination Form
16231-A	Add Generator to Fleet – Inspection List
17001-A	Instrument Tubing Leak Test Form
17001-B	Calibration Test Data Form.
17001-C	Functional Acceptance Test
17260-A	Factory Acceptance Test Report

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

00800-A CERTIFICATE OF SUBSTANTIAL COMPLETION

Form 00800-A

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

CERTIFICATE OF SUBSTANTIAL COMPLETION

PROJECT NUMBER WS85500455 AND WS90500307	PROJECT TITLE Northwest Water and Wastewater Master Plan Package 3A
--	--

DATE OF ISSUANCE: _____ OWNER'S CONTRACT NO.: _____

OWNER: _____ **CITY OF PHOENIX** _____

ENGINEER: _____

CONTRACTOR: _____

This Certificate of Substantial Completion applies to all Work under the Contract Documents or to the following specified parts thereof:

OVERALL PROJECT

To: _____ **CITY OF PHOENIX** _____
OWNER

And to: _____ CONTRACTOR _____

The Work to which this Certificate applies has been inspected by authorized representatives of OWNER, CONTRACTOR and ENGINEER, and that Work is hereby declared to be substantially complete in accordance with the Contract Documents on

TYPE DATE HERE
DATE OF SUBSTANTIAL COMPLETION

A tentative list of items to be completed or corrected is attached hereto. This list may not be all-inclusive, and the failure to include an item in it does not alter the responsibility of CONTRACTOR to complete all the Work in accordance with the Contract Documents. The items in the tentative list shall be completed or corrected by CONTRACTOR by Final Completion.

Form 00800-B

**CONTRACTOR'S AFFIDAVIT
REGARDING SETTLEMENT OF CLAIMS**

Project No.: _____

Contract No.: _____

Gentlemen:

This is to certify that all lawful claims for materials, rental of equipment and labor used in connection with the construction of the above project, whether by subcontractor or claimant in person, have been duly discharged.

The undersigned, for the consideration of \$_____ as set out in the final pay estimate, as full and complete payment under the terms of the contract, hereby waives and relinquishes any and all further claims or right of lien under, in connection with, or as a result of the above described project. The undersigned further agrees to indemnify and save harmless the City of Phoenix against any and all liens, suits, damages, charges and expenses whatsoever, which said City may suffer arising out of the failure of the undersigned to pay for all labor performance and materials furnished for the performance of said installation.

Contractor

By

Title

State of _____

County of _____

The forgoing instrument was subscribed and sworn to before me this ____ day of _____, 20____.

Notary Public

Commission Expiration Date

01330-A SCHEDULE OF VALUES

Form 01330-A

SCHEDULE OF VALUES

Sheet ____ of _____

Section No. _____

Item Description	Material	Labor	Equipment	Total

**SHOP DRAWINGS, PRODUCT
DATA AND SAMPLE
SUBMITTAL SCHEDULE**

CONTRACTOR _____
Project Name _____
Project No. _____ Date _____ Page ___ of _____

Item No.	Description	Specification Section Number	Date To Be Submitted	Approval Needed By	Date Submitted	Date Reviewed	Transmittal Number

**AUTHORIZED SIGNATURES FORM
(Corporation)**

Gentlemen:

WHEREAS, ____, a(n) (Name of State) _____ Corporation, is required to execute documents which are necessary for the prompt and efficient execution of the corporate business:

NOW, THEREFORE, BE IT RESOLVED, (by the Board of Directors of the Corporate Name), that name of parties listed below be authorized to execute and sign on behalf of said corporation the following documents:

- | | |
|-----------------|--|
| 1. The Proposal | 6. Change Orders |
| 2. The Contract | 7. Application for Payment |
| 3. The Bond | 8. Work Change Directives |
| 4. Payrolls | 9. All other papers necessary for the corporation's affairs and the execution of the contract. |
| 5. Claims | |

The powers and duties herein granted shall be and is hereby granted for the duration of the contract for the construction of the _____, Project No. _____, or until express notice of revocation has been duly given in writing, whichever is the lesser period.

Dated and passed by the Board of Directors this _____ day of _____, 20__.

<u>NAME</u>	<u>SIGNATURE</u>	<u>TITLE</u>	<u>DOCUMENTS</u>
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

I, _____ of the _____, a corporation, do hereby certify that the above is a true and correct copy of a resolution adopted by the Board of Directors of said corporation, at a meeting of said board held on _____, day of 20__, and that the same is in full force and effect at this time.

(Seal of Corporation)

(OFFICER OF CORPORATION)

(NAME & TITLE)

STATE OF _____

COUNTY OF _____

This instrument was acknowledged before me this _____ day of _____, 20 _____.
By _____ appearing before the undersigned Notary Public, and stated that he executed such instrument on behalf of said corporation for the purpose and consideration therein expressed.

My Commission Expires: _____
(NOTARY PUBLIC)



**CITY OF PHOENIX
WATER SERVICES DEPARTMENT
CONSTRUCTION MANAGEMENT DIVISION**

DISTRIBUTION:
ACCOUNTS
PAYABLE
CENTRAL FILES
PAYMENT FILE

APPLICATION FOR PAYMENT

To: Project Manager
200 W. Washington Street, 8th Floor
Phoenix, Arizona 85003

Progress Payment No. ___

Payment Period: From mm/dd/yy to mm/dd/yy

Project No. WSXXXXXXXX-1	Project Name Northwest Water and Wastewater Master Plan Package 3A			Contract No. XXXXX	
Name of Contractor NAME OF CONTRACTOR			Telephone (XXX) XXX-XXXX		Fax (XXX) XXX-XXXX
Address CONTRACTOR'S ADDRESS				Notice To Proceed Date MM/DD/YY	
ITEM NO.	DESCRIPTION List Contract Items, Change Order Items, and Deductions, Each with Subtotals	CONTRACT AMOUNT	ESTIMATED AMOUNT THIS PERIOD	AMOUNT PREVIOUSLY INVOICED	AMOUNT COMPLETED TO DATE
xxxxx	XXXXXXXXXXXXXXXXXXXXXXXXXXXX	\$xx,xxx,xxx.xx	\$xx,xxx,xxx.xx	\$xx,xxx,xxx.xx	\$xx,xxx,xxx.xx
ATTACHMENTS: SCHEDULE OF VALUES			GROSS AMOUNT DUE: \$xx,xxx,xxx.xx		
			<input type="checkbox"/> RETAINAGE - 10% \$xx,xxx,xxx.xx		
			<input type="checkbox"/> SECURITIES - 10% \$xx,xxx,xxx.xx		
			NET AMOUNT DUE TO DATE: \$xx,xxx,xxx.xx		
			LESS AMOUNT PREVIOUSLY PAID: \$xx,xxx,xxx.xx		
			AMOUNT DUE THIS APPLICATION:		\$xx,xxx,xxx.xx
<p>CERTIFICATION OF CONTRACTOR: I certify that all items and amounts shown on the face of this Application for Payment are correct, that to the best of my knowledge and belief, all work has been performed and/or material supplied in full accordance with the requirements of the referenced contract, and/or duly authorized deviations, substitutions, alterations, and/or additions; that the foregoing is true and correct statement of the contract account up to and including the last day of the period covered by this Application that no part of the "Amount Due This Application" has been received, and that the undersigned and subcontractors have: (check applicable line).</p> <p><input type="checkbox"/> a. Complied with all labor provisions of said contract.</p> <p><input type="checkbox"/> b. Complied with all the labor provisions of said contract except in those instances where a dispute exists with respect to said labor provisions. (If "b" is checked, include attachment briefly describing nature of dispute.)</p> <p>_____ Contractor Representative Date</p> <p>_____ Title</p>			<p>CERTIFICATION OF ENGINEER: I certify that all work described was inspected, and that to the best of my knowledge and belief the work was performed and/or supplied in full accordance with the requirements of this contract.</p> <p>_____ Resident Project Representative Date</p> <p>_____ Date</p> <p>I certify that I have checked and verified the above and foregoing Application for Payment; that to the best of my knowledge and belief it is a true and correct statement of work performed and/or material supplied by the contractor; that all work and/or material included in this Application has been inspected and that it has been performed and/or supplied in full accordance with the requirements of the referenced contract; and that payment claimed and requested by the Contractor is correctly computed on the basis of work performed and/or material supplied to date.</p> <p>_____ Project Manager/Engineer Date</p> <p>_____ Firm Date</p>		
CITY USE ONLY BELOW THIS LINE					
RECOMMENDED BY:			APPROVED BY:		
_____ Project Manager Date			_____ Superintendent Date		



**CITY OF PHOENIX
WATER SERVICES DEPARTMENT
CONSTRUCTION MANAGEMENT DIVISION**

CONTINUATION OF APPLICATION FOR PAYMENT

PROGRESS PAYMENT NO. 1

Project No. WS8500455 AND WS90500307		Project Name <i>Northwest Water and Wastewater Master Plan Package 3A</i>			Contract No. XXXXXX	
ITEM NO.	DESCRIPTION List Contract Items, Change Order Items, and Deductions, Each with Subtotals	CONTRACT AMOUNT	ESTIMATED AMOUNT THIS PERIOD	AMOUNT PREVIOUSLY INVOICED	AMOUNT COMPLETED TO DATE	
XXXXX	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXX	\$xx,xxx,xxx.xx	\$xx,xxx,xxx.xx	\$xx,xxx,xxx.xx	\$xx,xxx,xxx.xx	

01330-E MBE/WBE UTILIZATION FORM

CITY OF PHOENIX EQUAL OPPORTUNITY DEPARTMENT
 CONTRACTOR'S MONTHLY STATEMENT OF MBE/WBE UTILIZATION

CONTRACTOR: _____ PAY REQUEST NO.: _____ REPORT PERIOD FROM: _____ to _____

Project Number: _____ Project Description: _____	Base Bid Amount: \$ _____
	Required Goals: MBE _____% WBE _____%
	Proposed Goals: MBE _____% WBE _____%

M/WBE Business Name Representative Name and Telephone Number	MBE or WBE	Original Contract Amount	Contract Adjustments	Revised Contract Amount	AMOUNT EARNED THIS PERIOD	AMOUNT EARNED TO DATE	Amount Retained this Period	Amount Retained to Date	Percentage Completed to Date
Minority Owned Business Enterprise Totals									
Woman Owned Business Enterprise Totals									

Authorized Signature: _____ Date: _____

Name and Title: _____

FOR CITY OF PHOENIX USE
Percent of total project complete _____ % Date: _____
City Project Manager _____ Signature

REQUEST FOR CHANGE ORDER PROPOSAL

Date: _____

CONTRACTOR _____

Project Name _____

Project No. _____

Change Order No. _____

NOTICE TO CONTRACTOR: Please submit a Change Order Proposal for the proposed modifications to the Contract Documents as described below. If acceptable, a Change Order will be issued to authorize the work. **THIS IS NOT A CHANGE ORDER FOR AUTHORIZATION TO PROCEED WITH THE WORK AS DESCRIBED!**

SCOPE OF WORK:

OWNER _____

CHANGE ORDER PROPOSAL

Date _____

Subject: Project Name _____

Project No. _____

Change Order No. _____

Dear Sir:

Certain items of extra work have been found necessary which are not covered by the Contract for the above referenced Project. Therefore, we submit the following amounts as the basis of compensation for such extra work:

JUSTIFICATION:

The Contract completion time will be (increased)(decreased) ____ consecutive calendar days.

Total Cost of Extra Work Covered by Above: \$ _____

Previously Approved Extra Work: \$ _____

Original Contract Amount \$ _____

TOTAL: \$ _____

By: _____

Title: _____

CONTRACTOR: _____



CITY OF PHOENIX
WATER SERVICES DEPARTMENT
CONSTRUCTION MANAGEMENT DIVISION

WORK CHANGE DIRECTIVE NUMBER X

Project No. WS85500455 AND WS90500307	Project Title Northwest Water and Wastewater Master Plan Package 3A
--	--

CONTRACTOR: _____ CONTRACT NUMBER: _____

IN ACCORDANCE WITH THIS CONTRACT, THE FOLLOWING CHANGE IS ORDERED.

DESCRIPTION:

AUTHORIZATION FOR WORK DESCRIBED HEREIN TO PROCEED ON A NEGOTIATED COST BASIS.

AUTHORIZATION FOR WORK DESCRIBED HEREIN TO PROCEED ON A TIME AND MATERIALS BASIS.

COST:

NET AMOUNT OF THIS WORK CHANGE DIRECTIVE = \$ _____

THE ENGINEER HAS REVIEWED THE COST FOR THIS WORK CHANGE DIRECTIVE AND CONSIDERS IT REASONABLE FOR THE LABOR AND MATERIAL NECESSARY TO COMPLETE THE WORK.

CONTRACT TIME: INCREASE BY _____ DAYS. NO CHANGE.

RECOMMENDED BY: _____
ENGINEER

DATE: _____

ACCEPTED BY: _____
CONTRACTOR

DATE: _____

APPROVED BY: _____
OWNER

DATE: _____

ROUTE TO:

GRAY - CITY CLERK
 PINK - FINANCE
 GREEN - CONTRACTOR
 BLUE - CENTRAL FILES
 GOLDENROD - WATER DEPT.
 CANARY - PROJECT MANAGER
 WHITE - ENGINEER



**CITY OF PHOENIX
 WATER SERVICES DEPARTMENT
 CONSTRUCTION MANAGEMENT DIVISION**

Form A
 Form B
 Form C

CONTRACT CHANGE ORDER NO. X

Page 1 of 1

PROJECT NUMBER WS85500455 AND WS90500307	PROJECT TITLE Northwest Water and Wastewater Master Plan Package 3A		
CONTRACT NUMBER	NAME OF CONTRACTOR	% COMPLETE(\$)	% TIME USED

In accordance with this contract, the following change is ordered, resulting in: (Check all that apply).

- | | | |
|--|---|--|
| <input type="checkbox"/> Increase in Contract Amount | <input type="checkbox"/> No Change in Contract Amount | <input type="checkbox"/> Decrease in Contract Amount |
| <input type="checkbox"/> Increase in Contract Time | <input type="checkbox"/> No Change in Contract Time | <input type="checkbox"/> Decrease in Contract Time |

DESCRIPTION:

COST: _____

Work Change Directive No.

Prepared BY:

Prepared by: Project Manager

THIS CHANGE ORDER: AMOUNT: \$ _____ TIME (Days): _____	PRIOR CHANGE ORDER(S): AMOUNT: \$ _____ TIME (Days): _____	ORIGINAL CONTRACT: AMOUNT: \$ _____ TIME (Days): _____	ADJUSTED CONTRACT: AMOUNT: \$ _____ TIME (Days): _____
Notice to Proceed Date: _____	Original Contract Completion Date: _____	Adjusted Contract Completion Date: _____	
We, the undersigned, have given careful consideration to the change proposed, and hereby agree, if this proposal is approved, that we will provide all equipment, furnish all materials, except as may otherwise be noted above, and perform all services necessary for the work specified, and will therefore, accept as full payment, the fees or prices and adjustments in contract time shown above. This Change Order includes all direct costs such as labor, material, job overhead, profit, costs for modifications or changes in sequence of work to be performed, delays, rescheduling, disruptions, extended direct overhead or general overhead, acceleration, material or other escalation which include wages and other impact costs.		REVIEWED BY: _____ (Engineer) _____ DATE	
		RECOMMENDED BY: _____ (A or B - Project Manager) (C - Superintendent) DATE	
		RECOMMENDED BY: _____ (A or B - Project Manager) (C - Superintendent) DATE	
		APPROVED BY: _____ (A or B - Superintendent) (C - Assistant Director) DATE	
ACCEPTED (Contractor): COMPANY/FIRM: NAME OF CONTRACTOR SIGNATURE: _____ TITLE: _____ DATE: _____		AUTHORIZED FOR THE CITY MANAGER BY: _____ (A or B - Assistant Director) (C - Director) DATE	

01330-K REQUEST FOR INFORMATION

ROUTE TO:

GRAY - CITY CLERK
 BLUE - CENTRAL FILES
 GOLDENROD - WATER DEPT.
 CANARY - PROJECT MANAGER
 WHITE - ENGINEER



**CITY OF PHOENIX
 WATER SERVICES DEPARTMENT**

CONSTRUCTION MANAGEMENT DIVISION

CONTRACT CHANGE ORDER NO. X

SUPPLEMENTARY REPORT

Page 1 of 1

PROJECT NUMBER WS85500455 AND WS90500307	PROJECT TITLE Northwest Water and Wastewater Master Plan Package 3A		
CONTRACT NUMBER	NAME OF CONTRACTOR	% COMPLETE(\$)	% TIME USED

REASON:

Work Change Directive No.

Prepared By: Project Manager

BASIS FOR CHANGE: (Check all that apply).

- | | | |
|---|--|---|
| <input type="checkbox"/> City Request
Item 1 | <input type="checkbox"/> Negotiated Cost
Item 1 | <input type="checkbox"/> Contractor Request |
| <input type="checkbox"/> Use of Allowances | <input type="checkbox"/> Unforeseen Site Condition | <input type="checkbox"/> Final Quantity Adjustment |
| <input type="checkbox"/> Error or Omission | <input type="checkbox"/> Engineer Request | <input type="checkbox"/> Added Value for Added Cost |

Reviewed by: _____

Date: _____

CITY OF PHOENIX

REQUEST FOR INFORMATION

CONTRACTOR _____
Requested By _____
Subject _____
Spec. Section _____
Drawing References _____
Date Reply Needed _____

RFI# _____
Directed to _____
Date Received _____
Date Transmitted _____
Date Reply Received _____
Date Reply Transmitted _____

INFORMATION NEEDED:

Date _____ Signature _____

REPLY:

Date _____ Signature _____

CITY OF PHOENIX

REQUEST FOR ALTERATION

CONTRACTOR _____	RFA# _____
Requested By _____	Directed to _____
Subject _____	Date Received _____
Spec. Section _____	Date Transmitted _____
Drawing References _____	Date Reply Received _____
Date Reply Needed _____	Date Reply Transmitted _____

REQUESTED ALTERATION:

Date _____ Signature _____

REPLY:

Date _____ Signature _____

01330-M CONTRACTOR'S DAILY CONSTRUCTION REPORT

CONTRACTOR _____

CONTRACTOR'S DAILY CONSTRUCTION REPORT

Project Name _____	Report No. _____	Date _____
Project No. _____		

CONTRACTORS WORK FORCE:	SUBCONTRACTORS WORK FORCE:	EQUIPMENT ON SITE:
		In Use Not in Use
Administrative _____	Mechanical _____	Cranes _____
Supervisors _____	Electrical _____	Loaders _____
Carpenters _____	Instrumentation _____	Dozers _____
Iron Workers _____	Sitework _____	Scrapers _____
Operators _____	Masonry _____	Compactors _____
Finishers _____	Roofing _____	Compressors _____
Welders _____	Rebar _____	Welders _____
Electricians _____	Foundation _____	Graders _____
Laborers _____	Painting _____	Trucks _____
_____	_____	Backhoe _____
_____	_____	_____
_____	_____	_____

Work Performed: _____ _____ _____ _____ _____

Material and Equipment Delivered: _____ _____ _____ _____
--

Remarks: _____ _____ _____

By: _____

Title: _____



City of Phoenix
WATER SERVICES DEPARTMENT
WASTEWATER COLLECTION

TV INSPECTION REQUEST

DATE: _____

REQUESTOR: _____

PHONE #: _____

LOCATION: _____

REASON FOR INSPECTION: _____

Q.S.: _____ *(PLEASE PROVIDE COPY OF SECTION TO BE INSPECTED)*

LINEAL FT. TO INSPECT: _____ C/O-MH#: _____ TO C/O-MH#: _____

PIPE DIAM.: _____

PIPE TYPE: _____

DEPTH OF FLOW: _____ IN.

MH DEPTH: _____

DATE WHEN LAST CLEANED: MH=S: _____ MAIN: _____

COMMENTS: _____

FOR TV SECTION ONLY

DATE RECEIVED: _____

ASSIGNED TO: _____ DATE: _____ EQUIP: _____

COMPLETED: _____ DATE: _____

COMMENTS: _____

01330-O CONTRACTOR SUBMITTAL REVIEW CHECKLIST

Form 01330-O

CONTRACTOR SUBMITTAL REVIEW CHECKLIST

Contractor shall provide the completed review checklist with submittal to engineer. Submittals provided to the engineer without the completed checklist shall be rejected.

Project Name: _____ Submittal Description: _____
 Project No.: _____ Submittal No.: _____
 Project Location: _____ Specifications: _____
 Contractors Name: _____ Section: _____
 _____ Page No.: _____
 _____ Submittal Description: _____
 Received By: _____ Para. No.: _____
 Date: _____ Drawing No.: _____ of _____

Review Checklist

Item	Review Description	Yes	No	N/A
1	Submittal Meets Requirements per Specification 01330	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Submittal Meets Requirements of Referenced Specification Sections	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	If Submittal is a Shop Drawing Check Form 01332-B is Attached	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	If Submittal is an O&M Manual Check Form 01781 is Attached	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Contractor

Certify either A or B:

- ___ A. We have verified that the material or equipment contained in this submittal meets all the specified requirements, including coordination with all related work. (no exceptions).
 ___ B. We have verified that the material or equipment contained in this submittal meets all the requirements specified except for the attached deviations.

<u>No.</u>	<u>Deviation</u>
_____	_____
_____	_____
_____	_____

 CONTRACTOR'S SIGNATURE: DATE

Form 01330-P

SUBMITTAL REVIEW FORM

(Company Name)

Address:

Phone:
FAX :

WS#

CONTRACT #

Submittal Review

Project Title:	Submitting Firm:	Received Date:
Facility:	Reviewer:	Reviewed Date:
Submittal Title:	Reviewer Phone:	

ITEM	SPEC/DWG REFERENCE	COMMENT	RESPONSE

Additional comments: (your remarks here)

Response Column:

- Inc. - Incorporated verbatim
- Inc. / Edit – Incorporated with modification – include explanation of modification
- N/I – Not Incorporated – include explanation

SUBMITTAL TRANSMITTAL

Submittal Description: _____ Submittal No: _____

Spec Section: _____

	Routing	Sent	Received
OWNER:	Contractor/RPR		
PROJECT:	RPR/Engineer		
	Engineer/RPR		
CONTRACTOR:	RPR/Contractor		

We are sending you Attached Under separate cover via _____.
 Submittals for review and comment
 Product data for information only

Remarks: _____

Item	Copies	Date	Section No.	Description	Review action ^a	Reviewer initials	Review comments attached

^aNote: A = Approved; AC = Approved as Corrected; ACR = Approved as corrected Resubmit; RR - Revise and Resubmit; NR - Not Reviewed; NA - Not Approved; I - For Information Only Attach additional sheets if necessary.

Contractor

Certify either A or B:

- ___ A. We have verified that the material or equipment contained in this submittal meets all the requirements, including coordination with all related work, specified (no exceptions).
 ___ B. We have verified that the material or equipment contained in this submittal meets all the requirements specified except for the attached deviations.

No.

Deviation

_____	_____
_____	_____
_____	_____

Certified by: _____

01332-B SUBMITTAL SHOP DRAWING REVIEW CHECKLIST

Form 01332-B

SHOP DRAWING REVIEW CHECKLIST

Project Name: _____ Project No.: _____

Shop Drawing Description: _____

Manufacturer: _____ Specification No.: _____

Shop Drawing Review Checklist

Item	Review Description	Contractor			Engineer		
		Yes	No	N/A	Yes	No	N/A
1	Equipment Parts List Provided with Manufacturer Model Number	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Equipment Manufacturer Catalog Datasheets Provided per piece of Equipment	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Suggested Spare Parts List Provided	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Equipment Drawings Provided	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Equipment and System Wiring Diagrams Provided	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Applicable Certificates are Provided	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7	Mounting Templates, Instructions and Design Calculations were Provided as Required	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8	Required Maintenance Operations for Equipment 24 month Idle Period Provided	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9	Unloading and Handling Methods Provided	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10	Storage Requirements Provided	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11	Equipment Paint Submittal Provided and Meets Requirements of Division 9	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12	Drawings of Equipment Dimensions Field Verifications	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13	Materials that Contact Drinking Water Comply with Specifications for Drinking Water	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
14	Submittal Includes requirements of Specification 01821 Instruction of Operations and Maintenance Personnel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15	Equipment Specification Requirements have been meet	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CONTRACTOR'S SIGNATURE/DATE:

ENGINEER'S SIGNATURE/DATE

01415-A CONFINED SPACE DATA SHEET

Form 01415-A
Confined Space Data Sheet

Name of Confined Space: _____ Location of Confined Space: _____

Division/Section Responsible for Confined Space: _____

PRE-ENTRY SYSTEM CONTROL

Check

Mechanical: Isolate, lockout and de-energize to zero potential energy.
 Engulfment: Blank/block/cap/bleed off lines. Lock out gates, valves, pumps.
 Electrical: Lockout/Tagout
 Inerting: Flush/Purge/Vent
 Special Precautions: _____

ATMOSPHERE

Date of least measured values: _____

Constituent	O ₂	Explosive	H ₂ S/Toxic	CO	Date/Time	Initials
Permissible Range	19.5%- 23.5%	<10% LFL	<10ppm H ₂ S	<35ppm	Completed	
Last Measured	_____	_____	_____	_____	_____	_____
Values	-	-	-	-	-	

SITE AND PERSONAL SAFETY (check if required, list type where applicable)

Personal Protective Equipment:

Safety Harness Life Lines Hard Hats Fall Protection Retrieval Eye Ear Face Hand Foot
 Respiratory (type) _____ Clothing (type) _____
 Other: _____

Rescue and Emergency Equipment:

Retrieval Equipment Fire Extinguishers Radios/Telephone Ladder
 Other _____
 Equipment on Standby for Rescue Personnel _____

Site Safety:

Explosion-Proof Lighting Barriers/Shield/Barricades (type) _____ Postings/Flagging
 Other _____

List specific equipment isolated, de-energized, and locked out.

City of Phoenix

Water Services Department

Confined Space Data Sheet

Name of Confined Space: _____

Location of Confined Space: _____

Division/Section Responsible for Confined Space: _____

PRE-ENTRY SYSTEM CONTROL

	<u>Check</u>
Mechanical: Isolate, lockout and de-energize to zero potential energy.	<input type="checkbox"/>
Engulfment: Blank/block/cap/bleed off lines. Lock out gates, valves, pumps.	<input type="checkbox"/>
Electrical: Lockout/Tagout	<input type="checkbox"/>
Inerting: Flush/Purge/Vent	<input type="checkbox"/>
Special precautions: _____	

ATMOSPHERE

Date of least measured values: _____

Constituent	O ₂	Explosive	H ₂ S/Toxic	CO	Date/Time	Initials
Permissible Range	19.5%-23.5%	<10% LFL	<10ppm H ₂ S	<35ppm	Completed	
Last Measured Values	_____	_____	_____	_____	_____	_____

SITE AND PERSONAL SAFETY (check if required, list type where applicable)

Personal Protective Equipment:

Safety Harness Life Lines Hard Hats Fall Protection Retrieval Eye Ear Face Hand
 Foot Respiratory (type) _____ Clothing (type) _____
 Other: _____

Rescue and Emergency Equipment:

Retrieval Equipment Fire Extinguishers Radios/Telephone Ladder Other _____
 Equipment on Standby for Rescue Personnel _____

Site Safety:

Explosion-Proof Lighting Barriers/Shield/Barricades (type) _____ Postings/Flagging
 Other _____

List specific equipment isolated, de-energized, and locked out.

**City of Phoenix
Water Services Department**

Confined Space Entry Permit

ENTRY TEAM

Division: _____ **Facility:** _____

Specific confined space being entered: _____

Purpose of entry (describe the work to be done) _____

Date: _____ **Time:** _____ **Expected Job Duration (days/hours):** _____

Entry Supervisor: _____ **Designated Attendant:** _____

Authorized/Qualified Entrants: _____

Entry-Team Rotation:

Date: _____ **Time:** _____

Entry Supervisor: _____ **Designated Attendant:** _____

Authorized/Qualified Entrants: _____

Entry-Team Rotation:

Date: _____ **Time:** _____

Entry Supervisor: _____ **Designated Attendant:** _____

Authorized/Qualified Entrants: _____

Communication Procedures:

Entry Team: _____

Standby/Rescue Personnel: _____

Sign Offs:

Person authorizing this entry: _____

Entry Supervisor: _____

Person terminating permit: _____ **Date:** _____ **Time:** _____

Distribution to: _____

Confined Space Entry Permit

PRE-ENTRY SYSTEM CONTROL

	<u>Check</u>	<u>Date/Initials</u>
Mechanical: Isolate, lockout and de-energize to zero potential energy.	Completed <input type="checkbox"/>	_____
Engulfment: Blank/block/cap/bleed off lines. Lock out gates, valves, pumps.	Completed <input type="checkbox"/>	_____
Electrical: Lockout/Tagout	Completed <input type="checkbox"/>	_____
Inerting: Flush/Purge/Vent	Completed <input type="checkbox"/>	_____
Special precautions: _____		

ATMOSPHERE - Tested by portable atmospheric monitor with audible and visual alarms.
No one will enter a space with an unsafe atmosphere without approval from the Division Superintendent/Assistant Superintendent.

Constituent Permissible Range	O ₂ 19.5%-23.5%	Explosive <10% LFL	H ₂ S/Toxic <10ppm H ₂ S	CO <35ppm	Date/Time Completed	Initials
Pre-Entry	_____	_____	_____	_____	_____	_____
Post Ventilation	_____	_____	_____	_____	_____	_____
Continuous	_____	_____	_____	_____	_____	_____
Continuous	_____	_____	_____	_____	_____	_____
Continuous	_____	_____	_____	_____	_____	_____

Ventilation Used (circle one): **Mechanical** **Natural**

Special Precautions: (See Confined Space Data Sheet) _____

SITE AND PERSONAL SAFETY (check if required, list type where applicable)

Personal Protective Equipment:

Safety Harness Life Lines Hard Hats Fall Protection Retrieval Eye Ear Face Hand
 Foot Respiratory (type) _____ Clothing (type) _____
 Other: _____

Rescue and Emergency Equipment:

Retrieval Equipment Fire Extinguishers Radios/Telephone Other _____
 Equipment on Standby for Rescue Personnel _____

Site Safety:

Explosion-Proof Lighting Barriers/Shield/Barricades (type) _____ Postings/Flagging
 Other _____

List specific equipment isolated, de-energized, and locked out.

01415-C CONFINED SPACE HOT WORK PERMIT
Water Services Department

Confined Space Hot Work Permit

Division: _____ **Facility:** _____

Specific Confined Space Being Entered: _____

Date: _____ **Time:** _____

Expected Job Duration (days/hours): _____

Purpose of Entry (describe the work to be done): _____

Explain why work cannot be done outside of the confined space: _____

Safety Equipment Required:

Fire Extinguishers: **Yes** _____ **No** _____ **Number** _____
Type _____

Respirators: **Yes** _____ **No** _____ **Number** _____
Type _____

Other Equipment _____

Authorizing Supervisor:

Print Name _____

Signature _____

Date Signed _____

EQUIPMENT INFORMATION FORM INSTRUCTIONS
01600-A

EACH PIECE OF EQUIPMENT PROVIDED WILL REQUIRE AN INDIVIDUAL EQUIPMENT INFORMATION FORM TO BE PROVIDED IN RESPECTIVE O&M MANUAL (I.E., PUMP AND MOTOR, FLOW METER AND TRANSMITTER, PUMP, MOTOR AND V.F.D., SLUICE GATES ETC.).

TITLE BLOCK (HEADER): INSERT PROJECT TITLE.

FACILITY NAME: LIST NAME OF WATER SERVICES DEPARTMENT FACILITY WHERE PROJECT IS LOCATED.

SERVICE DESC: PROVIDE DESCRIPTION AS STATED ON DRAWINGS, EXAMPLE: FOR THE DISCHARGE FLOWMETER ON PRIMARY SLUDGE PUMP #1, STATE: PRIMARY SLUDGE PUMP #1 DISCHARGE FLOW.

PROCESS LOCATION: WHERE IN THE PROCESS AT THIS FACILITY DOES ITEM RESIDE, (AS STATED ON THE DRAWINGS).

DRAWING REF: AS SHOWN ON THE ISSUED FOR CONSTRUCTION DRAWINGS. IF NOT AVAILABLE, LEAVE BLANK. (DO NOT STATE THE MANUFACTURERS DRAWINGS OR SCHEMATICS).

“CMMS TAG” # AND SERIALIZED KEY #: AS STATED ON DRAWINGS. IF NOT AVAILABLE, LEAVE BLANK.

VENDOR: PROVIDE NAME OF LOCAL EQUIPMENT REP/VENDOR, (I.E., HENNESY EQUIPMENT, JAMES, COOKE & HOBSON, SOUTHWEST CONTROLS, ETC.).

ASSOC. EQUIP'T: IF ITEM IS PART OF A LARGER PIECE OF EQUIPMENT, EXAMPLE: LUBE OIL PUMP ON BLOWER, THE BLOWER IS THE ASSOC. EQUIPMENT.

MANUF: MOYNO, FLYGT, MILLTRONICS, EATON, DEZURIK, TRANE, CARRIER, ETC.

TYPE: I.E., POSITIVE DISPLACEMENT, SUBMERSIBLE, CENTRIFUGAL, PORTABLE, SINGLE STAGE, TWO STAGE, ETC.

SIZE: VALVES AND GATES: LINE SIZE IN INCHES. AIR CONDITIONING SYSTEMS, OVERHEAD CRANES, AND BRIDGE CRANES: RATING IS IN TONS.

01600-B EQUIPMENT INFORMATION FORM

**CITY OF PHOENIX
WATER SERVICES DEPARTMENT
NORTHWEST NORTHWEST WATER AND WASTEWATER MASTER PLAN PACKAGE 3A**

EQUIPMENT INFORMATION FORM

Facility Name: _____ Date: _____

Service Desc: _____ Process Location: _____

Spec Section #: _____ Drawing Ref: _____

CMMS TAG #: _____ Serialized Key #: _____
Vendor: _____ Assoc. equip't: _____
Manuf: _____ Type: _____
Model #: _____ Size: _____
Serial #: _____ GPM: _____
Temperature Range: _____ PSI Range: _____
CFM: _____ Operating Range: _____

Electrical Equipment or Motor Data:

Manufacturer Name: _____ Horsepower: _____ Volts: _____
Amp's: _____ Phase: _____ AC or DC: _____ RPM's: _____ Frame #: _____
Enclosure: _____ Service or Power Factor: _____ Insulation Class: _____
Miscellaneous _____ Info: _____

Mechanical Data:

Belt Manufacturer: _____ Belt Model #: _____ Number of Belts: _____
Bearing Manufacturer: _____ Bearing Model #: _____
Weight Oil used: _____ Amount Oil required: _____
Miscellaneous Info: _____

(Job Title)

**CERTIFICATE OF UNIT RESPONSIBILITY
for Specification Section _____**

(Section title)

*In accordance with Paragraph 01600.1.2.B of the Contract Documents,
the undersigned manufacturer accepts unit responsibility for all
components of equipment furnished under specification
Section _____. We hereby certify that these components are
compatible and comprise a functional unit suitable for the specified
performance and design requirements.*

Notary Public

Name of Corporation

Commission expiration date

Address

Seal:

By: _____
Duly Authorized Official

Legal Title of Official

Date: _____

(Project Title):

(Equipment Type):

MANUFACTURER:

Name: _____

Address: _____

City/State/Zip Code: _____

Office Phone: _____

Fax: _____

Web site: _____

E-mail address: _____

LOCAL REPRESENTATIVE:

Name: _____

Address: _____

City, State, Zip: _____

Office Phone: _____

Fax: _____

Web site: _____

E-mail address: _____

INSTALLER:

Name: _____

Address: _____

City, State, Zip: _____

Office Phone: _____

Fax: _____

Web site: _____

E-mail address: _____

MANUFACTURER'S INSTALLATION CERTIFICATION FORM

Contract No.: _____ Specification Section: _____

Equipment Name: _____

CONTRACTOR: _____

Manufacturer of Equipment Item: _____

The undersigned manufacturer of the equipment item described above hereby certifies that he has checked the installation of the equipment and that the equipment, as specified in the Contract Documents, has been provided in accordance with the manufacturer's recommendations, and that the trial operation of the equipment item has been satisfactory.

Comments: _____

Date

Manufacturer

Signature of Authorized Representative

Date

CONTRACTOR

Signature of Authorized Representative

01620-B DELIVERY INSPECTION FORM

Form 01620-B

DELIVERY INSPECTION FORM

Project Name: _____ Project No.: _____

Contractor Name: _____ Contract No.: _____

Equipment Description: _____ Equipment Tag No.: _____

Submittal No.: _____ Specification Section No.: _____

Materials and Equipment Supplier: _____

Sender: _____ Manufacturer: _____

Received By: _____ Date: _____

P.O. No.: _____ USPS Tracking No. _____

Storage Facility Location: _____

Delivery Checklist

Item	Review Description	Yes	No	N/A
1	Equipment Delivered to Approved Storage Area per Specification 01661	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2	Equipment Shop Drawings have been Approved by Engineer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3	Required FAT Test have been Provided	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4	Equipment has been Provided in Original, Unopened, Legible Labeled Containers which are intact.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5	Quantities Provided are Correct	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6	Engineer has been Provided a Copy of the Delivery Inspection Form	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The CONTRACTOR has inspected the materials and equipment item(s) described above and hereby certifies that he has verified the satisfactory delivery of the materials and equipment and that the materials and equipment , as specified in the Contract Documents, has been provided in accordance with the manufacturer’s recommendations, and that the status of the materials equipment item(s) has been satisfactory delivered and stored as requires in Section 01651 – Transportation and Handling of Materials and Equipment and Section 01661 – Storage of Materials and Equipment.

CONTRACTOR’S SIGNATURE

Date

EQUIPMENT TEST REPORT FORM

NOTE: This example equipment test report is provided for the benefit of CONTRACTOR and is not specific to any piece of equipment to be installed as a part of this project. The example is furnished as a means of illustrating the level of detail required for the preparation of equipment test report forms for this project.

CITY OF PHOENIX

Northwest Water and Wastewater Master Plan Package 3A

Sundt
Wilson Engineers

EQUIPMENT/SYSTEM TEST REPORT

Equipment Name: _____
 Equipment Number: _____
 Specification Ref: _____
 Location: _____
 System: _____

CONTRACTOR		ENGINEER	
Verified	Date	Verified	Date

PREOPERATIONAL CHECKLIST

Mechanical

Lubrication.	_____	_____	_____	_____
Alignment.	_____	_____	_____	_____
Anchor bolts.	_____	_____	_____	_____
Seal water system operational.	_____	_____	_____	_____
Equipment rotates freely.	_____	_____	_____	_____
Safety guards.	_____	_____	_____	_____
Valves operational.	_____	_____	_____	_____
Hopper purge systems operational.	_____	_____	_____	_____
Sedimentation tank/hopper clean.	_____	_____	_____	_____
O&M Manual information complete.	_____	_____	_____	_____
Manufacturer's installation certificate complete.	_____	_____	_____	_____

01752-A EQUIPMENT TEST REPORT FORM

CONTRACTOR
Verified Date

ENGINEER
Verified Date

Electrical (circuit ring-out and high-pot tests)

Circuits:

Power to MCC __.	_____	_____	_____	_____
Control to HOA.	_____	_____	_____	_____
Indicators at MCC:				
Red (running).	_____	_____	_____	_____
Green (power).	_____	_____	_____	_____
Amber (auto).	_____	_____	_____	_____
Indicators at local control panel.	_____	_____	_____	_____
Wiring labels complete.	_____	_____	_____	_____
Nameplates:				
MCC.	_____	_____	_____	_____
Control station.	_____	_____	_____	_____
Control panel.	_____	_____	_____	_____
Equipment bumped for rotation.	_____	_____	_____	_____

Piping Systems

Cleaned and flushed:				
Suction.	_____	_____	_____	_____
Discharge.	_____	_____	_____	_____
Pressure tests.	_____	_____	_____	_____
Temporary piping screens in place.	_____	_____	_____	_____

Instrumentation and Controls

Flowmeter FE_____ calibration	_____	_____	_____	_____
Calibration Report No. _____				
Flow recorder FR_____ calibrated against transmitter.	_____	_____	_____	_____
VFD speed indicator calibrated against independent reference.	_____	_____	_____	_____
Discharge overpressure shutdown switch calibration.	_____	_____	_____	_____
Simulate discharge overpressure Shutdown.	_____	_____	_____	_____

01752-A EQUIPMENT TEST REPORT FORM

CONTRACTOR
Verified _____ Date _____

Verified _____ Date _____

EQUIPMENT/SYSTEM PERFORMANCE TESTS (Section 01752)

Mechanical

Motor operation temperature satisfactory.	_____	_____	_____	_____
Pump operating temperature satisfactory.	_____	_____	_____	_____
Unusual noise, etc?	_____	_____	_____	_____
Pump operation: 75 gpm/50 psig	_____	_____	_____	_____
Measurement:				
Flow _____				
Pressure _____				
Test gage number _____				
Alignment hot.	_____	_____	_____	_____
Dowelled in.	_____	_____	_____	_____

Remarks: _____

Electrical

Local switch function:				
Runs in <i>HAND</i>	_____	_____	_____	_____
No control power in <i>OFF</i>	_____	_____	_____	_____
Timer control in <i>AUTO</i>	_____	_____	_____	_____
Overpressure protection switch				
PS_____ functional in both				
<i>HAND</i> and <i>AUTO</i>	_____	_____	_____	_____
Overpressure protection switch				
PS_____ set at 75 psig	_____	_____	_____	_____
PLC 2500 set at 24-hour cycle,				
25 min <i>ON</i>	_____	_____	_____	_____

Equipment/System Performance Test Completed

Contractor _____

Date _____

Equipment/System Performance Test Accepted

Engineer _____

Date _____

01781-A OPERATION AND MAINTENANCE TRANSMITTAL FORM

OPERATION AND MAINTENANCE TRANSMITTAL FORM

Date: _____ Submittal No.¹: _____
 To: _____ Contract No.: _____
 _____ Spec. Section: _____
 _____ Submittal Description: _____
 _____ From: _____
 Attention: _____

Checklist	CONTRACTOR		ENGINEER	
	Satisfactory	N/A	Satisfactory	Deficient
1. Table of Contents				
2. Equipment Information Forms				
3. Manufacturer information				
4. Vendor information				
5. Safety precautions				
6. Operator prestart instructions				
7. Start-up, shutdown, and post-shutdown instructions				
8. Normal operation instructions				
9. Emergency operation instructions				
10. Operator service requirements				
11. Environmental conditions				
12. Lubrication data				
13. Preventive maintenance plan and schedule				
14. Troubleshooting guides and diagnostic techniques				
15. Wiring diagrams and control diagrams				
16. Maintenance and repair procedures				
17. Removal and replacement instructions				
18. Spare parts and supply list				
19. Corrective maintenance information				
20. Parts identification				
21. Warranty information				
22. Personnel training requirements				
23. Testing equipment and special tool information				

Remarks: _____

CONTRACTOR'S Signature: _____ ENGINEER'S Signature: _____

¹ Refer to Paragraph 01340-1.2 A, Transmittal Procedure.

01781-B OPERATIONS & MAINTENANCE DATA REVIEW CHECKLIST



Northwest Water and Wastewater Master Plan Package 3A

Reviewing Firm:

Date:

WS#:

Contract #:

Reviewed by:

(SUBMITTAL # and REV #)

(O&M MANUAL TITLE)

(SPECIFICATION NUMBER)

(EQUIPMENT MANUFACTURER)

(PREPARED BY)

OPERATIONS & MAINTENANCE DATA REVIEW CHECKLIST

REQUIRE DATA	ITEM COMPLETE	ITEM INCOMPLETE	COMMENT NO.
GENERAL FORMAT			
Copies Required (Hard/Soft) with Proper Labeling <i>01781-1.1.D.2</i> and 3			1
Paper Quality <i>01781-1.1.D.4.a</i>			
Typed/Printed Originals <i>01781-1.1.D.4.b</i>			
D-Ring Binder/Triple Post <i>01781-1.1.D.4.c</i>			
Binder Identification <i>01781-1.1.D.4.c</i>			
Dividers <i>01781-1.1.D.4.e</i>			
Index Tabs <i>01781-1.1.D.4.e</i>			
Table of Contents <i>01781-1.1.D.4.f</i>			
Identify Specific Components <i>01781-1.1.D.4.g</i> <i>01781-1.1.D.4.h</i>			
Final Test Data <i>01781-1.1.D.4.i</i>			1

01781-B OPERATIONS & MAINTENANCE DATA REVIEW CHECKLIST

OPERATIONS & MAINTENANCE DATA			
Record Documents – “As Built” Information <i>01781-1.1.C.1.b.13)</i>			
Equipment Information Form <i>01781-1.1.C.1.b.13)</i> <i>01331 Form 01600-A</i>			
Operating Characteristics <i>01781-1.1.C.1.b.1) and 2)</i>			
Startup Procedures <i>01781-1.1.C.1.b.2)</i>			
Shutdown Procedures <i>01781-1.1.C.1.b.2)</i>			
Preventive Maintenance Instructions <i>01781-1.1.C.1.b.3)</i> <i>and 01781-1.1.C.2.a & b</i>			
Spare Parts List <i>01781-1.1.C.1.b.4)</i>			
Safety/M.S.D.S./Chemical Quantity Information <i>01781-1.1.C.1.b.5) & 15)</i>			
Manufacturer <i>01781-1.1.C.1.b.6)</i> <i>01331 Form 01600-C</i>			
Manufacturers Local Service Representative <i>01781-1.1.C.1.b.6)</i>			
Installer <i>01781-1.1.C.1.b.6)</i>			
Warranty/Service Contract <i>01781-1.1.C.1.b.7)</i> <i>General Conditions Guaranty-Warranty</i>			
As-built Wiring Diagrams & Nameplate Drawing <i>01781-1.1.C.1.b.8)</i>			
Test Data <i>01781-1.1.C.1.b.9)</i> <i>and</i> <i>01781-1.1.D.4.i</i>			1
Installation Instructions <i>01781-1.1.C.1.b.10)</i>			
Installation Data <i>01781-1.1.C.1.b.11)</i>			

01781-B OPERATIONS & MAINTENANCE DATA REVIEW CHECKLIST

Reference to Tag Number	<i>01781-1.1.C.1.b.12)</i>			
PREVENTIVE MAINTENANCE INSTRUCTIONS				
Tasks Required	<i>01781-1.1.C.2.b.1)</i>			
Recommended Schedule	<i>01781-1.1.C.2.b.2)</i>			
Lubrication Charts	<i>01781-1.1.C.2.b.3)</i>			
Alternative Lubricants	<i>01781-1.1.C.2.b.4)</i>			
Trouble Shooting Instructions	<i>01781-1.1.C.2.b.5)</i>			
Identification of Maintenance Tools/Equipment	<i>01781-1.1.C.2.b.6)</i>			
Special Tools	<i>01781-1.1.C.2.b.7)</i>			

Comments:

1. This item will be reviewed by the Construction Administrator and at the Final Approval of the manuals as stated in 01781-1.1.D.3

DOCUMENTS MANAGER **Date**

SPARE PARTS RECEIVER FORM

CONTRACTOR TO FILL OUT:

MANUFACTURER: _____

ITEM DESCRIPTION: _____

COST: _____ PART NUMBER: _____

VENDOR/SUPPLIER NAME: _____

ADDRESS: _____

TELEPHONE NUMBER: _____

FAX NUMBER: _____

PART TO BE USED ON
WHAT EQUIPMENT: _____

EQUIPMENT NUMBER: _____ SPECIFICATION SECTION: _____

CONTRACTOR REP DATE

CITY REP DATE

ENGINEER REP DATE

PREVENTIVE MAINTENANCE DATA SUBMITTAL FORM

Project Name:				City Project #				
				WS-----				
Engineer:				Contractor:				
Asset Type:				Asset Manufacturer:				
Preventive Maintenance Task Description		Class	Category	Task Duration (Hrs)	Est. Staff	Freq.	Freq. Unit (Run-Time Hrs or Calendar Days)	Preventive Maintenance Procedure MS WORD File Name
1.								
2.								
3.								
Assets IDs	Asset Description	Max. Life (yrs)	Warranty			Copy of Warranty Certificate File Name		
			Start Date	End Date	Duration (Months)			

MANUFACTURER'S INSTRUCTION CERTIFICATION FORM

Contract No: _____ Specification Section: _____ Equipment Name: _____

CONTRACTOR: _____

Manufacturer of equipment item: _____

The undersigned manufacturer certifies that a service engineer has instructed the Plant operating personnel in the proper maintenance and operation of the equipment designated herein.

Operations Check List (check appropriate spaces)

Start-up procedure reviewed.	_____
Shutdown procedure reviewed.	_____
Normal operation procedure reviewed.	_____
Others: _____	_____
_____	_____

Maintenance Check List (check appropriate spaces)

Described normal oil changes (frequency).	_____
Described special tools required.	_____
Described normal items to be reviewed for wear.	_____
Described preventive maintenance instructions.	_____
Described greasing frequency.	_____
Others: _____	_____
_____	_____

Date

Manufacturer

Signature of Authorized Representative

Date

Signature of OWNER'S Representative

Date

Signature of CONTRACTOR'S Representative

01821-B TRAINING REQUEST FORM

**TRAINING REQUEST FORM
CITY OF PHOENIX**

**SPECIFICATION SECTION 01821
INSTRUCTION OF OPERATIONS AND MAINTENANCE PERSONNEL**

Equipment Name: _____

Equipment Tag Number: _____

Equipment Description: _____

Specification Section: _____

Operations and Maintenance Data Submitted/Approved: _____

Start-up and Testing Complete/Date: _____

Lesson Plan Submitted/Approved: _____

Training Aids Submitted/Approved: _____

Hands-on Demonstration: _____

Training Schedule (Dates, Time, No. of Sessions): _____

11000-A MOTOR DATA FORM

MOTOR DATA FORM:

Equipment Name _____

Equipment No.(s) _____

Site Location _____

Nameplate Markings

Mfr _____ Mfr Model _____ Frame _____ HP _____
 Volts _____ Phase _____ RPM _____ Service factor _____
 FLA _____ LRA _____ Freq _____ Amb temp rating _____ deg.C
 Time rating _____ Design letter _____
 (NEMA MG1-10.35) (NEMA MG-1.16)
 KVA code letter _____ Insulation class _____

The following information is required for explosion proof motors only:

- A. Approved by UL for installation in Class _____, Div _____
- B. UL frame temperature code _____; Group _____ Atmosphere
 (NEC Tables 500-2 and 500-2(b))

The following information is required for all motors 1/2 horsepower and larger:

- A. Guaranteed minimum efficiency _____
 (Section 11000)
- B. Nameplate or nominal efficiency _____

Data Not Necessarily Marked on Nameplate

Type of enclosure _____ Enclosure material _____
 Temp rise _____ degrees C (NEMA MG1-12.41,42)
 Space heater included? _____ Yes _____ No; if Yes, _____ watts _____ volts
 Type of motor winding over-temperature protection, if specified: _____

Use the space below to provide additional information on other motor modifications, if specified:

15142-A REQUEST FOR BACTERIOLOGICAL SAMPLES

 CITY OF PHOENIX	<p style="text-align: center;">REQUEST FOR BACTERIOLOGICAL SAMPLES</p> <p style="text-align: right;">LAB# _____</p> <p>_____ Date:</p> <p>From: TYPE NAME HERE</p> <p style="text-align: center;"><i>NAME OF AGENCY MAKING REQUEST</i></p> <p style="text-align: center;">Fax: XXX XXX-XXXX, Telephone No. XXX XXX-XXXX</p> <p>To: Water Services Department Pollution Control Division - Fax: 602 534-7151</p>
<p>Area/Zone # _____ Permit/Project # _____</p> <p>Date Wanted: _____ Circle One: AM PM Any</p> <p>Contractor: _____ Office On Site? Yes No Phone No. _____</p> <p>Location Of Risers:</p> <p>#1. _____</p> <p>#2. _____</p> <p>#3. _____</p> <p>#4. _____</p> <p>#5. _____</p> <p>#6. _____</p> <p>Lines Represented: _____</p> <p>_____</p> <p>Requested By Inspector: _____ Beeper/Tel No.: _____</p>	
<p>Test Results:</p> <p>_____ Pass Fax Date: _____ Time: _____ No. of Pages: _____</p> <p>_____ Failed Faxed To: _____ Faxed By: _____</p> <p>_____ Bacteria Inspectors Comments: _____</p> <p>_____ High Chlorine _____</p> <p>_____ No Pressure _____</p> <p>_____ No Risers _____</p> <p>_____ Other _____</p>	

WIRE AND CABLE RESISTANCE TEST DATA FORM

Wire or Cable No.: _____ Temperature, °F _____

Location of Test

Insulation
resistance,
megaOhms

1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____
6.	_____	_____
7.	_____	_____

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

16000-B INSTALLED MOTOR TEST DATA FORM

INSTALLED MOTOR TEST DATA FORM

Motor Equipment Number _____ Date of test _____
Equipment Driven _____
MCC Location _____ Ambient temp _____°F

Resistance:

Insulation resistance phase-to-ground megohms:

Phase A _____, Phase B _____, Phase C _____

Current at Full Load:

Phase _____ Current, amps _____

Phase _____ Current, amps _____

Phase _____ Current, amps _____

Thermal Overload Device: Manufacturer/catalog # _____ Amperes _____

Circuit breaker (MCP) setting: _____

Motor Nameplate Markings:

Mfr _____ Mfr type _____ Frame _____ HP _____

Volts _____ Phase _____ RPM _____ **Service factor _____

Amps _____ Freq _____ Ambient temp rating _____ °C

Time rating _____ **Design letter _____
(NEMA 1-10.35) (NEMA MG-1.16)

Code letter _____ Insulation class _____

**Required for 3-phase squirrel cage induction motors only.

CERTIFIED _____ Date _____
CONTRACTOR'S Representative

WITNESSED _____ Date _____
OWNER'S Representative

16000-C DRY TRANSFORMER TEST DATA FORM

DRY TRANSFORMER TEST DATA FORM

Equipment No. _____ Temperature _____

Location _____

Winding: Primary _____ Secondary _____

A. INSULATION-RESISTANCE TEST:

The test shall be made with a megohmmeter at the test voltage for a period of 1 minute.

<u>Voltage rating</u>	<u>Test voltage</u>	<u>Test results (megohms)</u>	
		<u>Phase</u>	<u>Phase</u>
0-600	1000	A-GRD _____	A-B _____
601-5000	2500	B-GRD _____	B-C _____
5000+	5000	C-GRD _____	C-A _____

Resistance readings less than the manufacturer's recommended value or less than 10 megohms shall be brought to the attention of the ENGINEER.

B. DIELECTRIC-ABSORPTION TEST:

The test shall be made with a megohmmeter at the test voltage for a period of 10 minutes.

1.	TEST RESULTS:	<u>Phase</u>	<u>Phase</u>
	(megohms)	A-GRD _____	A-B _____
		B-GRD _____	B-C _____
		C-GRD _____	C-A _____

2. **POLARIZATION INDEX:**

$$\frac{10 \text{ minute reading}}{1 \text{ minute reading}} = \text{polarization index}$$

(from Paragraph "A" above)

<u>Phase</u>	<u>Phase</u>
A-GRD _____	A-B _____
B-GRD _____	B-C _____
C-GRD _____	C-A _____

Polarization index values less than two shall be brought to the attention of the ENGINEER.

CERTIFIED _____ Date _____
CONTRACTOR'S Representative

WITNESSED _____ Date _____
OWNER'S Representative

MOTOR CONTROL CENTER TEST FORM

Equipment No. _____ Ambient room temperature _____

Location _____

A. MECHANICAL CHECK:

- 1. All bolted connections either bus to bus or cable to bus shall be torqued to the manufacturer's recommendations.

B. ELECTRICAL TESTS:

- 1. Measure insulation resistance of each bus section phase to phase and phase to ground for one minute using a megohmmeter at 1000 volts.

<u>Test results (megohms)</u>	
<u>Phase</u>	<u>Phase</u>
A-GRD _____	A-B _____
B-GRD _____	B-C _____
C-GRD _____	C-A _____

- 2. Set the circuit breaker in the starter unit to comply with the requirements of NEC, Article 430-52 and Table 430-152.
- 3. Motor overload heater elements shall be sized and installed based on the actual nameplate full load amperes of the motor connected to the starter.

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

MEDIUM VOLTAGE MOTOR STARTER TEST FORM

Equipment No. _____

Location _____

Room Temperature _____

A. The protective devices shall be set in accordance with the specification before the tests are performed.

1. Measure contact resistance (micro-ohms)

Phase: A_____ B_____ C_____

Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

<u>Phase</u>	<u>A</u>	<u>B</u>	<u>C</u>	
Pole to ground	___	___	___	megohms
Across open pole	___	___	___	megohms
Pole to pole	AB_____	BC_____	CA_____	megohms

3. Perform minimum pickup voltage tests on trip and close coils.

4. Motor RTDs shall be tested by using a hot oil bath. The temperature at which the sensor trips shall be recorded for each RTD.

5. The Contactor shall be tripped by operation of each protective device.

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

MEDIUM VOLTAGE SWITCHGEAR TEST FORM

Equipment No. _____

Location _____

Room Temperature _____

A. The protective devices shall be set in accordance with the specification before the tests are performed.

1. Measure contact resistance (micro-ohms)

Phase: A____ B____ C____

Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

<u>Phase</u>	<u>A</u>	<u>B</u>	<u>C</u>	
Pole to ground	___	___	___	megohms
Across open pole	___	___	___	megohms
Pole to pole	AB___	BC___	CA___	megohms

3. Perform minimum pickup voltage tests on trip and close coils.

4. Verify the instrument transformer ratios. Check the transformer's polarity electrically.

5. The Contactor shall be tripped by operation of each protective device.

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

PROTECTIVE RELAY TEST FORM

Location _____

Switchgear Breaker No. _____

Protective Relay Description _____

- A. The protective relays shall be tested in the following manner:
 - 1. Each protective relay circuit shall have its insulation resistance tested to ground.
 - 2. Perform the following tests on the specified relay setting:
 - a. Pickup parameters on each operating element.
 - b. Timing test shall be performed at three points on the time dial curve.
 - c. Pickup target and seal-in units.
- B. The results shall be recorded and signed by CONTRACTOR. A copy shall be provided to the ENGINEER in accordance with Section 01752, Equipment and System Startup and Performance Testing.

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

LOW VOLTAGE SWITCHGEAR TEST FORM

Equipment No. _____

Location _____

Room Temperature _____

A. The protective devices shall be set in accordance with the specification before the tests are performed.

1. Measure contact resistance (micro-ohms)

Phase: A_____ B_____ C_____

Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

<u>Phase</u>	<u>A</u>	<u>B</u>	<u>C</u>	
Pole to ground	_____	_____	_____	megohms
Across open pole	_____	_____	_____	megohms
Pole to pole	AB _____	BC _____	CA _____	megohms

3. Minimum pickup current shall be determined by primary current injection.

4. Long time delay shall be determined by primary injection at three hundred percent (300%) pickup current.

5. Short time pickup and time delay shall be determined by primary injection of current.

6. Instantaneous pickup current shall be determined by primary injection.

7. Trip unit reset characteristics shall be verified.

8. Auxiliary protective devices, such as ground fault or under voltage relays, shall be activated to ensure operation of shunt trip devices.

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

MEDIUM VOLTAGE LOAD INTERRUPTER SWITCH TEST FORM

Equipment Number _____

Location _____

Date _____

1. Measure switch blade resistance (micro-ohms).

Phase: A _____ B _____ C _____

Contacts shall be replaced if resistance exceeds 50 micro-ohms.

2. Perform an insulation resistance test (1000 volts DC for 1 minute).

<u>Phase</u>	<u>A</u>	<u>B</u>	<u>C</u>
Pole to ground	___	___	___ megohms
Across open pole	___	___	___ megohms
Pole to pole	AB ___	BC ___	CA ___ megohms

The results shall be recorded and signed. A copy shall be provided to the ENGINEER in accordance with Section 01752, Equipment and System Startup and Performance Testing.

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

16000-J LIQUID-FILLED TRANSFORMER TEST FORM

LIQUID-FILLED TRANSFORMER TEST FORM

Equipment Number _____

Location _____

Date/Weather Conditions _____

- A. Perform the “Insulation-Resistance Test” and “Dielectric Absorption Test” using Form 16000-C, Dry Transformer Test Data Form.
- B. Perform an applied voltage (low frequency dielectric) test in accordance with ANSI C57.12.90, Paragraph 10.5, Applied Voltage Test. Applied voltage levels shall be 75 percent of recommended factory test levels or recommended test levels of ANSI C57.12.00, Table 5.
- C. Insulating oil shall be sampled and shall be laboratory tested for the following:
 - 1. Dielectric strength.
 - 2. Acid neutralization.
 - 3. Interfacial tension.
 - 4. Color.
 - 5. Power factor.
- D. Perform a turns ratio test between the windings for all tap positions.
- E. The temperature and pressure switches shall be tested using a hot oil bath and air pump.
- F. The results shall be recorded and signed by CONTRACTOR and ENGINEER. A copy shall be provided to the ENGINEER in accordance with Section 01752, Equipment and System Startup and Performance Testing. Any readings which are abnormal to ANSI industry standards shall be reported to the ENGINEER.

CERTIFIED _____
CONTRACTOR’S Representative

Date _____

WITNESSED _____
OWNER’S Representative

Date _____

AUTOMATIC TRANSFER SWITCH TEST FORM

Equipment Number _____

Location _____

Date _____

1. Perform an insulation resistance test (1000 volts DC for 1 minute):

	<u>Phase</u>			
	<u>A</u>	<u>B</u>	<u>C</u>	
Pole to ground	___	___	___	megohms
Pole to pole	AB___	BC___	CA___	megohms

2. Perform the following operations and initial:

- a. Manual transfer _____
- b. Loss of normal power; ___sec delay
- c. Return to normal power; ___sec delay

The results shall be recorded and signed. A copy shall be provided to the ENGINEER in accordance with Section 01752, Equipment and System Startup and Performance Testing.

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

16000-L NEUTRAL GROUNDING RESISTOR TEST

NEUTRAL GROUNDING RESISTOR TEST

Equipment No.: _____

Location: _____

Date: _____

- A. The pickup and time delay setting on the ground fault relay shall be set in accordance with Section 16061, Grounding Systems.
 - 1. The transformer neutral insulation resistance shall be measured with and without the grounding resistor connected to insure no parallel ground paths exist.
 - 2. The protective relay pickup current shall be determined by injecting test current into the current sensor. The pickup current should be within ten percent of the dial setting. Record the dial setting and actual pickup tie.
 - 3. The relay timing shall be tested by injecting 150 and 300 percent of pickup current into the current sensor. The relay timing shall be in accordance with the manufacturer's published time-current characteristic curves. Record the relay timing at 150 and 300 percent of pickup current.
 - 4. The circuit interrupting device shall be operated by operating the relay.

- B. The results shall be recorded and signed by the CONTRACTOR and ENGINEER. A copy shall be provided to the ENGINEER in accordance with Section 01752, Equipment and System Startup and Performance Testing.

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

16000-M CONDUIT AND WIRE TERMINATION SHEET

CONDUIT AND WIRE TERMINATION SHEET

CONDUIT NO.: _____ **No. of Wires:** _____ **Size:** _____
Process Area: _____

Wire No.	Terminal No.	From	Via	Via	To	Terminal No.	Service Description	DWG No.(s)

16000-N GROUND TEST POINT DATA FORM

Form 16000-N

Study Firm Logo

GROUND TEST POINT DATA FORM

COMPANY NAME

DATE:

STREET ADDRESS
CITY, STATE ZIP
TELEPHONE
FAX

Project Title:	Study Firm Representative:
Plant/Site:	City of Phoenix Project #: WS????????
Contract Drawing #:	Contract Reference Spec. #

EQUIPMENT INFORMATION

Building:	
Location in Building:	
Equipment Name:	
Equipment Tag Number:	
Test Point Location and Tag #	

EQUIPMENT DATA

Conductor Size:	
Conductor Type:	
Bus Type:	
Voltage:	
Amperage:	
Conductor Termination	

ATMOSPHERIC CONDITIONS

Weather:	
Soil Conditions:	
Date Since Last Measureable Rain:	

BONDING TYPE (check applicable)

Concrete Incased UFeR <input type="checkbox"/>	Ground Grid <input type="checkbox"/>	Building Steel <input type="checkbox"/>
¾ x 10' Copper Ground Rod <input type="checkbox"/>	Cold Water Pipe <input type="checkbox"/>	Chemical Ground Rod <input type="checkbox"/>
Gas Pipe <input type="checkbox"/>	Other: <input type="checkbox"/> (Explain):	

TEST RESULTS

OHMS:	Notes:
-------	--------

WITNESSED _____
ENGINEER

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

16215-A POWER STUDY COORDINATION FORM

Study Firm Logo

GROUND TEST POINT DATA FORM

COMPANY NAME

DATE:

STREET ADDRESS
CITY, STATE ZIP
TELEPHONE
FAX

Project Title:	Study Firm Representative:
Plant/Site:	City of Phoenix Project #: WS
Contract Drawing #:	Contract Reference Spec. #

EQUIPMENT INFORMATION

Building:	
Location in Building:	
Equipment Name:	
Equipment Tag Number:	
Test Point Location and Tag #	

EQUIPMENT DATA

Conductor Size:	
Conductor Type:	
Bus Type:	
Voltage:	
Amperage:	
Conductor Termination	

ATMOSPHERIC CONDITIONS

Weather:	
Soil Conditions:	
Date Since Last Measureable Rain:	

BONDING TYPE (check applicable)

Concrete Incased UFeR <input type="checkbox"/>	Ground Grid <input type="checkbox"/>	Building Steel <input type="checkbox"/>
¾ x 10' Copper Ground Rod <input type="checkbox"/>	Cold Water Pipe <input type="checkbox"/>	Chemical Ground Rod <input type="checkbox"/>
Gas Pipe <input type="checkbox"/>	Other: <input type="checkbox"/> (Explain):	

TEST RESULTS

OHMS:	Notes:
-------	--------

WITNESSED _____ Date _____
ENGINEER

WITNESSED _____ Date _____
OWNER'S Representative **POWER COORDINATION/ARC FLASH LABELING FORM**

16215-A POWER STUDY COORDINATION FORM



COMPANY NAME

DATE:

STREET ADDRESS
CITY, STATE ZIP
TELEPHONE
FAX

Project Title:	Study Firm Representative:
Plant/Site:	City of Phoenix Project #: WS
Contract Drawing #:	Contract Reference Spec. #

Per Specification 16215 – Power Study, the Power Coordination - Arc Flash Analysis Report breaker settings, arc flash / voltage labels, single line diagrams and panel schedules are incorporated on the equipment to the satisfaction of the CONTRACTOR, ENGINEER and OWNER.

The attached table identifies the breaker settings on the equipment at the time the labels were installed.

_____ Date _____
CONTRACTOR’S Representative (Print Name & Sign)

_____ Date _____
ENGINEER’S Representative (Print Name & Sign)

_____ Date _____
OWNER’S Representative (Print Name & Sign)

16215-A POWER STUDY COORDINATION FORM

Table 2 Recommended Low Voltage Breaker Settings

Reference d TCC	Breaker	Breaker Type	Trip Unit	Sensor / Plug	Settings								
					R/S	LTPU	LTD	STPU	STD	INST	GNDP U	GNDD	
					EXISTING								
					REC								
					REC								
					EXISTING								
					REC								
					EXISTING								
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					REC								

16231-A ADD GENERATOR TO FLEET – INSPECTION LIST

ADD GENERATOR TO FLEET – INSPECTION CHECKLIST

Site Information:

Site Name:	
Address:	
Access Requirements and Restrictions:	

Supplier Information:

Company Name:	
Address:	
Phone #:	
Start-Up Date:	
Cost:	
PO#	

General Information:

GENERATOR	Year:	Make:	Model:
	Serial #:	Spec:	Hrs:
	KW	Voltage:	Phase:
WARRANTY	Yrs:	Hrs:	Start Date:
BREAKER AMPS	1.	2.	3.
ENGINE	Mfg:	Model:	Serial #:
FUEL	Type:	Capacity:	
ALTERNATOR	Mfg:	Model:	Serial #
BATTERIES	Mfg:	Group Size:	Quantity:
BELTS	Fan:	Alternator:	Other:
FILTERS	Oil:	Air:	Fuel:
HOSES:	Upper:	Lower:	Bypass:

17001-A INSTRUMENT TUBING LEAK TEST FORM

INSTRUMENT TUBING LEAK TEST FORM

Loop No.: _____

List tubing associated with loop in table below. Make applicable measurements after isolating any air consuming pilots from circuit.

<u>Tub e No.</u>	<u>Tubing Length (feet)</u>	<u>Initial Pressure (psi)</u>	<u>Measured Pressure Drop (psi)</u>	<u>Measured Pressure Drop (psi)</u>	<u>Permitted Pressure Drop (psi)</u>
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

17001-B CALIBRATION TEST DATA FORM

CALIBRATION TEST DATA FORM

Tag No. and Description: _____

Make and Model No.: _____

Serial No.: _____

Input: _____

Output: _____

Scale: _____

Range: _____

<u>% of Range/ Set Point</u>	<u>Display Reading</u>	<u>Output Reading</u>	<u>% Deviation</u>	<u>Calibration Basis</u>
_____	_____	_____	_____	<input type="checkbox"/> Increasing <input type="checkbox"/> Decreasing
_____	_____	_____	_____	<input type="checkbox"/> Increasing <input type="checkbox"/> Decreasing
_____	_____	_____	_____	<input type="checkbox"/> Increasing <input type="checkbox"/> Decreasing
_____	_____	_____	_____	<input type="checkbox"/> Increasing <input type="checkbox"/> Decreasing
_____	_____	_____	_____	<input type="checkbox"/> Increasing <input type="checkbox"/> Decreasing

Instrument Programming Parameters

<u>Parameter Description</u>	<u>Parameter No.</u>	<u>Parameter Setting</u>
1. _____	_____	_____
2. _____	_____	_____
3. _____	_____	_____
4. _____	_____	_____

CERTIFIED _____
CONTRACTOR'S Representative

Date _____

WITNESSED _____
OWNER'S Representative

Date _____

17001-C FUNCTIONAL ACCEPTANCE TEST

FUNCTIONAL ACCEPTANCE TEST

System:							P&ID No.:				
Loop No.:							Page of				
Factory Acceptance Test:											
Tag Number:											
Loop Description:											
Instrument Location:											
Manufacturer:											
Model Number/Serial Number:											
Adjustable Range:											
Calibrated Range:											
Remarks:											
Installation Per Manufacturer's Requirements?							Yes:		No:		
Installation Per Contract Documents?							Yes:		No:		
If "No," Explain:											
Calibration Test:							Switch Test:				
%	Calibration Signal	Instrument Indication	Error %	4-20 ma Output	CCS Indication	Error %	Set Point	Setting	Switch Point Increasing	Switch Point Decreasing	
0							1				
25							2				
50							3				
75							4				
100							5				

FACTORY ACCEPTANCE TEST REPORT

PROJECT TITLE

Witnessing Firm(s):

Equipment Name:

Testing Date:

Manufacturer:

Witnessed by:

Location of Test:

REVIEW CHECKLIST

REVIEW ITEMS	ITEM COMPLETE	ITEM INCOMPLETE	COMMENT NO.
PRIOR TO FACTORY ACCEPTANCE TEST			
Control Panels Shall Be Furnished In Accordance With The Requirements As Shown On The Drawings And As Specified In Specification 16050, 17051, 17052, 17053, 17226 and 17260.			
Was The System Internally Tested By Manufacturer.			
Approved Submittal Available			
Panel Construction Fully Completed And Panel Clean Of Debris			
Programming Of All Devices And Logic Controllers Completed, Installed And Printed Program Copies Available			
Panel Drawings As-Built And Per Specifications			
Operations & Maintenance Manual Completed			
MECHANICAL INSPECTION			
Manufacturers UL 508 Label Installed			
Enclosure is NEMA Rated Per Specification 16050			
Enclosure Door Seals, Gaskets, Alignment, Latches And Locking Mechanisms Installed And Functioning Properly			
Panel Painted Per Specifications			
Front Panel Nameplates And Components Installed Per Specifications And NEMA Rated For Application			

17260-A FACTORY ACCEPTANCE TEST REPORT

REVIEW ITEMS	ITEM COMPLETE	ITEM INCOMPLETE	COMMENT NO.
Arc Flash Labels Installed			
Internal Components Mounted Securely And Locations Are As Per Approved Submittal			
Component Fasteners Constructed Of Stainless Steel			
Panels And Shelves Constructed Of Minimum 12 Gage Steel			
Wireways Covered And Wire Fill Limits Per Specifications			
All Wires Are Terminated And Labeled Per Specifications			
Spare Free Space Capacity Percentage Per Specifications			
Conduit Entry Points Free Space Per Specifications			
Steel Print Pocket With White Enamel Finish Provided			
Enclosure Mounting And Lifting Supports Provided			
Air Conditioner and Drain Line Installed and Functioning			
Sunshade Structure Per Specifications			
Shipping Container and Preparations Reviewed			
PANEL COMPONENTS			
Components Are Per Bill Of Materials And Specifications			
Components Are UL Listed			
Light Fixture And Operation Switch Installed			
Grounding Studs And Bars For The Door, Backplane And Controls Installed For AC And DC Circuits			
Air Conditioner, Heat Exchanger, Ventilation Fan Or Heater Installed			
Thermostat And Panel High Temperature Switch Installed			
All Internal Components Labeled Per Specification			
Wire Type, Colors, Size, Labeling, Routing And Terminations Per Specifications			
Panel Front Nameplate #1 As Per Specifications			

17260-A FACTORY ACCEPTANCE TEST REPORT

REVIEW ITEMS	ITEM COMPLETE	ITEM INCOMPLETE	COMMENT NO.
Panel Incoming Power Terminated To PTB			
Spare Parts Provided			
PANEL TESTING			
List Test Equipment Used For The Factory Acceptance Test			
List All Personal Protective Equipment Utilized For Factory Acceptance Test			
Verify Panel Is Grounded and Test All Panel Grounds			
Verify All Circuit Breaker And Fuse Sizes			
Verify Safety Circuits Are Fail Safe Including From The Panel To the Field Device			
Power On Verification Test			
Measure Panel Power Consumption – Test Total System Current With System In Non-Loaded State. Current Measured: _____			
Circuit Breaker And Disconnect Switch - Power On/Off/Lock-out Test			
Lamp Test			
Test All Power Supply(s) Voltages Power Measured: _____			
Test All Panel Start/Stop Controls And Computer Generated Controls			
Test Emergency Stop Controls			
Verify All Starters, Relays And Contactors Activate As Required			
Simulate All I/O As Near As Possible To The Installed System Configuration			
Simulate All Analog Signals Including Field Devices Inputs and Computer Control Inputs By Varying The Analog Inputs Between 4 – 20 mA's DC - 0 To 100% Ranges.			
Verify All Calibrations And Set Points Of Panel Components			
Test All Programmable Logic Controller Serial Ports			
Test Programmable Logic Controller Retentative Memory			

17260-A FACTORY ACCEPTANCE TEST REPORT

REVIEW ITEMS	ITEM COMPLETE	ITEM INCOMPLETE	COMMENT NO.
Test Programmable Logic Controller Power Failure			
Test All Start Up And Shut Down Sequence Procedures			
Test All Alarms			

Comments:

SECTION 01332

SHOP DRAWING PROCEDURES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The submittal of Shop Drawings shall conform to requirements of General Conditions and procedures described in this Section. A separate transmittal form shall be used for each specific item or class of material or equipment for which a submittal is required. Transmittal of Shop Drawings on various items using a single transmittal form shall be permitted only when the items taken together constitute a manufacturer's "package" or are so functionally related that expediency indicates review of the group or package as a whole.
- B. The term "Shop Drawings" as used herein shall be understood to include detailed design calculations, fabrication and installation drawings, lists, graphs, test data, operating instructions, and other items which shall include, but are not necessarily limited to:
1. Drawings and catalog information and cuts.
 2. Specifications, parts list, suggested spare parts lists, and equipment drawings.
 3. Wiring diagrams of systems and equipment.
 4. Complete lubrication, maintenance and operation instructions, including initial startup instructions as described in Section 01821, Instruction of Operations and Maintenance Personnel.
 5. Applicable certifications.
 6. Anchor bolt templates, mounting instructions and mounting design calculations as required.
 7. Required maintenance operations to allow all installed equipment to remain idle for a period of time not to exceed 24 months.
 8. Other technical, installation, and maintenance data as applicable.
 9. Unloading and handling methods and storage requirements.
 10. Note, highlight, and explain proposed changes to the Contract Documents.
 11. Paint submittal showing type of paint and the mils thickness of coating system used. The coating system shall be the approved system as submitted under Division 9, Finishes.
 12. Drawings showing CONTRACTOR field verifications illustrating all field dimensions. Field verify all dimensions and existing materials shown on the Drawings. Any modifications required shall be at CONTRACTOR'S expense.
 13. For materials or products which can contact drinking water as part of a Water Treatment Process or Water Supply System Certificate of Compliance with NSF/ANSI 61 Standard or with Arizona Administrative Code R18-4-213.
 14. Complete, detailed written preventive maintenance instructions as defined below, and in Section 01785.

- C. Preventive Maintenance Instructions:
1. The term "preventive maintenance instructions" includes all information and instructions required to keep a product or piece of equipment properly maintained according to the manufacturer's recommendation to fulfill the equipment warranty conditions and ensure the equipment or asset reaches its maximum potential life.
 2. Preventive maintenance instructions include, but are not limited to, the following:
 - a. A written explanation with illustrations for each preventive maintenance task.
 - b. Recommended schedule for execution of preventive maintenance tasks.
 - c. Lubrication charts.
 - d. Table of alternative lubricants.
 - e. Trouble shooting instructions.
 - f. List of required maintenance tools and equipment.
 - g. Special tools.
 3. The maintenance tasks frequency are driven by calendar, run-time, or meter reading.
 4. All assets' preventive maintenance information shall be reviewed and approved by the ENGINEER and the OWNER and are to be uploaded in the OWNER's Computer Maintenance Management System (CMMS) by the OWNER's Water Asset Management (WAM) Team. All information shall be submitted to the OWNER electronically following the OWNER's 01785-A – Preventive Maintenance Data Submittal Form in Section 01331 – REFERENCE FORMS, which is included at the end of Section 01785.
 5. The CONTRACTOR shall submit the preventive maintenance information package as part of the shop drawing submittal package to the ENGINEER for review and approval. **SHOP DRAWING SUBMITTAL PACKAGE WILL NOT BE APPROVED WITHOUT ACCEPTANCE OF PREVENTIVE MAINTENANCE INFORMATION AS DESCRIBED IN SPECIFICATION SECTION 01785.**
- D. Preliminary Submittal Schedule: CONTRACTOR, within 7 days after the Notice-to-Proceed, shall prepare and submit to the ENGINEER a Preliminary Submittal Schedule. Identify on his Preliminary Submittal Schedule all of the submittal items required by the Contract Documents governing the Work.
- E. Submittal Schedule: CONTRACTOR, within 14 days after the Notice-to-Proceed, shall prepare and submit to the ENGINEER a comprehensive Submittal Schedule. Identify on his Submittal Schedule all of the submittal items required by the Contract Documents governing his Work. Indicate, for each submittal item on his Submittal Schedule the following:
1. The date by which that item will be submitted to the ENGINEER.
 2. Whether the submittal is for a substitute or "equal" item. Complete submittal for all substitute or "equal" items shall be made to the ENGINEER, in accordance with the Contract requirements. Identification by the CONTRACTOR of substitute or "equal" items does not relieve CONTRACTOR of his responsibility to furnish equipment and materials that meet all the requirements of the Contract Documents.

Items of manufacturers' equipment listed with CONTRACTOR'S Bid Proposal shall not be replaced with any substitute or "equal" items as part of this Submittal Schedule process. Procedure for substitutions is specified under the General Conditions.

3. Whether the submittal is for review or "for record only".
 4. The date by which response is required.
 5. The date by which the material or equipment must be on site in order not to delay the progress of the Work.
- F. In preparing his Submittal Schedule, consider the nature and complexity of each submittal item and shall allow ample time for review, revision or correction. Submittal will normally be returned to CONTRACTOR within 14 calendar days following receipt of the submittal. Complex submittals, for example, Instrumentation and Control Systems, Variable Frequency Drives and other such submittals may require additional review time. Identify submittal(s) for which long review periods are anticipated.
- G. CONTRACTOR is hereby notified that the project electric motor requirements, specified in Section 11002, Medium Voltage Electric Motors, and 11000, Electric Motors, do not allow standard "off the shelf" motors. Make provisions in the Submittal Schedule to account for longer manufacturing and delivery lead times for the motors and equipment requiring electric motors under this Project.
- H. The ENGINEER will review CONTRACTOR'S Submittal Schedule to determine its completeness and compatibility with the Progress Schedule. A Submittal Schedule which is incompatible with the Progress Schedule or a review schedule which places extraordinary manpower demands on the ENGINEER will be sufficient reason(s) to reject the Submittal Schedule. It shall be understood that certain submittals will take longer than 14 days to review and that these particular submittals will be identified during the review of the Submittal Schedule, by the ENGINEER to allow for very complex submittal reviews. Also, identify submittal for which he anticipates long review periods.
- I. CONTRACTOR'S Submittal Schedule shall be consistent with the Progress Schedule as described in Section 01321, Progress Schedule.
- J. Approval of the Submittal Schedule shall be required prior to processing of the first progress payment.

1.2 PROCEDURE

- A. Submit Shop Drawings to: Wilson Engineers, 1620 W Fountainhead Parkway Suite 501, Tempe, AZ 85282.
- B. A letter of transmittal shall accompany each submittal. If data for more than one Section of the Specifications is submitted, a separate transmittal letter shall accompany the data submitted for each Section.

- C. All letters of transmittal shall be submitted in duplicate.
- D. CONTRACTOR shall initially submit to ENGINEER a minimum of three (3) hard copies and one (1) soft copy of all Submittals that are on 11-inch by 17-inch or smaller sheets, and also for all submittals on sheets larger than 11-inch by 17-inch. Soft copies shall be in CD format and shall include all information provided in hard copy. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
- E. Each Shop Drawing Submittal shall include a hard copy of the relevant Specification Section and shall be clearly marked to indicate whether the requirements for equipment and/or services in the Specification Section are met by writing "accept" or "deviate" next to each Paragraph. If clarifications are needed to any of the Paragraphs in the Specification Sections due to deviations, they shall be addressed next to the Paragraph as such and explained further with any additional information necessary. If any exceptions and/or deviations are proposed to any of the Specifications, they shall be clearly noted as such in the Submittal, and an explanation of any deviation and/or exception shall be provided. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected.
- F. At the beginning of each letter of transmittal, provide a reference heading indicating the following:
 - 1. OWNER’S Name: City of Phoenix Water Services Department
 - 2. Project Name: NORTHWEST WASTEWATER MASTER PLAN PACKAGE 4B
51st AVE GRAVITY SEWER
 - 3. Contract No. WS90500307 & WS90501004
 - 4. Transmittal No. _____
 - 5. Section No. _____
- G. If a Shop Drawing deviates from the requirements of the Contract Documents, specifically note each variation in his letter of transmittal.
- H. All Shop Drawings submitted for approval shall have a title block with complete identifying information satisfactory to ENGINEER.
- I. All Shop Drawings submitted shall bear the stamp of approval and signature of CONTRACTOR as evidence that they have been reviewed and verified to the completeness of the submittal by CONTRACTOR. Submittal without this stamp of approval will not be reviewed by ENGINEER and will be returned to CONTRACTOR. CONTRACTOR’S stamp contain the following minimum information:

Project Name: _____

CONTRACTOR'S Name: _____

Date: _____

-----Reference-----

Item: _____

Specifications:

Section: _____

Page No.: _____

Para. No.: _____

Drawing No.: _____ of _____

Location: _____

Submittal No.: _____

Approved By: _____

J. In order to identify and track all submittals as separate and unique items, utilize the submittal identification numbering system as follows:

1. The Submittal Number shall be a separate and unique number correlating to each individual submittal that is required to be tracked as a separate and unique item. The Submittal Number shall be a two part, eight character, alpha/numeric number assigned by CONTRACTOR in the following manner:
 - a. The first part of the Submittal Number shall consist of five characters that pertain to the applicable Specification Section number.
 - b. The second part of the Submittal Number shall consist of three digits (numbers 001 to 999) to number each separate and unique submittal submitted under each Specification Section.
 - c. A dash shall separate the two parts of the Submittal Number.
 - d. A typical Submittal Number for the third Working Drawing submitted under Section 15101, Ductile Iron Pipe, would be 15101-003.
2. The Review Cycle shall be a three-digit number indicating the initial submission or resubmission of the same submittal. For example:

001 = First (initial) submission
002 = Second submission (first resubmission)
003 = Third submission (second resubmission)

3. An example of the typical submittal identification numbers for the first submission of the third submittal submitted under Section 15101, Ductile Iron Pipe is:

Submittal Number Review Cycle

15101-003 001

4. An example of the typical submittal identification numbers for the second submission of the third submittal submitted under Section 15101, Ductile Iron Pipe is:

Submittal Number Review Cycle

15101-003 002

- K. After ENGINEER completes his review, Shop Drawings will be affixed with a stamp and marked with one of the following notations:
1. Approved.
 2. Approved as Corrected.
 3. Approved as Corrected, Resubmit.
 4. Revise and Resubmit.
 5. Not Approved.
 6. Not Reviewed.
 7. For Information Only.
- L. If a submittal is acceptable, the ENGINEER will mark it “Approved” or “Approved as Corrected” and will forward two (2) hard copies and one (1) electronic PDF format of the submittal to the OWNER for review and comment. The OWNERS review process will begin when all required copies of a specific submittal are received. After the OWNERS review is complete, the ENGINEERS and OWNERS comments will be combined and two (2) prints or copies of the submittal will be returned to CONTRACTOR.
- M. Upon return of a submittal marked “Approved” or “Approved as Corrected”, CONTRACTOR may order, ship or fabricate the materials included on the submittal, provided it is in accordance with the corrections indicated.
- N. If a Shop Drawing marked “Approved as Corrected” has extensive corrections or corrections affecting other Shop Drawings or Work, ENGINEER may require that CONTRACTOR make the corrections indicated thereon and resubmit the Shop Drawings for record purposes. Such Shop Drawings will have the notation, “Approved as Corrected - Resubmit.” The corrected Shop Drawing shall be a pre-condition for payment for the work item of the Shop Drawing.
- O. If a submittal is unacceptable, one (1) copy will be returned to CONTRACTOR with one of the following notations:
1. “Revise and Resubmit”.
 2. “Not Approved”.

- P. Upon return of a submittal marked “Revise and Resubmit”, make the corrections indicated and repeat the initial approval procedure. The “Not Approved” notation is used to indicate material or equipment that is not acceptable. Upon return of a submittal so marked, repeat the initial approval procedure utilizing acceptable material or equipment.
- Q. Any related Work performed or equipment installed without an “Approved” or “Approved as Corrected” Shop Drawing will be at the sole responsibility of CONTRACTOR.
- R. Shop Drawings shall be submitted well in advance of the need for the material or equipment for construction and with ample allowance for the time required to make delivery of material or equipment after data covering such is approved. Assume the risk for all materials or equipment which are fabricated or delivered prior to the approval of Shop Drawings. Materials or equipment will not be included in periodic progress payments until approval thereof has been obtained in the specified manner.
- S. ENGINEER will review and process all submittals promptly; a reasonable time shall be allowed for this, for the Shop Drawings being revised and resubmitted, and for time required to return the approved Shop Drawings to CONTRACTOR.
- T. Responsibility belongs to CONTRACTOR to review submittals made by his suppliers and subcontractors before transmitting them to the ENGINEER to assure proper coordination of the Work and to determine that each submittal is in accordance with CONTRACTOR’S desires and that there is sufficient information about materials and equipment for ENGINEER to determine compliance with the Contract Documents. Incomplete or inadequate submittals will be returned for revision without review.
- U. Furnish required submittals with complete information and accuracy in order to achieve required approval of an item within one submittal. Back charges for resubmittals that account for a number greater than 20 percent of the total number of first time submittals and will be back charged for all third submittals. The number of first time submittals shall be equal to the number of submittals agreed to by ENGINEER and CONTRACTOR in accordance with Section 01330.1.2.A.2. All costs to ENGINEER involved with subsequent submittal of Shop Drawings, Samples or other items requiring approval will be back charged to CONTRACTOR at the rate of 3.0 times direct technical labor cost by deducting such costs from payments due CONTRACTOR for Work completed. In the event that CONTRACTOR requests a substitution for a previously approved item, all of ENGINEER’S costs in the reviewing and approval of the substitution will be back charged to CONTRACTOR, unless the need for such substitution is beyond the control of CONTRACTOR.
- V. The OWNER reserves the right to withhold monies, identified in the General Conditions, for Shop Drawing reviews beyond those described herein.

CITY OF PHOENIX: Water Services Department
PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
PROJECT NUMBER: WS90500307 & WS90501004

- W. The ENGINEER will implement, if requested by CONTRACTOR, one special Shop Drawing Review Meeting. The purpose of the meeting is to expedite Shop Drawing reviews for the equipment and materials required for the first document of the Work. Requirements of this Section will not be waived, but could be expedited.
- X. Mark each page of a submittal and each individual component submitted with the specification number, paragraph, and subparagraph. Arrange submittal information presentation to appear in the sequence in the Specification Section.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01333

SAMPLES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The submittal of Samples shall conform to the requirements of the General Conditions and to procedures described in this Section.
- B. Samples and Shop Drawings which are related to the same unit of Work or Specification Section shall be submitted at the same time. If related Shop Drawings and Samples are submitted at different times, they cannot be reviewed until both are furnished to the ENGINEER.

1.2 PROCEDURE

- A. CONTRACTOR shall review, approve, and submit all Samples promptly. Samples shall be identified with correct reference to Specification Section, page, article and paragraph number, and Drawing Number, when applicable. Samples shall clearly illustrate functional characteristics of the product, all related parts and attachments, and full range of color, texture, pattern and material. Samples shall be furnished so as not to delay fabrication, allowing the ENGINEER reasonable time for the consideration of the Samples submitted.
- B. CONTRACTOR shall submit at least three Samples of each item required for the ENGINEER'S approval. Submission of Samples shall conform to all applicable provisions under Shop Drawing Submittal and Correspondence Procedure. Two of the Samples shall be delivered to Wilson Engineers, 1620 W Fountainhead Parkway Suite 501, Tempe, 85282 unless otherwise authorized by the ENGINEER. The ENGINEER shall retain all samples. If CONTRACTOR requires a Sample for his use, he shall notify the ENGINEER, in writing.
- C. CONTRACTOR shall make all corrections required and shall resubmit the required number of new Samples, until approved.

1.3 JOB MOCK-UPS

- A. Job mock-ups (sample panels) shall be constructed on site by CONTRACTOR and only one of each type will be required. Mock-ups shall be constructed only after the individual Samples and components used in the mock-up have been approved by the ENGINEER. If a mock-up is not approved, CONTRACTOR shall construct additional ones until approval is received.

CITY OF PHOENIX: Water Services Department
PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
PROJECT NUMBER: WS90500307 & WS90501004

- B. CONTRACTOR shall store and protect large Samples and mock-ups until the Work is complete or until a time approved by ENGINEER.

1.4 SAMPLES FOR TESTS

- A. CONTRACTOR shall furnish such Samples of material as may be required for examination and tests. All Samples of materials for tests shall be taken according to standard methods and as required by the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01412

STORMWATER POLLUTION PREVENTION PLAN AND PERMIT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Comply with the terms and conditions of the Arizona Pollutant Discharge Elimination System (AZPDES) requirements under the Arizona Department of Environmental Quality (ADEQ) General Permit. Under provisions of that permit, CONTRACTOR is designated as permittee and responsible for providing necessary material and for taking appropriate measures to minimize pollutants in stormwater runoff from the Project. Obtain a DeMinimus discharge permit from ADEQ for any discharge that is to Waters of the U.S., and comply with the requirements of the permit.
- B. The Contract Price shall include all material, labor and other permits and incidental costs related to:
 - 1. Preparing, updating and revising the Stormwater Construction Pollution Prevention Plan (SWPPP).
 - 2. Installing and maintaining all structural and non-structural items chosen by CONTRACTOR to comply with the construction SWPPP.
 - 3. Clean-up and disposal costs associated with clean-up and repair following storm events or CONTRACTOR caused spills on the Project.
 - 4. Implementing and maintaining Best Management Practices to comply with the OWNER'S stormwater code.
 - 5. Preparing the Notice of Intent and Notice of Termination shall be covered by the AZPDES General Permit for Arizona.
 - 6. Obtain and comply with DeMinimus permit, if such permit is required.
- C. Coordinate the requirements under this Section with Section 02315, Structural Excavation and Backfill, permit requirements. All necessary SWPPP controls and practices must be implemented prior to commencement of any construction activity.

1.2 SUBMITTALS

- A. Submit, at least two days prior to the initial start of construction on the project; completed and signed Notice of Intent forms to the State of Arizona at the following addresses:
 - 1. Stormwater Program - Water Permits Section / NOI
Arizona Department of Environmental Quality
1110 West Washington, 5415B-3
Phoenix, AZ 85007

- B. Submit to the OWNER, no later than 14 days before submitting to the State agency the following:
1. Notice of Intent (NOI) to be covered by the AZPDES General Permit for Arizona, including certifications of signature.
 2. SWPPP for the Project, including certification of signature. Stormwater Plan shall include CONTRACTOR'S proposed temporary means for stormwater control during all phases of construction and include stormwater pumping/retention plans. This submittal shall be coordinated with CONTRACTOR'S Excavation Plan submittal, specified in Section 02315, Excavation and Backfill.
 3. A manual has been prepared by the Maricopa County Flood Control District to aid in CONTRACTOR'S preparation of the SWPPP. This manual, "Drainage Design Manual for Maricopa County Arizona, Volume III, Erosion Control" is available at the Flood Control District Office, 2801 West Durango Street, Phoenix, Arizona. The complete Construction General Permit is available from the ADEQ website at: www.azdeq.gov/environ/water/permits/download/2013_cgp.pdf.
- C. Submit to the OWNER, as part of the Construction SWPPP a construction site inspection report that includes the following:
1. Inspection scope.
 2. Inspector qualifications.
 3. Observations of SWPPP non-compliance and corrective steps taken.
 4. Certificate of Compliance with SWPPP and the AZPDES General Permit for Stormwater Discharge in the event of no incidents. Reports shall be submitted each quarter, at a minimum, throughout the Contract duration.
- D. Submit to the OWNER, upon project completion the Notice of Termination (NOT) of coverage under AZPDES General Permit.
- E. Shop Drawings: Submit for approval the following:
1. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
 2. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
 3. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall

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furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01413

CONTRACTOR'S HAZARDOUS MATERIALS MANAGEMENT PROGRAM

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Comply with all Federal, State, and local Laws and Regulations related to environmental protection and environmental safety including, but not limited, to the following:
1. Title 29 Code of Federal Regulations Parts 1910, Occupational Safety and Health.
 2. Title 40 Code of Federal Regulations, Environmental Protections.
 3. Title 49 Code of Federal Regulations, Transportation.
 4. Arizona Division of Occupational Safety and Health (ADOSH).
 5. Arizona Department of Environmental Quality (ADEQ).
 6. Arizona Department of Water Resources (ADWR).
 7. Maricopa County Air Pollution Control Regulations.
- B. In order to ensure the OWNER that CONTRACTOR is complying with the intent of the regulations stated in Paragraph 1.1.A, above, as they relate to the onsite use of hazardous materials, hazardous wastes and other substances similarly defined in those regulations, CONTRACTOR shall develop and maintain a CONTRACTOR'S Hazardous Materials Management Program that includes as a minimum, but is not limited to the requirements specified herein. The interests of the OWNER are that accidental spills, site contamination, and injury of personnel on the site are avoided. OWNER will not enforce suspected violations of the rules and regulations referenced in Paragraph 1.1.A, above, however the OWNER will notify CONTRACTOR of suspected violations. If in the opinion of the OWNER, CONTRACTOR fails to address the suspected violations in a timely and appropriate manner, OWNER will notify Federal, State, or local regulatory agencies, report the suspected violations to them, and request that they inspect CONTRACTOR'S operations. Any fines that may be levied against OWNER for violations committed on the site by CONTRACTOR, as well as any costs to OWNER associated with cleanup of materials, shall be reimbursed immediately by CONTRACTOR. All documents required by the program shall be made available to the OWNER'S Environmental Representative immediately, upon request.
- C. Responsibility for any hazardous waste, as defined in any of the above listed regulations, and those generated by the CONTRACTOR, belongs to CONTRACTOR. If CONTRACTOR is going to generate, or has generated, a substance that qualifies as a hazardous waste, must obtain an EPA identification number, listing CONTRACTOR'S name and construction site address as the generator of the hazardous waste. Responsibility for the identification, analysis, profiling, transport and disposal of hazardous wastes generated, belongs to CONTRACTOR. The identification number can be obtained from the Arizona Department of Environmental Quality (ADEQ). This

number shall be provided to the ENGINEER within 30 days after the Notice to Proceed, or before any hazardous materials are brought onto the site.

1.2 HAZARDOUS MATERIALS PROGRAM REQUIREMENTS

- A. Within the regulations listed in Paragraph 1.1.A, above, terms such as hazardous material, hazardous wastes, and similar terms have varying definitions. To dispel confusion regarding what materials fall under the Program Requirements and for the purposes of this Article, Hazardous Material is defined as “any material, whether solid, semi-solid, liquid, or gas, which, if not stored or used properly, may cause harm or injury to persons through inhalation, ingestion, absorption or injection, or which may negatively impact the environment through the use or discharge of the material on the ground, in the water (including groundwater), or to the air.”
- B. All chemicals brought onto the site must be approved by OWNER. Prior to bringing any chemical on site, request approval from OWNER’S Environmental Representative for each chemical CONTRACTOR proposes to bring on site. At the time of request, OWNER’S Environmental Representative may request and receive from CONTRACTOR, specific information associated with each chemical. The specific information may include, but is not limited to, SDS, manufacture, vendor, container size(s), number of containers, minimum and maximum volume of material intended to be stored on site, as well a description to the process or procedures in which any requested chemical is to be used. OWNER, within 10 working days from receipt of the specific chemical information, will inform CONTRACTOR as to whether the chemical has been approved for use on site.
- C. CONTRACTOR shall maintain on site two notebooks containing (1) a chemical inventory, and (2) current (dated within the past two years) Material Safety Data Sheets for all materials being used on site, whether or not they are defined as a Hazardous Material in Paragraph 1.2.A, above. One notebook shall be kept in CONTRACTOR’S on-site office and the other shall be kept in a location specified by the OWNER’S Environmental Representative. These notebooks must be kept up-to-date as materials are brought onto and removed from the site. Copies of SDS sheets for chemicals removed from the site shall be provided to the OWNER’S Environmental Representative.
- D. CONTRACTOR shall develop an emergency/spill response plan, for each hazardous material or class/group of materials. As a minimum, the response plan must address the following:
1. Provide a description of equipment on site available to contain or respond to an emergency/spill of the material.
 2. Notification procedures.
 3. Response coordination procedures between CONTRACTOR, OWNER, and ENGINEER.

4. Provide a Site Plan showing the location of stored hazardous materials and location of spill containment/response equipment.
 5. Provide a description of the hazardous material handling and spill response training provided to CONTRACTOR'S employees.
- E. CONTRACTOR shall in accordance with applicable Laws and Regulations, properly and safely store all hazardous materials, which shall include as a minimum, the following:
1. Have a designated storage site for hazardous materials that includes secondary containment. The site must include barriers to prevent vehicles from colliding with the storage containers and offer protection from environmental factors such as weather.
 2. Provide signage in accordance with applicable Laws and Regulations, clearly identifying the hazardous materials storage site.
 3. All hazardous materials containers must bear the applicable Hazard Diamonds.
- F. CONTRACTOR shall properly label all containers of consumable materials, whether or not they are classified as Hazardous Materials under this Section. The name of CONTRACTOR or subcontractor shall be stenciled on any container containing a hazardous material and on any container over five-gallon capacity containing a non-hazardous material. Any container must have a label clearly identifying the contents. If any such unlabeled containers are discovered on the site, the OWNER'S Environmental Representative will notify CONTRACTOR. Responsibility to remove such containers belongs to CONTRACTOR. Containers will be properly labeled or removed it from the site within one hour. Any containers that are filled from larger containers must also be properly labeled.
- G. OWNER encourages storage of hazardous materials off site until the materials are needed on site.
- H. CONTRACTOR shall provide all documentation required herein available immediately upon request of OWNER'S Environmental Representative. CONTRACTOR'S Safety Representative will meet at least monthly with OWNER'S Environmental Representative to review CONTRACTOR'S Hazardous Materials Management Program documents, procedures, and inspect the storage site and job site to ensure the requirements specified herein are being complied with. Also, provide OWNER'S Environmental Representative and the ENGINEER with copies of all permits obtained from environmental regulatory agencies.
- I. Provide documentation to ENGINEER and OWNER's Environmental Representative that CONTRACTOR, subcontractors, or others hired by CONTRACTOR making deliveries of hazardous Materials (as defined in Title 49 CFR) to the site are in compliance with Title 49 CFR 172.800 – 172.804, which requires each person who offers for transportation in commerce or transports in commerce one or more of the

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following hazardous materials, as defined by Title 49 CFR, must develop and adhere to a security plan for hazardous materials that conforms to the requirements of this subpart.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01415

CONFINED SPACE ENTRY PLAN

PART 1 - GENERAL

1.1 DESCRIPTION

- A. OWNER has determined that portions of the Work site may constitute “confined spaces” as defined in 29 CFR §1926.21(b)(2) and 1910.146. Accordingly, CONTRACTOR shall incorporate into its Safety Plan for the Work site appropriate measures to protect the health and safety of all persons on the Work site or who may be affected by the Work, including, without limitation thereby, employees and representatives of CONTRACTOR, any subcontractor, OWNER, or ENGINEER while they are present and engaged in the performance of their duties on the Work site.
- B. CONTRACTOR shall comply with all local, State and Federal rules and regulations related to the protection of persons working or entering into confined spaces including, but not limited to the following:
1. 29 United States Code §654.
 2. Title 29 Code of Federal Regulations Parts 1910 and 1926, Occupational Safety and Health.
 3. Ariz. Rev. Stat. §23-403.
 4. City of Phoenix, Confined Space Program.
- C. To assure OWNER that CONTRACTOR is complying with the intent of the regulations stated in Paragraph 1.1.A, above, as they relate to the protection of all persons on the Work site, CONTRACTOR’S Safety Plan, at a minimum, respond to the following requirements as they relate to Work in confined spaces:
1. Conducting a Site-specific hazard assessment to identify confined spaces that should be characterized as “Permit Required Confined Spaces” within the meaning of 29 CFR §1926.21 (b)(6)(i) and 29 CFR §1910.146.
 2. Adopting as an element of its Safety Plan appropriate requirements for safeguarding access to “Permit Required Confined Spaces.”
 3. Providing training, personal protective or safety equipment and personnel as needed to perform the Safety Plan’s requirements for “Permit Required Confined Spaces.”
 4. Performing all record-keeping required for “Permit Required Confined Spaces”, including the required permits and confined space data sheets located in Section 01331, Reference Forms.

1.2 CONFINED SPACES SAFETY PLAN REQUIREMENTS

- A. For purposes of the Safety Plan requirements listed in Article 1.1, above, “confined spaces” are those areas on or about the Work site that fall within OSHA’s definition

- means “a space that: (1) is large enough and so configured that an employee can bodily enter and perform assigned work and (2) has limited or restricted means for entry or exit (for example tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means or entry.); and (3) is not designed for continuous employee occupancy.” Confined or enclosed spaces include, but are not limited to, storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, and open top spaces more than four feet in depth such as pits, tubs, vaults, and vessels.
- B. CONTRACTOR shall ensure that those persons who are required to enter a confined space are trained according to OSHA requirements set forth in 29 CFR §1926.21 (b)(6)(i).
- C. If the confined space is a “Permit Required Confined Space”, then CONTRACTOR shall comply with the standards set forth in 29 CFR §1910.146. and the City of Phoenix, Confined Space Program.
- D. “Permit Required Confined Space” means a confined space that has one or more of the following characteristics:
1. Contains or has the potential to contain a hazardous atmosphere.
 2. Contains a material that has the potential for engulfing an entrant.
 3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or floors, or by a floor that slopes downward and tapers to a smaller cross-section.
 4. Contains any other recognized serious safety or health hazard.

1.3 SUBMITTALS

- A. CONTRACTOR shall prepare and submit a site-specific Confined Space Entry Plan as a portion of the CONTRACTOR’S site-specific Health and Safety Plan.
- B. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for

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any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01416

SPECIAL INSPECTIONS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The following types of Work will be subject to Special Inspections, which may be performed by the ENGINEER or by such other special inspector as the OWNER may employ:
1. High-Strength Bolting: During all bolt installations and tightening operations.
 - a. Exceptions:
 - 1) The special inspector need not be present during the entire installation and tightening operation, provided he has:
 - a) Inspected the surfaces and bolt type for conformance to plans and specifications prior to start of bolting, and "will, upon completion of all bolting, verify the minimum specified bolt tension for ten percent of the bolts for each connection, with a minimum of two bolts per connection".
 - 2) In bearing-type connections when threads are not required by design to be excluded from the shear plane, inspection prior to or during installation will not be required.
 2. Concrete.
 3. Reinforcing Steel.
 4. Epoxy Anchors.
 5. Electrical Inspections and Observation.

1.2 SPECIAL INSPECTOR

- A. CONTRACTOR shall coordinate the above listed Work with the Special Inspector.
- B. The special inspector shall be a qualified person who shall demonstrate his competence to the satisfaction of the regulatory authorities for inspection of the particular type of construction or operation requiring special inspection.

1.3 DUTIES AND RESPONSIBILITIES OF SPECIAL INSPECTOR

- A. The special inspector shall observe the Work assigned to be certain it conforms to the Contract Documents.
- B. The special inspector shall furnish inspection reports to the regulatory authorities, the ENGINEER and other designated persons. All discrepancies shall be brought to the

immediate attention of CONTRACTOR for correction, then, if uncorrected, to the ENGINEER and regulatory authorities.

- C. The special inspector shall submit a final signed report stating whether the Work requiring special inspection was, to the best of his knowledge, in conformance with the Contract Documents and the applicable workmanship provision of these codes.

1.4 PERIODIC SPECIAL INSPECTIONS

- A. Some inspections may be made on a periodic basis and satisfy the requirements of continuous inspection, provided this periodic scheduled inspection is performed as outlined in the Contract Documents and approved by the regulatory authorities.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01420

REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Definitions of basic Contract terms are included in the General Conditions.
- B. Definitions of terms commonly found in the Specifications are as follows:
1. Indicated: The term indicated refers to graphic representations, notes, or schedules on the Drawings, or to other paragraphs or schedules in the Specifications and similar locations in the other Contract Documents. Terms such as “shown”, “noted”, “scheduled”, and “specified” are used to help the user locate the reference. There is no limitation on the location.
 2. Installer (or applicator, or erector): An installer is CONTRACTOR or another entity engaged by CONTRACTOR, either as an employee or subcontractor to perform a particular construction activity, including installation, erection, application or similar operations. Installers are required to be experienced in the operations they are engaged to perform.
 - a. The term “experienced”, when used with the term “installer”, means having successfully completed a minimum of five previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with the requirements of authorities having jurisdiction and of the Supplier of the product being installed.
 3. Trades: Use of a term such as “carpentry” does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as “carpenter”. It also does not imply that requirements specified apply exclusively to trades persons of the corresponding generic name.
 4. Assigned Specialists: Certain Sections of the Specifications require that specific construction activities shall be performed by specialists who are recognized experts in those operations. Said specialists shall be engaged for those activities, and their engagement is a requirement over which CONTRACTOR has no option. These requirements shall not be interpreted to conflict with the enforcement of building codes and similar regulations governing the Work. Also, they are not intended to interfere with local trade-union jurisdictional settlements and similar conventions. Such assignments shall not relieve CONTRACTOR of its responsibility for fulfilling the requirements of the Contract Documents.
 5. Equipment Identification: Several terms define the information attached to equipment.
 - a. The term “CMMS Tag” means information attached to equipment pertaining to the City of Phoenix Water Services Department Computerized Maintenance

Management System. CMMS Tags shall be provided by the Contractor. Refer to Section 01630, Equipment Identification Tag System for specifications regarding CMMS Tags.

- b. The term “Manufacturer Nameplate” means information attached to equipment by the manufacturer pertaining to equipment criteria, such as capacity, power supply requirement, model number, etc.

1.2 ABBREVIATIONS

- A. Common abbreviations, which may be found in the Specifications, are:

alternating current	AC
Ampere	A
ante meridiem	am
Average	avg.
biochemical oxygen demand	BOD
brake horsepower	BHP
British thermal unit	BTU
Centigrade	C
Company	Co.
cubic inch	cu. in.
cubic foot	cu. ft.
cubic yard	cu. yd.
cubic feet per minute	cfm
cubic feet per second	cfs
Decibel	DB
degree Centigrade (or Celsius)	(Say) 20°C
degree Fahrenheit	(Say) 68°F
Diameter	dia.
direct current	DC
Dollars	\$

Each	ea
Efficiency	eff
Fahrenheit	F
feet per hour	fph
Feet	ft.
feet per minute	fpm
feet per second	fps
Figure	Fig.
Flange	flg
foot-pound	ft-lb
gallon	gal
gallons per minute	gpm
gallons per second	gps
gram	g
Hertz	Hz
horsepower	hp
hour	hr
inch	in.
inch-pound	in.-lb
inside diameter	id
kilovolt-ampere	kva
kilowatt	KW
kilowatt-hour	kwhr
linear foot	lin. ft.
liter	l
maximum	max.
mercury	Hg

milligram	mg
milligrams per liter	mg/l
milliliter	ml
millimeter	mm
million gallons per day	mgd
million gallon	mil
minimum	min.
National Pipe Threads	NPT
net positive suction head	npsh
number	No.
ounce	oz
outside diameter	OD
parts per million	ppm
post meridiem	pm
pound	lb
pounds per square inch	psi
pounds per square inch absolute	psia
pounds per square inch gage	psig
pounds per square foot	psf
revolutions per minute	rpm
second	sec.
specific gravity	sp gr
square	sq
square foot	sq ft
square inch	sq in
square yard	sq yd
standard	std

standard cubic feet per minute	scfm
total dynamic head	tdh
totally-enclosed-fan-cooled	tefc
Volt	V

1.3 APPLICABLE CODES

- A. When a reference standard is specified, comply with requirements and recommendations stated in that standard, except when they are modified by the Contract Documents, or when applicable laws, ordinances, rules, regulations or codes establish stricter standards. The latest provisions of applicable standards shall apply to the Work, unless otherwise specified. Reference standards include, but are not necessarily limited to, the following:
1. American Association of State Highway and Transportation Officials (AASHTO).
 2. American Concrete Institute (ACI).
 3. American Gear Manufacturers Association (AGMA).
 4. American Institute of Steel Construction (AISC).
 5. American Iron and Steel Institute (AISI).
 6. American National Standards Institute (ANSI).
 7. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE).
 8. American Society of Mechanical Engineers (ASME).
 9. American Society for Testing and Materials (ASTM).
 10. American Water Works Association (AWWA).
 11. American Welding Society (AWS).
 12. Arizona Administrative Code (AAC).
 13. Concrete Reinforcing Steel Institute (CRSI).
 14. Factory Mutual (FM).
 15. Institute of Electrical and Electronics Engineers (IEEE).
 16. National Electrical Manufacturer's Association (NEMA).
 17. National Electrical Code (NEC) current adoption.
 18. City of Phoenix – Amendments to the National Electric Code.
 19. National Fire Protection Association (NFPA).
 20. Occupational Safety and Health Administration (OSHA).
 21. Prestressed Concrete Institute (PCI).
 22. Underwriters' Laboratories, Inc. (UL).
 23. All other applicable standards listed in the Specifications and the standards of utility service companies, where applicable.
 24. Maricopa Association of Governments (MAG), Uniform Standard Specifications for Public Works Construction, as supplemented by the City of Phoenix. References to MAG Standard Details refer to the "Uniform Standard Details for

Public Works Construction” sponsored and distributed by the Maricopa Association of Governments 1999, Arizona.

25. International Building Code (2018), with City of Phoenix Amendments.
26. International Existing Building Code (2018) with City of Phoenix Amendments
27. National Electric Code – NFPA70 (2017), with City of Phoenix Amendments.
28. American Petroleum Institute (API).
29. International Fire Code (2018) as supplemented by the City of Phoenix, Building Construction Code.
30. International Energy Conservation Code (2018), with City of Phoenix Amendments.
31. Phoenix Fire Code (2018).
32. International Fuel and Gas Code (2018), with City of Phoenix Amendments.
33. International Mechanical Code (2018), with City of Phoenix Amendments.
34. Uniform Plumbing Code (2018), with City of Phoenix Amendments.
35. International Plumbing Code (2018) with City of Phoenix Amendments.
36. National Sanitation Foundation (NSF-61) and Arizona Administration Code (AAC R18-4-213).
 - a. Incorporate the requirements NSF-61, Drinking Water System Components Health Effects and AAC R18-4-213, Standards for Additives, Materials and Equipment on all potable water systems, water treatment facilities and water distribution facilities.

B. To ensure consistent application of standards and codes the following terminology definitions shall be applicable throughout the contract documents.

<u>Term</u>	<u>Definition</u>
Phoenix Building Code	International Building Code (2018) with City of Phoenix Amendments
Phoenix Electrical Code	National Electric Code – NFPA 70 (2017) with City of Phoenix Amendments
Phoenix Energy Conservation Code	International Energy Conservation Code (2018) with City of Phoenix Amendments
Phoenix Fire Code	Phoenix Fire Code (2018) based on International Fire Code (2018)
Phoenix Fuel and Gas Code	International Fuel and Gas Code (2018) with City of Phoenix Amendments
Phoenix Mechanical Code	International Mechanical Code (2018) with City of Phoenix Amendments

Phoenix Plumbing Code	Uniform Plumbing Code (2018) with City of Phoenix Amendments
Phoenix Construction Code	All of the Codes Listed Above

1.4 OWNER'S REFERENCE SPECIFICATIONS

- A. Except as maybe otherwise specified, all control panel work shall conform to the requirements of the Water Services Department, Section 17260, Control Panels.
- B. The CONTRACTOR shall maintain a complete copy of the Reference Specifications on the site.

1.5 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 to the extent referenced. Such standards are made a part of the Contract Documents by reference.
- B. Publication Dates: For applicable publication dates, refer to General Conditions.
- C. Conflicting Requirements: Where compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, refer to ENGINEER for a decision before proceeding.
- D. Copies of Standards: Each entity engaged in construction on the Project is required to be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents. Where standards are required to perform a required construction activity, obtain copies of same from the publication source.
- E. Abbreviations and Names: Whenever in these Specifications or the other Contract Documents references are made to the standards, specifications, or other published data of international, national, regional or local organizations, such organizations may be referred to by their acronym or abbreviation only. The following acronyms or abbreviations, which may appear in the Specifications, shall have the meanings indicated herein.

1. AA Aluminium Association
2. AABC Associated Air Balance Council
3. AAMA American Architectural Manufacturers Association
4. AASHTO American Association of State Highway and Transportation Officials
5. ACI American Concrete Institute
6. ACS American Chemical Society
7. AFBMA Anti-Friction Bearing Manufacturers' Association
8. AGMA American Gear Manufacturers Association
9. AI Asphalt Institute
10. AIChE American Institute of Chemical Engineers
11. AISC American Institute of Steel Construction
12. AISI American Iron and Steel Institute
13. AITC American Institute of Timber Construction
14. ALS American Lumber Standards
15. AMA Acoustical Materials Association
16. AMCA Air Movement and Control Association
17. ANSI American National Standards Institute
18. APA American Plywood Association
19. API American Petroleum Institute
20. APHA American Public Health Association
21. AREA American Railway Engineering Association
22. ARI Air Conditioning and Refrigeration Institute
23. ASA American Standards Association
24. ASAE American Society of Agricultural Engineers
25. ASTM American Society for Testing and Materials
26. ASCE American Society of Civil Engineers
27. ASHRAE American Society of Heating, Refrigerating and Air Conditioning

28.	ASME	American Society of Mechanical Engineers
29.	AWI	Architectural Woodwork Institute
30.	AWPA	American Wood Preservers' Association
31.	AWPB	American Wood Preservers Bureau
32.	AWPI	American Wood Preservers' Institute
33.	AWS	American Welding Society
34.	AWWA	American Water Works Associations
35.	BHMA	Builders Hardware Manufacturers' Association
36.	CBMA	Certified Ballast Manufacturers' Association
37.	CDA	Copper Development Association
38.	CGA	Compressed Gas Association
39.	CISPI	Cast Iron Soil Pipe Institute
40.	CMAA	Crane Manufacturers' Association of America
41.	CRSI	Concrete Reinforcing Steel Institute
42.	EPA	Environmental Protection Agency
43.	ETL	Engineering Test Laboratories
44.	FCC	Federal Communications Commission
45.	FEMA	Federal Emergency Management Agency
46.	FGMA	Flat Glass Marketing Association
47.	FM	Factory Mutual Association
48.	FS	Federal Specification
49.	GA	Gypsum Association
50.	HEW	Department of Health, Education and Welfare
51.	HI	Hydraulic Institute
52.	HMI	Hoist Manufacturers' Institute
53.	HUD	Department of Housing and Urban Development
54.	ICBO	International Conference of Building Officials

55.	ICEA	Insulated Cable Engineers' Association
56.	IEEE	Institute of Electrical and Electronic Engineers
57.	IES	Illuminating Engineering Society
58.	IFI	Industrial Fasteners Institute
59.	IRI	Industrial Risk Insurers
60.	ISA	The Instrumentation Systems and Automation Society
61.	ISO	Insurance Services Office
62.	MAG	Maricopa Association of Governments
63.	MIA	Marble Institute of America
64.	MS	Military Specifications
65.	MMA	Monorail Manufacturers' Association
66.	NAAMM	National Association of Architectural Metal Manufacturers
67.	NACE	National Association of Corrosion Engineers
68.	NARUC	National Association of Railroad and Utilities Commissioners
69.	NBHA	National Builders Hardware Association
70.	NEC	National Electrical Code
71.	NEMA	National Electrical Manufacturers Association
72.	NESC	National Electrical Safety Code
73.	NFPA	National Fire Protection Association
74.	NHLA	National Hardwood Lumber Association
75.	NHPMA	Northern Hardwood and Pine Manufacturer's Association
76.	NLMA	National Lumber Manufacturers' Association
77.	NRCA	National Roofing Contractors Association
78.	NSF	National Sanitation Foundation
79.	NTMA	National Terrazzo and Mosaic Association
80.	NWWDA	National Wood Window and Door Association
81.	OECI	Overhead Electrical Crane Institute

82.	OSHA	Occupational Safety and Health Administration
83.	PCI	Precast Concrete Institute
84.	PEI	Porcelain Enamel Institute
85.	PPI	Plastic Pipe Institute
86.	PS	Product Standards Section-U.S. Department of Commerce
87.	RMA	Rubber Manufacturers' Association
88.	SAE	Society of Automotive Engineers
89.	SCPRF	Structural Clay Products Research Foundation
90.	SDI	Steel Deck Institute
91.	SDI	Steel Door Institute
92.	SIGMA	Sealed Insulating Glass Manufacturing Association
93.	SJI	Steel Joist Institute
94.	SMACNA	Sheet Metal and Air Conditioning National Association
95.	SPI	Society of the Plastics Industry
96.	SSPC	The Society for Protective Coatings
97.	SWI	Steel Window Institute
98.	TEMA	Tubular Exchanger Manufacturers' Association
99.	TCA	Tile Council of America
100.	UL	Underwriters' Laboratories, Inc.
101.	USGS	United States Geological Survey
102.	USPHS	United States Public Health Service
103.	WCLIB	West Coast Lumber Inspection Bureau
104.	WWEMA	Water and Wastewater Equipment Manufacturers Association
105.	WWPA	Western Wood Products Association

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PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
PROJECT NUMBER: WS90500307 & WS90501004

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01453

TESTING OF HYDRAULIC STRUCTURES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide all labor, material, tools, equipment and incidentals as shown, specified and required to clean, flush and test structures.
2. The Work also shall include all labor and materials required to prepare a structure for testing, convey water to the testing location, perform the testing, and all labor and materials required to drain and dispose of water used for testing.

B. Hydraulic Structures Scheduled for Hydrostatic Testing: Clean and test the following structures:

Hydraulic Structure Number	Hydraulic Structure Service and Location
1	Junction Structure No. 1
8 to 55	Manhole No. 8 to No.55

C. Water for Testing:

1. Water for initial testing will be furnished by the OWNER.
2. Provide all temporary piping, hose, valves, backflow preventers, appurtenances, and services required for testing.
3. Convey the water to the testing location.
4. Water for testing may be withdrawn from:
 - a. AS directed by the OWNER and ENGINEER.
5. The maximum rate at which water may be withdrawn is to be determined by the OWNER and ENGINEER. Provide on the withdrawal piping, downstream of the backflow preventer, a valve to control the rate of flow and a flow meter. The flow meter shall be calibrated within one year and field calibrated/verified prior to the date of its use, and its certification of calibration shall be submitted to the ENGINEER for approval.
6. Cost of water for re-testing shall be paid by CONTRACTOR to OWNER at OWNER’S standard rates.

D. Testing and piping is specified under Section 15051, Buried Piping Installation, and Section 15052, Exposed Piping Installation.

1.2 DEFINITIONS

- A. The term “hydraulic structures” is defined as tanks, channels, and other structures through which liquid is conveyed or that hold liquid. Hydraulic structures include

structures that are open to the atmosphere and structures with closed tops. Hydraulic structures, include but are not limited to, wet wells, junction chambers equalization tanks, storage tanks, treatment process tanks such as grit chambers, clarifiers, aeration tanks, filter beds, contact tanks, and other channels or tanks as designated herein.

1. Excluded are structures where cleaning and testing are specified under other Sections or contracts.

1.3 SUBMITTALS

- A. Provide written notice of the proposed testing schedule for a given structure for review by the ENGINEER and OWNER at least 15 days prior to the scheduled testing. Include proposed plans for water conveyance, control, and disposal. Testing will not commence without approval of ENGINEER.
- B. Shop Drawings: Submit for approval the following:
 1. Cleaning procedures.
 2. Hydrostatic testing procedures, methods, equipment, coordination, and schedules.
 3. Report for each test.
 4. Comply with the requirements of Section 01332, Shop Drawing Procedures.
 5. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
 6. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
- C. The CONTRACTOR shall submit the preventive maintenance information package as part of the shop drawing submittal package to the ENGINEER for review and approval.
SHOP DRAWING SUBMITTAL PACKAGE WILL NOT BE APPROVED

**WITHOUT ACCEPTANCE OF PREVENTIVE MAINTENANCE
INFORMATION AS DESCRIBED IN SPECIFICATION SECTION 01785.**

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Temporary valves, bulkheads, and other water control equipment and materials, shall be determined by CONTRACTOR subject to the ENGINEER'S review. No materials shall be used which would be injurious to the construction or its future function.

PART 3 - EXECUTION

3.1 CLEANING

- A. Cleaning Requirements:
1. Remove all scaffolding, planks, tools, rags, dirt, debris, and material not part of the structure prior to testing.
 2. Thoroughly clean the walls, floors, and operating equipment by sweeping, high-pressure wash, scrubbing, or other methods approved by ENGINEER.
 3. Remove all water, dirt, or foreign material accumulated during cleaning from the hydraulic structure. Provide temporary pumps, piping, and facilities as required to discharge water from the cleaning operation in a manner approved by ENGINEER.
 4. Do not proceed with testing until ENGINEER has approved the results of the cleaning operation.
 5. Cleaning shall conform to the requirements of 00700 General Conditions.

3.2 GENERAL FOR TESTING AND DISINFECTION

- A. The following requirements apply:
1. Each hydraulic structure shall be tested separately.
- B. Hydraulic structures shall be free of visible leakage. Repair leaks in a manner subject to ENGINEER'S approval and in accordance with the Contract Documents.
- C. The structure shall be tested prior to the application of exterior coating systems and the installation of masonry block veneer, if applicable.
- D. Release of water from structures, after testing shall be as approved by the ENGINEER.

3.3 HYDROSTATIC TESTING OF HYDRAULIC STRUCTURES

- A. Analysis of data from hydrostatic tests of hydraulic structures shall be performed by

- CONTRACTOR in accordance with the requirements of ACI 350.1 and as specified herein. Supply all materials and labor to obtain the test data.
- B. Prior to the start of hydrostatic testing, the following shall be met.
1. All elements of the structure that will resist pressure exerted by the retained liquid shall be in place and at specified strength levels. Concrete shall be fully cured.
 2. Structure walls shall not be backfilled and, if damp proofing is specified, coated with damp proofing prior to leakage testing, unless otherwise approved by ENGINEER.
 3. All valves, gates, blind flanges, and other items, other than concrete, that control the flow of or otherwise retain the liquid contents of the structure, shall be checked for water-tightness. If not watertight, provide measures to ensure water-tightness during the hydrostatic test.
 4. Defective concrete shall be repaired.
 5. Notify ENGINEER and OWNER a minimum of 24 hours prior to the start of filling of the structure for hydrostatic testing.
 6. Concrete hydraulic structures shall remain filled with clean water for an initial 48-hour period to allow for adsorption. Following this initial period, add make-up water to fill the hydraulic structure to the specified water surface test elevation.
- C. Fill the hydraulic structure with clean water to the maximum water surface overflow elevation or as directed by the ENGINEER.
- D. Filling Hydraulic Structures with Water:
1. Fill the portion of the hydraulic structure to be tested at a rate not to exceed two vertical feet per hour.
 2. During filling, provide a backflow preventer at the point where water is withdrawn from the existing potable water system, if applicable.
- E. After water has been brought to the test elevation and the specified wetting period has elapsed, inspect the exposed surfaces of the structure for leakage. Repair locations where leakage or weeping is evident prior to the start of hydrostatic testing.
- F. Hydrostatic test duration shall be determined by the ENGINEER based on ACI 350.1, but shall not be less than 24 hours.
- G. Allowable Leakage:
1. Leakage is defined as the quantity of water that must be supplied to the hydraulic structure or any section thereof to maintain the water level within 3-inches of the specified water surface test elevation during the hydrostatic test, plus the amount of water required to fill the hydraulic structure to the specified water surface test elevation at the conclusion of the hydrostatic test, plus precipitation, minus an allowance for evaporation if applicable.
 2. For concrete structures without lining of interior wetted surfaces, the allowable leakage is 0.075 percent of the volume tested per 24-hour period.

3. For concrete structures with interior wetted surfaces lined with a waterproof material, the allowable leakage is 0.050 percent of the volume tested per 24-hour period.

H. Measurement Locations:

1. Structures or structure cells that are less than 1,000 square feet in water surface area shall have measurements of water level taken at a minimum of two locations that are approximately 180 degrees apart.
2. Structures or structure cells that are greater than 1,000 square feet in water surface area shall have measurements of water level taken at a minimum of four locations that are approximately 90 degrees apart.
3. Each measurement location shall be marked and given a reference number. A reference point shall be marked on the face of the wall above the test water surface in a manner that will prevent movement or deterioration of the reference point mark during the test.
4. Measurement locations shall be located so that the effects of wave action and wind are minimized.

I. Evaporation and Precipitation Measurement:

1. In hydraulic structures that are open to the atmosphere, a clear plastic calibrated open-topped container not less than 18-inches in diameter and depth shall be partially filled, floated in the tank, and held in position near each measurement location. Calibration increments shall be 0.1-inch or less.
2. Containers shall be located so that they are not shaded by the structure's walls, and are away from overhead items such as beams, pipes, and walkways.

J. Test Measurements:

1. Do not start hydrostatic tests when severe weather conditions, such as heavy precipitation, high winds, major changes in average daily temperature, and other severe conditions are predicted.
2. Record the following measurements at each test location at the start of the test period and at 12-hour intervals thereafter.
 - a. Distance from reference point to test water surface.
 - b. Depth of water in the evaporation-precipitation containers.
 - c. Temperature of the test water at a point 18-inches below the water surface.
 - d. Temperature of the water in the evaporation-precipitation containers at mid-depth.
3. If the water surface is subject to wave action at the measurement location, the average water surface elevation of the wave oscillations shall be recorded as the data.
4. The change in the water surface elevation at each measurement location shall be averaged and adjusted as follows:
 - a. The total change in the hydraulic structure's water surface elevation shall be adjusted by the average change in water surface elevation in the evaporation-precipitation containers.

- b. Where the averaged water temperature measurements vary by more than 3 degrees from start to completion of the test period, adjustment in the test volume shall be determined by the change of the density of water resulting from the change in the average water temperature.
5. Determination of Leakage:
- a. Provide a test container filled with a known quantity of water at the start of the test. Attach the test pump suction to the test container.
 - b. Pump water from the test container into the hydraulic structure with the test pump to maintain the water level in the hydraulic structure within 3-inches of the specified test elevation for the duration of the test period.
 - c. At the conclusion of the test, pump water from the container into the hydraulic structure to attain the specified test elevation.
 - d. Measure the water remaining in the container and record the amount used during the test on the test report.
- K. Criteria for Acceptance:
1. The hydrostatic test will pass if the measured leakage is less than the allowable leakage and no leaks or weeping are observed.
 2. The hydrostatic test shall be considered to have failed if the allowable leakage is exceeded or if leakage or weeping is observed.
 3. If the test becomes unreliable due to excessive precipitation or other external factors, the test shall be re-started.
 4. If a hydrostatic test fails, the structure may be re-tested immediately without repairs if approved by the ENGINEER. If the subsequent hydrostatic test fails, repair probable areas of leakage and repeat the hydrostatic test.
 5. Re-test the structure until it meets the specified criteria for acceptance. Repair probable leakage areas before testing.
- L. Reuse and Disposal of Water Used in Hydrostatic Tests:
1. Obtain written approval of the ENGINEER before water used in one hydrostatic test is pumped to a different hydraulic structure for reuse in a subsequent test.
- M. The hydraulic structure shall not be backfilled or damp-proofed until acceptance of the hydrostatic test by the ENGINEER.

3.4 TESTING OF APPURTENANT PIPING

- A. Piping appurtenant to hydraulic structures shall be tested as specified in applicable Sections.

++ END OF SECTION ++

SECTION 01510

TEMPORARY CONSTRUCTION FACILITIES

PART 1 - GENERAL

1.1 GENERAL

- A. Responsible for all temporary construction facilities required for the Work. Make all arrangements with utility service companies for temporary services and shall pay all costs associated therewith.
- B. Temporary construction facilities include:
 - 1. Water.
 - 2. Electricity and Lighting.
 - 3. Telephone.
 - 4. Heat, Weather Protection and Ventilation.
 - 5. Fire Protection.
 - 6. Sanitary and First Aid Facilities.
- C. Abide by all rules and regulations of the utility service company or authority having jurisdiction.
- D. Sufficient temporary heat and ventilation shall be provided to assure safe working conditions and that no damage will occur to any of the Work. In addition, all enclosed areas shall be maintained at a minimum of 50° F, unless otherwise specifically accepted in the Specifications.
- E. Provide all materials, equipment and power required for temporary electricity and lighting. Temporary Electricity shall be per specification section 01511 – Temporary Electricity and shall include continuous power for construction site offices. Provide all outlets with circuit breaker protection and comply with ground fault protection requirements of NEC. Minimum lighting shall be per specification section 01512 – Temporary Lighting..
- F. Suitably enclosed chemical or self-contained toilets shall be provided for the use of general employees. Toilets shall be located near the Work site and secluded from observation insofar as possible. Toilets shall be serviced at regular intervals, kept clean and supplied throughout the course of the Work.
- G. Furnish and maintain a safe drinking water supply readily available to all workers.
- H. Responsible for all utility service costs until Final Acceptance of the Work. Included are all fuel, power, light, heat and other utility services necessary for execution, completion, testing and initial operation of the Work.

I. CONTRACTOR:

1. Comply with applicable requirements specified in Division 15, Mechanical, and Division 16, Electrical.
2. Maintain and operate systems to assure continuous service.
3. Modify and extend systems as Work progress requires.
4. Completely remove temporary materials and equipment when their use is no longer required.
5. Clean and repair damage caused by temporary installations or use of temporary facilities.
6. Restore existing facilities used for temporary services to specified or to original condition.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01511

TEMPORARY ELECTRICITY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Temporary electrical service shall be provided by CONTRACTOR until Final Acceptance of the Work, unless otherwise agreed by ENGINEER.
- B. All costs, including the charge for power consumed, shall be assumed by CONTRACTOR.
- C. The temporary service shall conform to applicable provisions of Division 16, Electrical.
- D. Materials and equipment may be new or used; however, they shall be in first class, fully serviceable condition and shall not create unsafe conditions or violate requirements of applicable codes.
- E. Service is required for lighting, power tools, construction trailers, dewatering equipment, and similar usages. Electric space heaters and large welding machines are not included herein.
- F. All temporary service required beyond the specified locations shall be the responsibility of CONTRACTOR requiring such power, who shall furnish his own portable generator or other means.

1.2 POWER SOURCE AND SERVICE REQUIRED

- A. A temporary power service is required. CONTRACTOR may contact Arizona Public Service (APS) or provide a Diesel Generator. .
- B. System shall be 240/120 volt, single phase, 60 Hz with sufficient capacity to provide service for construction use by all trades and with the following minimum facilities:
 - 1. 100 ampere frame with 100 ampere trip primary circuit breaker.
 - 2. Two pole safety switch, and a 240/120 volt, single phase, 3 wire distribution panel.
- C. Service shall be provided and maintained so that power can be secured at any desired point with no more than a 50-foot extension.
- D. One power center, minimum.
- E. Provide each outlet with circuit breaker protection and comply with ground fault protective requirements of NEC.

- F. Work hours are specified under the General Conditions.
- G. Provide continuous power for construction site offices.
- H. OWNER will provide power to maintain continuous operation of existing facilities during changeover of electrical equipment.
- I. OWNER will provide power for testing, checking, initial start-up of equipment and commissioning.

1.3 INSTALLATION

- A. Install temporary work in a neat orderly manner and make structurally and electrically sound throughout.
- B. Maintain installation throughout construction period to provide continuous service and to provide safe working conditions.
- C. Modify service and rearrange wiring as Work progress requires.
- D. Locate all facilities to avoid interference with hoisting, materials handling, storage, traffic areas, existing operable facilities and Work under other contracts.
- E. Assume responsibility for and return to original condition any part of the permanent electrical system that is used for construction purposes.

1.4 REMOVAL

- A. Completely remove temporary materials and equipment after permanent installation is in use.
- B. Repair damage caused by the temporary service or its removal and restore to specified or original condition.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01512

TEMPORARY LIGHTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Temporary lighting shall be provided by CONTRACTOR.

1.2 DEFINITIONS

- A. Work Lighting: That required to provide adequate illumination for Work being performed.
- B. Safety Lighting: That required to provide:
1. Adequate illumination for safe movement of authorized persons throughout project.
 2. Adequate illumination for public safety.
 3. Special warning lighting for hazardous conditions.
- C. Security Lighting: That required in protection of Work from unauthorized entry.

1.3 DESCRIPTION OF SYSTEM

- A. Furnish and install temporary lighting that is required for:
1. Construction needs.
 2. Safe and adequate working conditions throughout the Work.
 3. Public safety.
 4. Security lighting.
 5. Lighting for temporary office, storage and construction buildings.
- B. Lighting Intervals:
1. Work Lighting:
 - a. General: Five foot candles.
 - b. All stairs: Ten foot candles.
 - c. Construction Plant and Shops: Ten foot candles.
 - d. For Detail and Finishing Work: Twenty foot candles.
 - e. For Detailed Testing and Inspection: Thirty foot candles.
 - f. For First Aid Stations: Thirty foot candles.
 - g. Operating areas: One 300 watt lamp per 15 foot on centers.
 2. Safety Lighting:
 - a. General: Five foot candles, minimum.
 - b. For Hazardous Conditions: As required by applicable codes.
 3. Night Security Lighting: Provide over area within 50 feet of any portion of construction

C. Periods of Service:

1. Work Lighting: Continuous from 15 minutes prior to 15 minutes past scheduled Work hours on scheduled Work days.
2. Safety Lighting:
 - a. Within Project site: At all times authorized personnel are present.
 - b. Public areas: At all times.
3. Security Lighting: All hours of darkness.

D. Maintain strict supervision of use of temporary lighting. Enforce conformance with applicable standards and safe practices and prevent abuse of services.

1.4 POWER

A. As specified in Section 01511, Temporary Electricity.

1.5 COSTS OF INSTALLATION AND OPERATION

A. Electrical contractor shall pay costs of Temporary Lighting, including costs of installation, maintenance and removal.

B. Power Costs: As specified in Section 01511, Temporary Electricity.

1.6 REQUIREMENTS OF REGULATORY AGENCIES

A. Comply with National Electrical Code (NEC) current adoption and City of Phoenix – Amendments to the National Electrical Code, federal, state and local codes, and utility service company regulations.

1.7 USE OF OWNER’S EXISTING SYSTEM

A. Existing systems cannot be used for temporary lighting.

1.8 USE OF PERMANENT SYSTEM

A. Secure OWNER’S written permission for use of system, indicating conditions of use.

B. Furnish and install temporary lamps for temporary lighting.

C. Lamps used shall be replaced upon Final Acceptance of the Work.

1.9 MATERIALS

A. Comply with applicable provisions of Division 16, Electrical.

B. Materials and equipment may be new or used, but must be adequate for purposes intended and must not create unsafe conditions or violate requirements of applicable codes.

- C. Provide all required facilities, including wiring, switches, accessories and supports.
- D. At CONTRACTOR'S option, patented specialty products may be used, if UL approved.

1.10 RECEPTACLES, FIXTURES

- A. Standard products, meeting UL requirements.
- B. Provide heavy-duty guards on fixtures.
- C. Provide appropriate types of fixtures for environment in which used, in accordance with NEC and NEMA standards.

1.11 INSTALLATION

- A. Install temporary work in neat and orderly manner and make structurally and electrically sound throughout.
- B. Maintain throughout construction period to give continuous service and to provide safe working conditions.
- C. Modify and extend lighting as Work progress requires.
- D. Locate to avoid interference with or hazards to:
 - 1. Work or movement of personnel.
 - 2. Traffic areas.
 - 3. Materials handling.
 - 4. Storage areas.
 - 5. Work for other contracts.
- E. Install lighting switches at entrance to each area, or successive areas, so that progress to all areas of the Work may be made through lighted areas.
- F. Install exterior security lighting.
 - 1. Illuminate entire Work site.
 - 2. Control lighting by photo-electric cell.

1.12 REMOVAL

- A. Completely remove temporary materials and equipment after permanent lighting is in use.
- B. Repair damage caused by temporary service and restore surfaces to specified, or original condition.
- C. Immediately prior to completion of the Work, remove temporary lamps and install new lamps throughout.

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PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01513

TEMPORARY HEATING, COOLING AND VENTILATING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Temporary Enclosure: Sufficient preliminary enclosure of a portion of a structure, or of an entire building, to prevent entrance or infiltration of rainwater, wind or other elements, and to prevent undue heat loss from within the enclosed area.
- B. Permanent Enclosure: State of construction at which all moisture and weather-protection elements of construction have been installed, in accordance with Contract Documents, either for a portion of structure, or for entire building.

1.2 DESCRIPTION OF SYSTEM

- A. Provide temporary heat and ventilation in enclosed areas throughout construction period required to:
 - 1. Facilitate progress of Work.
 - 2. Protect Work and all products from rain, dampness and cold.
 - 3. Prevent moisture condensation on surfaces.
 - 4. Raise temperature of ground or materials for proper execution of Work.
 - 5. Provide suitable ambient temperatures and humidity levels for installations and curing of materials.
 - 6. Provide adequate ventilation to meet health regulations for safe working environment.
 - 7. Allow beneficial occupancy of Work, or portion of Work, prior to Final Acceptance, including air conditioning, if applicable.
- B. Temperature Required:
 - 1. Except where specified otherwise, the limits of the temperatures, which shall be maintained during the time of temporary heating, are a minimum of 50°F to a maximum of the design temperature of the facility.
 - 2. During a normal working day, minimum temporary heat for the types of activities indicated shall be as follows:
 - a. Placing, setting and curing of concrete and the erection of masonry units: 50°F.
 - b. Application of masonry units: 55°F.
 - c. Ten days prior to, during and until completion of the placing of interior woodwork and interior finishes such as varnishing and painting: 70°F.
 - d. After application of interior finishes and until Final Acceptance of the Work: 70°F.
 - 3. Twenty-four hours per day during placing, setting and curing of cementitious materials: As required by Specification Section for each product.

4. Storage Areas: As required by Specification Section for each product.
 5. Provide temporary enclosures as required to maintain conditions described above.
- C. Ventilation Required:
1. General: Prevent hazardous accumulations of dusts, fumes, mists, vapors or gases in areas occupied during construction.
 - a. Provide local exhaust ventilation to prevent harmful dispersion of hazardous substances into atmosphere of occupied areas.
 - b. Dispose of exhaust in a manner that shall not result in harmful exposure to persons.
 - c. Ventilate storage spaces containing hazardous or volatile materials.
 2. Provide adequate ventilation for:
 - a. Curing installed materials.
 - b. Humidity dispersion as needed to provide suitable ambient conditions for Work.
- D. Maintain strict supervision of operation of temporary heating and ventilating equipment:
1. Enforce conformance with all applicable codes and standards.
 2. Enforce safe practices.
 3. Prevent abuse of services.
 4. Prevent damage to finishes.
 5. Ensure that temporary facilities and equipment do not interrupt the continuous progress of construction operations.

1.3 COSTS OF INSTALLATION AND OPERATION

- A. Pay all costs for temporary heat, ventilation and enclosures required during construction, including cost of installation, fuel, electricity, operation, maintenance and removal.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

- A. Obtain and pay for any permits as required by governing authorities.
- B. Comply with federal, state and local laws, ordinances, rules and regulations and with utility service company regulations.

1.5 USE OF OWNER'S EXISTING SYSTEM

- A. When the Work is an addition to an existing building, the existing systems in building may not be used for temporary heat and ventilation, unless the OWNER'S written permission can be secured and equitable allocation of costs acceptable to the OWNER is agreed upon.

1.6 USE OF PERMANENT SYSTEM

- A. When completed, the permanent heating system may be used to provide temporary heat, if the system is substantially complete, and if the OWNER'S written permission for use of the system is obtained.
- B. The following are the conditions for using the permanent heating system:
 - 1. Building must be sufficiently complete so it can fulfill the requirements as a "Permanent Enclosure."
 - 2. The permanent system shall be substantially complete including the installation and functionality of the systems' operating and safety controls. All heating equipment, piping systems, strainers, filters and associated items should be flushed, cleaned and prepared for proper operation.
 - 3. ENGINEER shall approve the time when the permanent system may be operated.

1.7 MATERIALS AND EQUIPMENT

- A. Materials may be new or used, but shall be adequate for purposes intended and shall not create unsafe conditions nor violate requirements of applicable codes.
- B. Provide all required facilities, including piping, wiring and controls.
- C. Portable units shall be space heaters that burn natural gas or propane. They shall be units that meet code requirements and have the following:
 - 1. Safety controls against explosion, overheating and carbon monoxide buildup.
 - 2. Except where otherwise permitted by applicable codes, vent direct-fired units to outside.
 - 3. Adequate combustion air.
- D. Electrical heaters for temporary heat shall not be used.
- E. Provide covers or temporary enclosures to protect Work and materials.

1.8 INSTALLATION

- A. Install all temporary Work in neat, orderly manner and make structurally, mechanically and electrically sound throughout.
- B. Maintain to provide safe, continuous service at required times and to provide safe working conditions.
- C. Modify and extend system as Work progress requires.
- D. Locate units to provide uniform distribution of heat and air movement. When feasible, temporary units shall be located as near as possible to permanent piping.

- E. If air conditioning or ventilating duct systems are to be used for drying purposes, provide and maintain temporary filters until permanent filters are installed.
- F. Permanently installed direct radiation units, such as convectors or finned pipes, shall be protected with temporary sheet metal enclosures.
- G. Locate all systems so as to avoid interference with or hazards to:
 - 1. Work or movement of personnel.
 - 2. Traffic areas.
 - 3. Materials handling.
 - 4. Storage areas.
 - 5. Finishes.
 - 6. Work of utility service companies.

1.9 REMOVAL

- A. Completely remove temporary materials and equipment upon completion of construction.
- B. Clean and repair damage caused by temporary installation, and restore all materials and equipment to specified or to original condition.
- C. If permanent HVAC facilities were used for temporary heat, install new replaceable type filters or clean permanent filters

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01514

TEMPORARY WATER

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Temporary water shall be provided by CONTRACTOR, as specified in the paragraphs below.

1.2 DESCRIPTION OF SYSTEM

- A. Furnish and install temporary water service for entire Project for use throughout construction period.
- B. Provide water hoses from hose bibbs to point of operations.
- C. Also, provide water for sanitary facilities, first aid facilities, fire protection, field offices, cleaning, and drinking.
- D. Maintain adequate volume of water for all purposes.
- E. Potable Water Source:
 - 1. Supplier: Provide water source by connecting to existing utility mains at locations designated by OWNER. Provide backflow preventers, where required. Hydrants cannot be taken out of service.
 - 2. Provide adequate supply service and supply and install meter satisfactory to water utility.
 - 3. Permission shall be obtained from OWNER for water from hydrants.
- F. Maintain strict supervision of use of temporary services:
 - 1. Enforce conformance with applicable codes and standards.
 - 2. Enforce sanitary practices.
 - 3. Prevent abuse of services.
 - 4. Prevent wasteful use of water.
 - 5. Protect system from freezing.

1.3 COSTS OF INSTALLATION AND OPERATION

- A. Pay material costs of temporary water service, including costs of installation, maintenance and removal of pipe and equipment.
- B. Pay costs for water used by all trades.

1.4 REQUIREMENTS OF REGULATORY AGENCIES

- A. Obtain and pay for permits, fees, deposits required by governing authorities.
- B. Obtain and pay for temporary easements required across property, other than that of OWNER.
- C. Comply with federal, state and local laws, ordinances, rules and regulations and standards, and with utility service company regulations.

1.5 USE OF OWNER'S EXISTING SYSTEM

- A. Use existing system for temporary water for construction.
- B. Modify and extend system as necessary to meet temporary water requirements.
- C. Upon completion of Work, restore existing system to specified, or original condition.

1.6 MATERIALS

- A. Comply with applicable provisions of Division 15, Mechanical.
- B. Materials may be new or used, but must be adequate for purpose required, sanitary, and must not violate requirements of applicable codes.
- C. Provide all required facilities, including piping, valves, pumps, pressure regulators, tanks and other appurtenances.
- D. All materials or products which can contact drinking water or a water treatment chemical furnished and installed under this Section, shall require NSF/ANSI 61, Drinking Water System Components Health Effects approval or comply with Arizona Administrative Code R18-4-213, Standards for Additives, Materials, and Equipment.

1.7 INSTALLATION

- A. Install Work in a neat and orderly manner and make structurally and mechanically sound throughout.
- B. Maintain to provide continuous service.
- C. Modify and extend service as Work progress requires.
- D. Locate piping and outlets to provide service convenient to work stations and to avoid interference with traffic and work areas, materials handling equipment, storage area, and work under other contracts.
- E. Do not run piping on floor or on ground.

- F. Provide drip pan under each hose bibb located within building, and connect drain to sewer.
- G. Provide insulation, or other means, to prevent pipes from freezing.
- H. When necessary to maintain pressure, provide temporary pumps, tanks and compressors.
- I. Disinfect temporary or permanent potable water piping prior to use in accordance with City, State and Maricopa Association of Governments (MAG) requirements and as supplemented by the City of Phoenix.

1.8 REMOVAL

- A. Completely remove temporary materials and equipment upon completion of construction.
- B. Clean, repair damage caused by installation, and restore to specified or original condition.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01515

TEMPORARY SANITARY AND FIRST AID FACILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Temporary sanitary and first aid facilities shall be provided by CONTRACTOR.
- B. Provide temporary sanitary and first aid facilities for use throughout the Contract including:
 - 1. Potable water and sanitary drinking cups.
 - 2. Sanitary drinking fountains, where feasible.
 - 3. Enclosed toilet facilities.
 - 4. Suitable general employee washing facilities.
 - 5. First aid stations at or immediately adjacent to all major Work areas and in the temporary field offices.
 - 6. Post telephone numbers of physicians, hospitals and ambulance services by each telephone at the Project site.
 - 7. At least one person thoroughly trained in first aid procedures shall be present on the site, whenever Work is in progress. These persons must have a certificate indicating that they have completed a first aid training course conducted by the American Red Cross or other approved agency. Submit the certificates to the ENGINEER.
- C. Provide facilities and fixtures in compliance with all applicable federal, state, and local laws, ordinances, standards, and regulations.
- D. Maintain strict supervision of use of facilities.
- E. Maintain, service and clean facilities and keep them supplied continuously with soap, towels, paper and all other required supplies.
- F. Enforce proper use of sanitary facilities, including preventing the committing of nuisances in buildings on the site.
- G. Dispose of all wastes in conformance with applicable regulations.

1.2 COSTS OF INSTALLATION AND OPERATION

- A. Pay all cost including installation, maintenance and removal.

1.3 USE OF EXISTING SYSTEM

- A. Existing facilities may not be used, unless an agreement is obtained in writing from the OWNER stating the conditions of use.

1.4 USE OF PERMANENT FACILITIES

- A. Permanent facilities shall not be used by construction personnel.

1.5 INSTALLATION AND REMOVAL

- A. Temporary flush toilets or portable toilets may be used.
- B. Comply with all applicable provisions of Division 15, Mechanical.
- C. Completely remove temporary materials and equipment upon completion of construction and restore all damaged facilities to original condition.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All materials or products which can contact drinking water or a water treatment chemical furnished and installed under this Section, shall require NSF/ANSI 61, Drinking Water System Components Health Effects approval or comply with Arizona Administrative Code R18-4-213, Standards for Additives, Materials, and Equipment.

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01516

TEMPORARY FIRE PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Conform to the fire protection and prevention requirements specified herein as well as those which may be established by federal, state or local governmental agencies.
- B. Comply with all applicable provisions of NFPA Standard No. 241, Safeguarding Building Construction and Demolition Operations.
- C. Facilities specified herein shall be provided by CONTRACTOR, but all other contractors shall conform to the provisions of this Section and all applicable laws, ordinances, rules and regulations.

1.2 REQUIRED FIRE FIGHTING EQUIPMENT

- A. Provide portable fire extinguishers, rated not less than 2A or 5B in accordance with NFPA Standard No. 10, Portable Fire Extinguishers, for each temporary building and for every 3000 square feet of floor area under construction.
- B. Locate portable fire extinguishers 50 feet maximum from any point in the protection area.

1.3 FIRE PREVENTION AND SAFETY MEASURES

- A. Prohibit smoking in all hazardous areas and in all of the OWNER'S buildings. Post suitable warning signs in areas which are continuously or intermittently hazardous.
- B. Use metal safety containers for storage and handling of flammable and combustible liquids.
- C. Do not store flammable or combustible liquids in or near stairways or exits.
- D. Maintain clear exits from all points in the Work site.

1.4 COSTS OF INSTALLATION

- A. Pay all costs including installation, maintenance, and removal.

1.5 HAZARDOUS MATERIALS RELEASE EVACUATION

- A. Be familiarized with the OWNER'S hazardous materials release evacuation plan and shall have the Work force prepared to evacuate should the emergency occur.

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- B. The OWNER will conduct a training session for CONTRACTOR'S supervisory staff, which would be responsible to train all of CONTRACTOR'S employees, all Subcontractors' employees or any other personnel who are on site.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01521

ENGINEER'S FIELD OFFICE

PART 1 - GENERAL

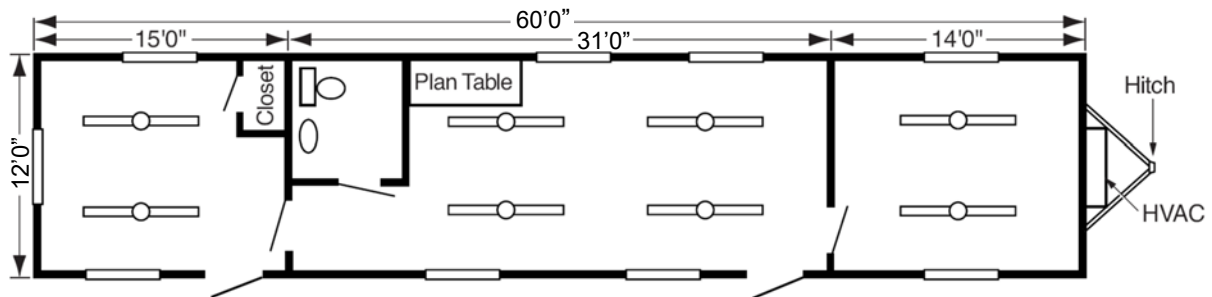
1.1 DESCRIPTION

- A. Furnish, install, and maintain the field office, furnishings, and equipment for ENGINEER. Locate office near CONTRACTOR'S office in a location approved by ENGINEER. Provide office complete within four weeks after the Notice-to-Proceed.
- B. Allocate three reserved parking spaces marked for use by the ENGINEER and one reserved parking space for use by OWNER. Reserved parking spaces shall be adjacent to ENGINEER'S field office and shall be graded and paved.
- C. The office shall be separate from all CONTRACTOR'S offices.
- D. CONTRACTOR shall submit, pay for and obtain any required permits.
- E. Field office security shall be the responsibility of CONTRACTOR. Deliver 5 field office door keys and all furniture keys to ENGINEER upon installation of field office to site.
- F. Complete layout of office shall be submitted to the ENGINEER for approval. Submittal shall include a hard copy of the relevant Specification Section and shall be clearly marked to indicate whether the requirements for equipment and/or services in the Specification Section are met by writing "accept" or "deviate" next to each Paragraph. If clarifications are needed to any of the Paragraphs in the Specification Sections due to deviations, they shall be addressed next to the Paragraph as such and explained further with any additional information necessary. If any exceptions and/or deviations are proposed to any of the Specifications, they shall be clearly noted as such in the Submittal, and an explanation of any deviation and/or exception shall be provided. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected.

1.2 MINIMUM CONSTRUCTION

- A. Mobile single wide office trailer 12' x 60' in first class, new condition acceptable to ENGINEER, which is specifically designed for this type of use and conforms to requirements above and below. Provide trailer by Pac-Van, GE Modular Space, or approved equal.

- B. Trailers owned by the CONTRACTOR that do not meet the criteria listed will not be allowed.
- C. Concrete or boardwalk steps, landings and sidewalks of four feet minimum width for complete access to field office. Access to the office must comply with ADA (Americans with Disabilities Act) Standards, as applicable. Access doors shall be furnished with locking security bar doors as approved by the ENGINEER.
- D. Trailer shall be completely weather tight and insulated, with resilient floor tiles and carpet in first class, new condition.
- E. All interior finishes acceptable to ENGINEER.
- F. Area: 720 square feet minimum consisting of two offices, conference room, and lavatory as depicted below. Interior layout shall be submitted to the ENGINEER for approval prior to ordering.



- G. Windows: Ten percent of floor area with operable sash and screens. Windows shall be furnished with locks and exterior security bars approved by the ENGINEER. All windows shall be equipped with operable venetian blinds. All offices shall be furnished with a window.

1.3 MINIMUM SERVICES

- A. Interior lighting of 50 foot candles at desktop height.
- B. Exterior light at entrance(s) and at parking areas.
- C. Automatic heating to maintain 75°F in winter. CONTRACTOR shall furnish and pay for all fuel/electric.
- D. Automatic cooling to maintain 70°F in summer. CONTRACTOR shall furnish and pay for all fuel/electric.
- E. Continuous electric service required and pay all charges.

- F. A minimum of one electric duplex receptacle wall outlets that are accessible from six feet along any wall.
- G. Provide continuous Internet service with all associated equipment a maximum of two weeks after trailer is installed. Configure Internet so service is available by all workstations, with a minimum connection speed of 100 Mbps download. Provide one internet connection along with cabling and required hardware for each desk. Internet shall also have a secure wireless connection as well, with firewall (to be coordinated with Engineer/Owner).
- H. One bottled water cooler with chilled and hot drinking water and cups. Supply bottled water and cups as required for the duration of the Contract.
- I. Private sanitary facilities with one water closet, one lavatory, with hot and cold running water, medicine cabinet with mirror, one tissue paper holder and one paper towel holder. Supply tissue paper, hand soap and paper towels as required for the duration of the Contract.
- J. All plumbing facilities and sewers required in accordance with local codes. Protect from freezing.
- K. One new color combination copy machine and printer. Unit shall be able to connect to network and have document feeder, with reduction, enlargement, auto-document feed, auto stapler function, high capacity feeder, bypass tray, four paper trays, top tray, stacker tray and sorting capability. Copier/printer shall have email capabilities for sending files. Provide service, warranty (including toner and replacement cartridges) and maintenance for the duration of the Contract. Provide 8-1/2-inch by 11-inch, 8-1/2-inch by 14-inch, and 11-inch by 17-inch copy paper for the duration of the Contract. Copier shall make up to 11-inch by 17-inch copies. Copier shall copy at a rate no slower than 40 copies per minute.

1.4 MINIMUM FURNISHINGS

- A. Field Office Furniture: Lease (or purchase) and install the following equipment for the duration of the Contract:
 - 1. Furnishings for each individual office, two offices total:
 - a. Two desks, 36-inches wide by 72-inches long table top with locking lap and 5-side drawers.
 - b. One 4-drawer locking legal size filing cabinet.
 - c. One 6-shelve bookcase, 36-inches wide by 84-inches high by 12-inches deep.
 - d. Two cushioned swivel arm chair and two cushioned folding chairs.
 - e. Two 48-inches by 36-inches liquid marking board with two sets of compatible markers (six colors and one eraser per set).
 - f. Two standard size wastepaper baskets.
 - 2. Furnishings to be provided for conference room shall include:

- a. Two 30-inches by 96-inches folding tables.
 - b. Sixteen upholstered executive high-back chairs with cushioned seat and back, five-star base, wheels, arms, swivel, tilt control conference chairs.
 - c. Two 48-inches by 60-inches liquid marking board with two sets of compatible markers (four colors and one eraser per set).
 - d. One 48-inch by 60-inches cork bulletin board.
 - e. Two standard size wastepaper baskets.
3. Furnishings to be provided for hallways and other areas:
- a. Two 4-drawer legal size, fire-proof filing cabinets.
 - b. Two 6-shelve bookcases, 36-inches wide by 84-inches high by 12-inches deep.
 - c. Two folding reference tables, 30-inches wide by 72-inches long.
4. Furnishings to be provided with Kitchen area shall include:
- a. One, new refrigerator with freezer, minimum 12 cu.ft. frost-free, GE or approved equal.
 - b. Ten-pound ABC approved fire extinguishers (number as required by Phoenix Building Code).
 - c. One OSHA approved first aid kit, First Aid Only Contractor's First Aid Kit (Model 9302-25M), or approved equal. Upkeep as needed.
 - d. One, new microwave oven, 0.9 cu.ft. minimum 1100 watts rotating base, and keypad controls.
 - e. One standard size wastepaper basket.
5. Furnishings to be provided in the toilet area shall include:
- a. One 15-gallon electric water heater (220 volt).
 - b. One water closet accessible to handicap with grab bars.
 - c. One toilet paper and paper towel dispenser.
 - d. One 8-inch ceiling mounted exhaust fan, 60 cfm, Marlite.
 - e. One 6-shelve bookcases, 36-inches wide by 84-inches high by 12-inches deep.
 - f. Vinyl cove base on wall.
 - g. One wastebasket.
 - h. Provide paper products and sanitizing soap for the duration of the Contract.
- B. Smoke detectors (number as required by Phoenix Building Code).
- C. Identifying exterior sign, professionally lettered, at least 24-inches by 36-inches, with wording acceptable to ENGINEER.
- D. Three battery operated clocks, wall mounted.
- E. Three Calendars.
- F. Walk-off mats at all entrances.
- G. Furnish and install a new complete computer system ready to operate. This system will consist of two laptop computers, and one printer connected in a network. Each computer shall be able to access the other computers. They shall be able to share files and make

use of the internet lines and printer. Minimum hardware and software requirements shall be as follows:

1. Personal Computers:
 - a. Lenovo 15” ThinkPad Laptop, Silver (or Equal):
 - 1) 15.6” Screen (FHD).
 - 2) Intel Core i7 processor (min. 8th Generation).
 - 3) 16GB Memory, 512 GB SSD hard drive.
 - 4) Microsoft Windows 10 Pro 64-Bit Operating System (pre-installed).
 - 5) Wi-Fi and Bluetooth Enabled, latest version.
 - 6) Thunderbolt USB 3.1 port.
2. Provide one new networked color printer with high volume printing capabilities.
 - a. HP Color LaserJet Pro m255dw Wireless Laser Printer.
3. Software (for each computer system):
 - 1) Microsoft Office Professional – newest version.
 - 2) BlueBeam Revu Standard – Windows.
 - 3) Primavera P6 Professional – Release 20.
4. Computer Accessories (for each computer system):
 - a. Keyboard, Mouse.
 - b. Universal Docking Station, with laptop Thunderbolt 3 charging USB C, dual HDMI, CAT5, and min two USB connections.
 - c. All cabling as required for complete installation.
5. Computers shall be capable to be setup in a Peer to Peer network connected by a CAT5, twisted pair, with RJ 45, Ethernet 10 Base T cable connections. One computer shall be the file server for the NT network. Access to the system shall be password protected and each user will have their own unique login name and password.
6. One 10/100 Base T, RJ 45, 8-Port 3 com office connect switch. Switch shall be installed where the office CAT5 data drops terminate. Power source to be provided.
7. CAT5, RJ 45 twisted pair data lines for three data lines. Each office will have two CAT5 data drop near each desk and two CAT5 data drop in the conference room area. All CAT5 data drops will terminate in one location for proper installation to the network hub.
8. The computer network shall be capable of Virtual Private Network access through the internet, a Cox connection, or a CenturyLink connection.

H. Furnish office supplies, consumables, and service contracts for office and communications equipment for the duration of the Contract.

1.5 MAINTENANCE

- A. Continuous maintenance of office and services. Cleaned not less than once per week.
- B. Provide soap, paper towels, toilet tissues, cleansers, sanitary supplies, janitorial service (including vacuuming, washing floors, and cleaning toilets weekly) and implements.

- C. Repair immediately any damage, leaks or defective service.
- D. Maintenance shall be for the duration of the Contract.
- E. Provide maintenance contract for the items described in Paragraphs 1.3.G., 1.3.K., 1.4.G. and 1.6 for the duration of the Contract. Also, provide a 24-hour response, service contract, for equipment with a minimum of eight hours pre-paid service per month.

1.6 PROVISIONS

- A. All items shall be furnished and maintained by CONTRACTOR from the Notice to Proceed to the date of Final Acceptance. The cost of these items shall be considered incidental to the cost of the Project. No separate measurement of payment shall be made for these items.

1.7 REMOVAL

- A. The office, together with the equipment, furnishings and facilities thereof, except miscellaneous small supplies shall become the property of CONTRACTOR and shall be removed from the site of the Work upon OWNER Acceptance of the Project or when directed by ENGINEER.
- B. At the completion of the Project, the OWNER'S computers, filing cabinets and filing cabinet contents shall become the property of the OWNER, unless directed otherwise. All titles for software and hardware shall be transferred to the OWNER.
- C. At the completion of the Project, the ENGINEER'S computers and any other ENGINEER provided belongings shall remain the property of the ENGINEER.
- D. At the completion of the Project, the ENGINEER and OWNER will return field office keys to CONTRACTOR.
- E. Remove underground installations to minimum depth of 24-inches and grade to match surrounding conditions.
- F. Restore existing facilities used during construction to specified or original condition.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01522

CONTRACTOR'S FIELD OFFICE AND SHEDS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall provide a CONTRACTOR'S field office with the minimum facilities specified. Provide all required storage and work sheds.
- B. Field Office and Furnishings:
 - 1. Provide field office and furnishings with sufficient room for Project meetings.
 - 2. Provide the following items for the OWNER'S representative:
 - a. Desk.
 - b. Chair.
 - c. Four-drawer file cabinet.
 - 3. Exterior identifying sign.
 - 4. Other furnishings at CONTRACTOR'S option.
 - 5. Company sign no larger than 4 feet by 8 feet.
 - 6. Four protective helmets for visitor's use.
- C. Provide one set of all Contract Documents in the office for ready reference at all times by interested parties.
- D. Storage and Work Sheds:
 - 1. Provide storage and work sheds sized, furnished, and equipped to accommodate personnel, materials, and equipment involved, including temporary utility services.
- E. Remove office and sheds upon Final Acceptance, unless otherwise approved by ENGINEER.
- F. CONTRACTOR shall pay for all permits that may be required.

1.2 MINIMUM CONSTRUCTION

- A. Concrete or boardwalk steps, landings, and sidewalks of 4 feet minimum width for complete access to field office. Access to the office must comply with ADA (Americans with Disabilities Act) Standards, as applicable. Access doors shall be furnished with locking security bar doors as approved by the ENGINEER.
- B. Completely weather tight and insulated.

1.3 MINIMUM SERVICES

- A. Continuous electric service required and pay all charges.
- B. One bottled water cooler with chilled and hot drinking water and cups. CONTRACTOR shall supply bottled water and cups as required for the duration of the Contract.
- C. One new copy machine, HP Digital Copier 160 with document feeder, or approved equal, with reduction, enlargement, auto-document feed, auto stapler function, high capacity feeder, bypass tray, four paper trays, top tray, stacker tray and sorting capability. Provide service, warranty (including toner and replacement cartridges) and maintenance for the duration of the Contract. Provide 8-1/2-inch by 11-inch, 8-1/2-inch by 14-inch, and 11-inch by 17-inch copy paper for the duration of the Contract. Copier shall make up to 11-inch by 17-inch copies. Copier shall copy at a rate no slower than 40 copies per minute.

1.4 PROVISIONS

- A. All items shall be furnished and maintained by CONTRACTOR from the Notice to Proceed to the date of Final Acceptance. The cost of these items shall be considered incidental to the cost of the Project. No separate measurement of payment shall be made for these items.

1.5 REMOVAL

- A. The office, together with the equipment, furnishings, and facilities thereof, except miscellaneous small supplies, shall become the property of CONTRACTOR and shall be removed from the site of the Work upon OWNER Acceptance of the Project or when directed by ENGINEER.
- B. At the completion of the Project, the ENGINEER and OWNER will return field office keys to CONTRACTOR.
- C. Remove underground installations to minimum depth of 24-inches and grade to match surrounding conditions.
- D. Restore existing facilities used during construction to specified or original condition.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01550

ACCESS ROADS AND PARKING AREAS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall provide all temporary construction roads from the CAP canal and from the Loop 303 and 51st Ave to the construction site within the 51st Avenue alignment, walks and parking areas required during the construction and for use of emergency vehicles. Temporary roads and parking areas shall be designed and maintained by CONTRACTOR so as to be fully usable in all weather conditions.
- B. CONTRACTOR shall prevent interference with traffic and the OWNER'S operations on existing roads. CONTRACTOR shall indemnify and save harmless the OWNER from any expenses caused by CONTRACTOR'S operations over these roads.
- C. Roadway damage shall be restored to the original condition by CONTRACTOR subject to approval of the OWNER or ENGINEER.
- D. Temporary roads, walks and parking areas shall be removed by CONTRACTOR, prior to Final Acceptance, and the ground returned to its original condition, unless otherwise required by the Contract Documents.

1.2 DESIGNATED PARKING

- A. All CONTRACTOR'S employee vehicles shall park in an area specifically designated for that purpose, as more fully described in Section 01561, Security.

1.3 MAINTENANCE OF ROADS

- A. CONTRACTOR shall, at all times, maintain approved access for trucks to loading areas of the plant and parking facilities for plant personnel. All parking of construction vehicles shall be in approved lots.
- B. Have all paved roads swept by mechanical sweeper as required by Dust Control Permit but no less than one time a week. Keep roads serviceable at all times. Specific roads include:
 - 1. All roads within the limits of this Contract.
 - 2. Plant roads from entrance to work parking and work sites.
- C. Dust resulting from construction shall be controlled by CONTRACTOR to prevent a nuisance on the site or in adjacent areas. Apply water or use other methods subject to the ENGINEER'S approval, which will keep dust in the air to a minimum. Use of water will

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not be permitted when it results in hazardous or objectionable conditions such as ice, mud, ponds and pollution, refer to the requirements within 00700 General Requirements pertaining to Earthmoving and Dust Control.

- D. Provide temporary heavy duty steel roadway plates to protect existing manholes, handholes, valve boxes and vaults.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01551

MAINTENANCE AND PROTECTION OF TRAFFIC

PART 1 - GENERAL

1.1 DESCRIPTION

- A. All streets and trafficways shall be kept open for the passage of traffic and pedestrians during the construction period, unless otherwise approved by the ENGINEER, in writing, or authority having jurisdiction over same. Construction traffic at the project site shall only use the entrances stated in Section 01561, Security.
- B. When required to cross, obstruct or temporarily close a street or traffic way, CONTRACTOR shall provide and maintain suitable bridges, detours or other approved temporary expedient for the accommodation of traffic. Closings shall be for the shortest time practical, and passage shall be restored immediately after completion of backfill and temporary paving or bridging.
- C. CONTRACTOR shall give the required advance notice to the fire and police departments of proposed operations.
- D. CONTRACTOR shall give reasonable notice to owners or tenants of private property who may be affected by CONTRACTOR'S operations. A minimum seven (7) day notice shall be given.
- E. CONTRACTOR shall provide signs, signals, barricades, flares, lights and all other equipment, service and personnel required to regulate and protect all traffic and warn of hazards. All such work shall conform to requirements of the OWNER or authority having jurisdiction. Remove temporary equipment and facilities when no longer required, and restore grounds to original or to specified conditions.

1.2 TRAFFIC SIGNALS AND SIGNS

- A. CONTRACTOR shall provide and operate traffic control and directional signals required to direct and maintain an orderly flow of traffic in all areas under CONTRACTOR'S control, or affected by CONTRACTOR'S operations.
- B. CONTRACTOR shall provide traffic control and directional signs, mounted on barricades or standard posts at the following locations:
 - 1. Each change of direction of a roadway and at each crossroad.
 - 2. Detours and hazardous areas.
 - 3. Parking areas.

1.3 FLAGMEN

- A. CONTRACTOR shall provide qualified and suitably equipped flagmen when construction operations encroach on traffic lanes, as required for regulation of traffic and in accordance with the requirements of the authority having jurisdiction.

1.4 FLARES AND LIGHTS

- A. CONTRACTOR shall provide flares and lights during periods of low visibility:
 - 1. To clearly delineate traffic lanes, to guide traffic and to warn of hazardous areas.
 - 2. For use by flagmen in directing traffic.
- B. Provide illumination of critical traffic and parking areas.

1.5 PARKING CONTROL

- A. CONTRACTOR shall control all CONTRACTOR related vehicular parking within the limits of the Work to preclude interference with public traffic or parking, access by emergency vehicles, OWNER'S operations, or construction operations. CONTRACTOR shall provide temporary parking facilities for the public, as may be required because of construction or operations.
- B. Monitor parking of all construction and private vehicles:
 - 1. Maintain free vehicular access to and through parking areas.
 - 2. Prohibit parking on or adjacent to access roads or in non-designated areas.
 - 3. All construction vehicles must possess current registration.
 - 4. Private vehicles shall park only in the designated areas.

1.6 HAUL ROUTES

- A. CONTRACTOR shall consult with governing authorities and establish thoroughfares which will be used as haul routes and site access.
- B. CONTRACTOR shall provide drawings indicating haul routes which have been designated by authorities to be used for construction.
- C. CONTRACTOR shall submit requested routes to ENGINEER and OWNER for designation as haul route and secure approval of authorities.
- D. CONTRACTOR shall confine construction traffic to designated haul routes.
- E. CONTRACTOR shall provide traffic control at critical areas of haul routes to expedite traffic flow, and to minimize interference with normal public traffic.

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PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01561

SECURITY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall safely guard all Work, materials, equipment and property from loss, theft, damage and vandalism. CONTRACTOR'S duty to safely guard property shall include the OWNER'S property and other private property from injury or loss in connection with the performance of the Work.
- B. CONTRACTOR shall employ watchmen as required to provide the required security and prevent unauthorized entry.
- C. CONTRACTOR shall make no claim against the OWNER for damage or injury resulting from trespass.
- D. CONTRACTOR shall be responsible for security and shall make good all damage to property of OWNER and others arising from failure to provide adequate security. The standard for security shall be, at a minimum, equivalent to the owner's standards.
- E. If the existing fencing or barriers are breached or removed for purposes of construction, CONTRACTOR shall provide and maintain temporary security fencing equal to the existing in a manner satisfactory to the ENGINEER and OWNER. The CONTRACTOR shall also provide additional security staff, if required, to maintain the security of the facility.
- F. Security measures taken shall be at least equal to those usually provided by OWNER to protect his existing facilities during normal operation.
- G. Maintain security program throughout the Work until OWNER'S acceptance and occupancy precludes need for CONTRACTOR'S security program.
- H. CONTRACTOR shall comply with all aspects of OWNER'S site specific Security Guard Protocol. This shall include background checks equivalent to those conducted by the owner.
- I. All costs for security as specified in this Section shall be borne by CONTRACTOR.
- J. All security specified herein shall be arranged and available prior to CONTRACTOR'S Mobilization.

1.2 CONTRACTOR’S ACCESS TO THE SITE

- A. Access to the site north of the CAP canal for CONTRACTOR’S employees, material, tools and equipment shall be from N Stetson Valley Pkwy (51st Avenue Alignment) over the existing canal bridge or the entrance at 51st Ave and Loop 303.
- B. Ensure that each of his employees, representatives, delivery persons, suppliers and others acting for CONTRACTOR, shall be subject to the following regulations:
 - 1. CONTRACTOR’S subcontractor’s, suppliers and manufacturer’s employee’s shall not park anywhere other than CONTRACTOR Employee’s Parking Area. The Area shall be designated by the ENGINEER. Prepare and maintain this area, as required.
 - 2. All CONTRACTOR employees shall wear a laminated photograph identification and badge bearing CONTRACTOR’S name, employee’s name, and employee number at all times when the employee is on the site. Badge and Background Check Data form shall be completed by CONTRACTOR and approved by OWNER prior to CONTRACTOR personnel entering the site.
 - 3. Turn over the identification badge to the OWNER upon the individual’s completion of the participation on the project or project completion.
 - 4. OWNER reserves all rights to the approval of all CONTRACTOR, subcontractor, suppliers and manufacturers employees receiving an identification badge.
 - 5. All vehicles, including those belonging to CONTRACTOR, his employees and subcontractors, delivery persons and suppliers entering the site shall conform to all security and safety regulations in force at the site. All vehicles entering and leaving the site are subject to search.
 - 6. Personal vehicles shall not be allowed outside CONTRACTOR’S Employee Parking Area.
 - 7. Delivery vehicles shall access the site from the designated construction entrance stated in Paragraph 1.2 A. above.
 - 8. Firearms are not allowed at the sites.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01570

TEMPORARY CONTROLS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall provide and maintain methods, equipment, and temporary construction, as necessary to provide controls over environmental conditions at the construction site and adjacent areas. Remove physical evidence of temporary facilities at completion of Work.
- B. CONTRACTOR shall obtain all City, County and State permits required for the construction of all Work, including Hazardous Material Management, Earth Moving/Dust Control and Stormwater/Stormwater Pollution Prevention Permits.

1.2 NOISE CONTROL

- A. CONTRACTOR'S vehicles and equipment shall be such as to minimize noise to the greatest degree practicable. Noise levels shall conform to the latest OSHA standards and in no case will noise levels be permitted which interfere with the Work of the OWNER or others.

1.3 PEST AND RODENT CONTROL

- A. Provide rodent and pest control as necessary to prevent infestation of construction or storage areas.
 - 1. Employ methods and use materials that will not adversely affect conditions at the site or on adjoining properties.

1.4 WATER CONTROL

- A. Provide methods to control surface water and water from excavations and structures to prevent damage to the Work, the site, or adjoining properties.
 - 1. Control fill, grading and ditching to direct water away from excavations, pits, tunnels and other construction areas and to direct drainage to proper runoff courses so as to prevent any erosion, damage or nuisance.

1.5 EROSION CONTROL

- A. Plan and execute construction and earth work by methods to control surface drainage from cuts and fills, and from borrow and waste disposal areas, to prevent erosion and sedimentation.
 - 1. Hold the areas of bare soil exposed at one time to a minimum.

2. Provide temporary control measures such as berms, dikes and drains.
- B. Construct fills and waste areas by selective placement to eliminate surface silts or clays which will erode.
- C. Periodically inspect earthwork to detect any evidence of the start of erosion; apply corrective measures as required to control erosion.
- D. Coordinate erosion control requirements with the requirements of Article 1.4, above.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01580

PROJECT IDENTIFICATION AND SIGNS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Furnish, install and maintain temporary project identification and informational signs.
- B. The following signs shall be provided:
 - 1. Post two directional signs near the main entrance gate of the project. These signs shall indicate the location of the CONTRACTOR and ENGINEER's field office location.
 - 2. Post a minimum of three signs along the 51st Avenue Alignment. These signs shall provide directions for the hauling routes to the project location. Contractor shall indicate a clear pathway to the site.
 - 3. Post up to three signs to the temporary spoils locations along construction routes to be used by CONTRACTOR'S personnel.
 - 4. Post signs for traffic control when partial closure of a roadway.
- C. No signs, except those specified, shall be displayed, unless approved by OWNER.

1.2 SUBMITTALS

- A. Submit for approval the following:
 - 1. Type of grade of materials.
 - 2. Layout, size, trim, framing, supports and coatings.
 - 3. Size and style of lettering.
 - 4. Samples of colors.
- B. Shop Drawings: Submit for approval the following:
 - 1. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
 - 2. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
 - 3. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each

deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

1.3 CONSTRUCTION

- A. Use 3/4-inch exterior grade plywood, unless shown otherwise.
- B. Use, trim, mitered on all edges.
- C. Design signs and supports to withstand 75 mile per hour wind.
- D. Paint with exterior gloss-finish enamel. Sign painter shall be a professional in the type work required.

1.4 INSTALLATION AND MAINTENANCE

- A. Location of signs shall be as shown on the Drawings or directed by ENGINEER.
- B. Maintain signs so they are clean, legible and upright. Keep grass and weeds cut away from signs.
- C. Repair and repaint damaged signs. Relocate signs as required by progress of the Work.
- D. Remove signs when project is completed or when directed by ENGINEER.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01600

GENERAL EQUIPMENT PROVISIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. These General Equipment Provisions apply, to all equipment furnished under this Contract including equipment specified in Division 11, Equipment, Division 13, Special Construction, Division 15, Mechanical, Division 16, Electrical, and Division 17, Instrumentation. These General Provisions shall supplement the Detailed Equipment Specifications, but in case of conflict the Detailed Equipment Specifications shall govern.

B. Environmental Conditions:

1. Equipment shown or specified for exterior locations shall be designed for continuous operation in a dusty environment, with normal ambient air temperatures of 120°F, and exposed to air that contains corrosive compounds.

1.2 QUALITY ASSURANCE

A. Arrangement:

1. The arrangement of equipment shown on the Drawings is based upon information available to the ENGINEER at the time of design and is not intended to show exact dimensions peculiar to a specific manufacturer. The Drawings are, in part, diagrammatic, and some features of the illustrated equipment installation may require coordination to meet actual equipment installation requirements. Structural supports, foundations, connected piping, valves, and electrical conduit specified may have to be coordinated to accommodate the equipment provided. No additional payment will be made for the coordination.

B. Unit Responsibility:

1. Equipment systems made up of two or more components shall be manufactured and assembled as a unit by the responsible manufacturer. The responsible Manufacturer shall select all components of the system to assure compatibility, ease of construction and efficient maintenance. The responsible manufacturer shall coordinate selection and design of all system components, such that all equipment furnished under the specification for the equipment system, including equipment specified elsewhere, but referenced in the specification, is compatible and operates properly to achieve the performance requirements specified. Unless otherwise specified, the responsible manufacturer shall be the manufacturer of the driven equipment. Agents, representatives or other entities that are not a direct component

of the Manufacturing corporation will not be acceptable as a substitute for the Manufacturer's corporation in conforming to this requirement. This requirement for unit responsibility shall in no way relieve CONTRACTOR of his responsibility to the OWNER for performance of all systems.

2. CONTRACTOR shall assure that all equipment systems provided for the Project are products for which unit responsibility has been accepted by the responsible manufacturer. Where the detailed specification requires a certificate from the Unit Responsibility Manufacturer, CONTRACTOR shall coordinate delivery of such certificates. Certificates shall conform to the content, form and style of Form 01600-B specified in Section 01331, Reference Forms, shall be signed by an Officer of the Manufacturer's corporation and shall be notarized. No other submittal material will be processed until a Certificate of Unit Responsibility has been received and has been found to be satisfactory. Failure to provide acceptable proof that the unit responsibility requirement has been satisfied will result in withholding approval of progress payments for the subject equipment even though the equipment may have been installed in the Work.

1.3 WORKMANSHIP AND MATERIALS

- A. All equipment shall be designed, fabricated and assembled in accordance with the best modern engineering and shop practice and in accordance with applicable standards. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required for tests.
- B. In various Sections of the Specification, Manufacturer's names have been used for clarity and to establish minimum product standards only. Responsibility for selection and coordination of all materials required for construction belongs to CONTRACTOR.
- C. All parts and components of mechanical equipment shall be designed for satisfactory service under continuous duty and under the specified and indicated operating conditions. Any part of mechanical equipment that shows excessive wear or fails due to wear, under normal operating conditions, within the warranty period shall be considered as evidence of defective material or defective workmanship, and it shall be replaced by CONTRACTOR with equipment or parts to meet the specified requirements, at no additional cost to the OWNER.
- D. Bronze which shall be in contact with water or any liquid, used in the manufacture of any equipment shall not contain aluminum or more than six percent zinc, and shall conform to ASTM B62, or equivalent.
- E. Tolerances and clearances, shall be as indicated on the Shop Drawings, and these tolerances and clearances shall be closely followed to secure proper operation of the equipment.

- F. All flanges on equipment and equipment appurtenances furnished shall conform in dimensions and drilling to ANSI B16.1, Class 150, unless otherwise noted.
- G. Responsibility to coordinate compatible materials of construction for all elastomer components for all seats, seals, gaskets, etc., for each process application belongs to CONTRACTOR. Acceptable compatible materials of construction for all elastomer materials are as follows:

Process Fluid	Compatible Materials of Construction
Potable Water	Buna-N, SBR
Wastewater	Buna-N, SBR
Foul Air (H ₂ S)	Buna-N, EPDM
Calcium Nitrate	Buna-N, SBR, EPDM

- H. All materials in contact with drinking water or a water treatment process furnished and installed under this section shall be NSF/ANSI 61, drinking water system components health effects, approval or comply with Arizona Administrative Code R18-4-213, standards for additives, materials, and equipment.

1.4 MANUFACTURER’S NAMES

- A. Manufacturer’s name and catalog numbers are for the convenience of CONTRACTOR. The detailed Contract Documents shall apply in the event of a conflict. If detailed Contract Documents have not been given, the manufacturer’s name and catalog number shall determine the design criteria for comparison should an equal be submitted.

1.5 REGULATIONS AND CODES

- A. Electrical and Instrumentation Work, furnished with equipment supplied under Division 11, Equipment, Division 13, Special Construction, and Division 15, Mechanical, including connection to electrical equipment integral with mechanical equipment, shall be performed in accordance with the requirements of Division 16, Electrical, and Division 17, Instrumentation. When applicable, the material used in the performance of the electrical Work shall be approved by the Underwriter’s Laboratories, Inc. (UL) for the class of service for which they are intended.

1.6 BEARINGS

- A. Unless otherwise specified, all equipment bearings shall be oil or grease lubricated and ball or roller antifriction type of standard manufacture. Bearings shall be conservatively designed to withstand all stresses of the service specified. Each bearing, except as

otherwise noted, shall be rated in accordance with the latest revisions of Anti-Friction Bearing Manufacturer’s Association’s (AFBMA) Methods of Evaluating Load Ratings of Ball and Roller Bearings for B-10 rating life of 100,000 hours.

- B. All grease lubricated bearings, except those specified to be factory sealed lubricated, shall be fitted with easily accessible grease supply, flush, drain, and relief fittings of the standard hydraulic type. Extension tubes shall be provided for easy access.
- C. Oil-lubricated bearings shall be equipped with either a pressure lubricating system or a separate oil reservoir type system. Each oil lubrication system shall be of sufficient size to safely absorb the heat energy normally generated in the bearing under a maximum ambient temperature of 55°C and shall be equipped with a filler pipe and an external level gauge. Fittings for pressure lubrication shall be 1/4-inch straight type.
- D. To avoid work hardening or “Brinelling” damage from vibration, bearings shall be separately packed or otherwise suitably protected during transport.

1.7 LUBRICATION AND LUBRICATION FITTINGS

- A. Equipment shall be adequately lubricated by systems that require attention no more often than weekly during continuous operation. Lubrication systems shall not require attention during startup or shutdown and shall not waste lubricants. Lubricants of the type recommended by the equipment manufacturer shall be provided in sufficient quantity for consumption prior to completion of required testing and commissioning of equipment. Provide the ENGINEER at Substantial Completion of the Project or portion of the Project, 10 copies of a list showing the proper lubricants for each item of mechanical equipment, approximate quantities needed per year of continuous operation, and recommended lubrication intervals. Wherever possible, the types of lubricants shall be consolidated with the Manufacturer’s approval to minimize the number of different lubricants required for plant maintenance.
- B. Equipment and bearing lubrication fittings shall be extended with piping beyond obstructions, such as guards or covers, to provide ease of lubrication without disassembly of the unit.
- C. All lubrication fittings shall be constructed of Type 304L stainless steel and shall be brought to the outside of all equipment so they are readily accessible from the outside without the necessity of removing covers, plates, housing, or guards. Fittings shall be of button head type. Lubrication fittings shall be mounted together wherever possible and shall be made of factory-mounted multiple fitting assemblies. Fittings shall not be individual fittings field-mounted together.
- D. Lubrication: Food grade oil meeting NSF 61 for water applications.

1.8 EQUIPMENT BASES AND BEDPLATES

- A. A heavy cast iron, FRP, or stainless steel base shall be provided for each item of equipment that is to be installed on a concrete base, in accordance with the equipment Manufacturer's requirements. Equipment assemblies, unless otherwise specified or shown on the Drawings, shall be mounted on a single, heavy, cast iron, FRP, or stainless steel bedplate, in accordance with the equipment manufacturer's requirements. Bases and bedplates shall be provided with machined support pads, tapered dowels for alignment of mating or adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits. Seams and contact edges between stainless steel plates and shapes shall be continuously welded and ground smooth. Bedplate drain fittings shall be piped to the nearest sump or designated drainage area.
- B. After assembly and installation on the concrete base, each unit shall be leveled, using a precision level, and aligned in place but not grouted until after the initial fitting and alignment of connecting piping. Each unit shall then be grouted to the concrete base. Each base and bedplate shall be completely filled with grout, where applicable. The grout shall extend to the edge of each base or bedplate and shall be beveled at 45 degrees all around the unit. Grout exposed at horizontal surfaces shall be rounded to provide drainage to appropriate points. After grout has set, jacking screws shall be removed, and nuts on anchor bolts shall be tightened followed by an overall check on leveling and alignment. Should equipment not meet tolerances of leveling and alignment, as recommended by the Manufacturer, corrective measures shall be taken to obtain the tolerances required. Reciprocating equipment shall be grouted with non-shrinking epoxy grout, as specified under Section 03600, Grout.

1.9 EQUIPMENT GUARDS

- A. Belt or chain drives, fan blades, couplings, exposed shafts, and other moving or rotating parts shall be covered on all sides by guards conforming to the General Industry Safety Orders of the Arizona Division of Industrial Safety. The guards shall be fabricated from 15 USS gauge or heavier aluminum or Type 316 stainless steel. Each guard shall be designed for easy installation and removal. Necessary supports and accessories shall be provided for each guard. Guards in outdoor locations shall be designed to prevent the entrance of rain and dripping water. Drawings of the guards shall be submitted to the ENGINEER for approval prior to fabrication or delivery.
- B. CONTRACTOR shall secure guards in position by aluminum or Type 316 stainless steel braces or straps, securely fastened to floor, wall, or frame of the equipment. Fastenings shall permit easy removal for servicing the equipment.

1.10 EQUIPMENT DATA NAMEPLATES

- A. Manufacturers' nameplates shall meet requirements as stated in individual equipment specifications. Manufacturers' equipment data nameplates shall be stamped on Type 316 stainless steel and fastened to the equipment in an accessible location with No. 4 or

- larger oval head Type 316 stainless steel screws or drive pins. The nameplate shall include manufacturer's name, equipment model number, serial number, drive speed, motor horsepower, and rated capacity etc. Manufacturers' nameplates for pumps shall also include, at a minimum, rated total dynamic head, impeller size and capacity, where applicable.
- B. All storage tanks (steel, fiberglass and polyethylene), shall include a second sign with the description of the contents. The lettering on the sign shall be visible from at least ten feet.
 - C. Refer to Section 01630, Computerized Maintenance Management System Tags for CMMS Tag requirements.

1.11 WARNING SIGNS

- A. CONTRACTOR shall furnish and install permanent warning signs at all mechanical equipment, prior to startup, that may be started automatically or from remote locations. Signs shall be located near the equipment, in accordance with safety regulations, and shall be suitable for exterior use.
- B. Warning signs shall be colored yellow with black letters, on not less than 18 gauge vitreous enameling stock. Copy shall read:

**CAUTION:
THIS EQUIPMENT STARTS
AUTOMATICALLY**

- C. Each sign shall be clearly readable from a distance of 20 feet.
- D. Additional warning sign requirements are specified in Section 10400, Identification Devices.

1.12 EQUIPMENT PAINTING/COATINGS

- A. Surfaces requiring painting or coating for corrosion protection shall be smooth, free from sharp edges, burrs, and projections and shall have all welds ground smooth and all edges and corners of structural members rounded. Non-conformance shall be grounds for rejection of equipment, as determined by the ENGINEER.
- B. Equipment shall be shop-primed prior to delivery to the Work site, unless otherwise specified, in accordance with Section 09900, Painting.
- C. Surfaces of equipment, which will be inaccessible after assembly, shall be painted or otherwise protected before assembly by a method that provides protection for the life of the equipment. Furnish equipment to replace any equipment that the ENGINEER

determines to be damaged beyond repair by rust or mishandling, etc., while in storage or during installation by CONTRACTOR.

- D. Manufacturers' equipment or motor data nameplates shall not be painted.
- E. The equipment supplier shall certify, by a letter included with the equipment submittal, confirming that the proposed primer and finish coating used is compatible with the approved Division 9, Finishes, painting scheme. After delivery to the Work site, the equipment finished surfaces shall be inspected and evaluated. A final coat of paint shall be applied to all equipment in the field.
- F. Machined, polished, and other ferrous and non-ferrous surfaces that are not to be painted shall be coated with rust preventative compound, Dearborn Chemical "NO-Ox-Id", Houghton "Rust Veto 344," Rust-oleum "R9," or approved equal. Should rust occur during shipment or storage, responsibility for correction, as determined by the ENGINEER, belongs to CONTRACTOR.
- G. Copper, bronze, chromium plate, nickel, stainless steel, aluminum, monel metal, lead, lead coated copper, brass, and plastic are not to be painted or finished, unless otherwise specified or recommended by the manufacturer.
- H. All metallic surfaces requiring a shop applied primer shall be primed with an approved priming system that has been certified, by letter, as being compatible with the Division 9, Finishes, coating systems proposed and shall be applied in accordance with the recommendations of the paint manufacturer. Submittal for equipment shall include:
 - 1. Coating Manufacturer's "Cut-sheet" describing components, surface preparation requirements, recommended mil thicknesses, and application procedures for the proposed primer.
 - 2. A letter from the equipment supplier stating that he has confirmed that the proposed primers are compatible and that the primer will be applied in accordance with the coating Manufacturer's requirements. In addition, the letter shall certify that the appropriate surface preparations will be made prior to primer application.
- I. After delivery to the Work site, equipment surfaces shall be inspected and evaluated by the ENGINEER. Touch-up or complete removal of shop priming, by sandblasting or other approved method, may be required as determined by the ENGINEER based on the condition of the equipment primer prior to final, in place, finish coat application.
- J. Field touch-up, final surface preparation, and final finish coatings shall be applied by CONTRACTOR.

1.13 FACTORY TEST AND CERTIFICATION

- A. All equipment, devices, and systems requiring factory test and certification, as specified in these Specifications, may be witnessed by the OWNER. CONTRACTOR shall notify the ENGINEER, in writing, at least 30 calendar days in advance of all equipment,

devices and system testing. The written notifications shall specify the exact date and location of the tests that will be conducted and shall define the test procedures to be utilized. Testing procedure shall be scheduled and performed during normal working hours and shall be subject to review by the ENGINEER.

1.14 EQUIPMENT INFORMATION FORMS

- A. Complete Form 01600-A found in Section 01331, Reference Forms, for all equipment and devices that are specified in the Contract Documents. This includes each component mounted as a package, or “skid” mounted equipment and control panels. The completed Equipment Information Forms shall be included in the individual Operation and Maintenance Manuals.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01620

INSTALLATION OF EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section describes Work necessary to install equipment and materials to be incorporated into this Project. It supplements the Specification requirements in Division 2, Sitework, through Division 17, Instrumentation.
- B. Shop Drawings, installation drawings and instructions furnished by the Manufacturers shall be used by CONTRACTOR in the installation of the equipment and materials.

1.2 ANCHOR BOLTS AND GROUT

- A. Anchors and adhesive anchors shall be furnished by CONTRACTOR, as specified and required. Use adhesive anchors only where shown or approved by ENGINEER or required by the Manufacturer. Anchors and adhesive anchors shall be of specified materials with heavy hexhead nuts. Anchorage items shall conform to the applicable requirements of Section 05051, Anchor Bolts, Expansion Anchors, Toggle Bolts and Concrete Inserts.
- B. Grouting shall be in accordance with Section 03600, Grout, and Section 01600, General Equipment Provisions.

1.3 TRANSPORTING, HANDLING AND INSTALLING EQUIPMENT AND MATERIALS

- A. CONTRACTOR shall conform to requirements of Section 01600, General Equipment Provisions, and Section 01651, Transportation and Handling of Materials and Equipment.
- B. CONTRACTOR shall employ competent Mechanics experienced in the installation of the types of equipment and materials to be furnished, and shall ensure that all equipment and materials are installed in accordance with the recommendations of the Manufacturers.

1.4 EQUIPMENT ERECTION

- A. General: Conform to the following as a minimum:
 - 1. Use only mechanics, machinists or mill wrights skilled in the handling, setting, aligning, leveling and adjusting of the type of equipment and materials furnished.

2. Use only an oil bath heater to expand couplings, gears, etc. Do not force or drive them on equipment shafts, nor subject them to an open flame or torch.
 3. Wedging shall not be permitted. Use the least number of flat shims possible in leveling equipment. Shims shall be clean and free of slags. Provide all shims, filling pieces, keys, packing, red or white lead grout, or other materials necessary to properly align, level and secure apparatus in place. When requested by ENGINEER, CONTRACTOR shall demonstrate that all elements so required are level and plumb. Grind as necessary to bring parts to proper bearing after erection.
 4. Use proper tools in the assembly of equipment and materials to prevent deforming or marring the surface of shafts, nuts or other parts.
 5. Tighten connections requiring gaskets evenly all around to ensure uniform stress over the entire gasket area.
 6. Equipment and materials shall not be altered or repaired, and no burning or welding shall be permitted on any parts having machined surfaces, except by written permission of ENGINEER.
 7. No rigging shall be done from any structure without the permission of ENGINEER. Responsibility for any damage to the structure resulting from this operation, belongs to CONTRACTOR.
 8. Use tools, equipment and materials that shall not damage the structure or equipment.
 9. CONTRACTOR shall furnish and install plugs in lubrication holes to prevent entry of foreign material.
 10. Electrical work, testing, lubricating and painting shall all comply with requirements of the applicable Section.
- B. Setting and Erection:
1. All units shall be carefully set and aligned on their foundations, by qualified Millwrights, after their sole plates have been shimmed to true alignment at the anchor bolts. Anchor bolts shall be set in place and the nuts tightened against the shims. Bedplates or wing feet of the equipment shall be further checked after securing to the foundations and, after confirmation of all alignments, the sole plates shall be finally grouted in place. CONTRACTOR shall be responsible for the correct alignment of equipment with its associated piping. “Pipe springing” shall not be allowed.
 2. Misaligned holes shall be reamed. “Driving” of bolts or keys shall not be permitted.
- C. Jacking Screws and Anchor Bolts:
1. All equipment shall be anchored to supporting members by bolts or other connections to accommodate all operating forces and satisfy the seismic restraint requirements of the Phoenix Building Code for Zone 1 Seismic Area. Anchors shall provide resistance to a lateral force of at least 0.30 times the weight of the equipment, including its contents.
 2. Jacking screws shall be provided in the heavy equipment bases and bedplates, and where required elsewhere, to aid in leveling during installation.

3. Anchor bolt setting drawings shall be delivered sufficiently early to permit setting the anchor bolts when the structural steel support frame is fabricated by others.
 4. All anchor bolts and anchoring hardware shall be of Type 316 stainless steel. Adhesive anchors shall only be used where permitted by the ENGINEER and shall be Type 316 stainless steel. Alternate methods of anchoring to those shown on the Contract Documents shall meet the requirements of this Section and shall be submitted to the ENGINEER for review.
- D. Alignment and Leveling:
1. Field check all shafts, couplings and sheaves for alignment and adjust to Manufacturer's specifications where necessary.
 2. Couplings shall be aligned while the equipment is free from all external loads.
 3. Angular and parallel alignment shall be checked, and the actual alignment shall be recorded and submitted to ENGINEER. Alignment shall be within Manufacturer's recommended tolerance.
 4. Dial indicators shall be used for the checking of angular and parallel alignment. During rotation of the half couplings in performance of this test, they shall be maintained in the same relative position, and the dial indicator readings shall be taken at the same place on the circumference of the coupling.
- E. Threaded Connections:
1. Apply a molybdenum disulfide, anti-seize compound to all threads in mechanical connections such as bolts, studs, cap screws, tubing, etc., unless otherwise specified.
- F. Equipment Drive Guards:
1. Unless shown or specified otherwise, provide all equipment driven by open shafts, belts, chains, pulleys, sheaves, or gears with all-metal guards conforming to the requirements of Section 01600, General Equipment Provisions.

1.5 EQUIPMENT INSTALLATION

- A. CONTRACTOR shall obtain installation instruction booklets or other recommendations from the equipment Manufacturers as to procedures for, sequence of, and tolerances allowed in equipment installation. In particular, the Manufacturer's recommendations as to grout spaces required, type of grout to be used, and tolerances for level and alignment, both vertical and horizontal, shall be obtained and followed. One copy of this material shall be given to the ENGINEER prior to the installation of the equipment.
- B. Whenever applicable, CONTRACTOR shall obtain the services of a manufacturer's representative specifically trained in erection of his equipment to supervise the installation. Be responsible for the proper alignment of all installed driven equipment and drives in accordance with the tolerance recommendation of the manufacturers for both OWNER furnished and CONTRACTOR furnished equipment. Within 14 calendar days after installation, submit to the ENGINEER a letter from the Manufacturer, on the

- Manufacturer's letterhead, stating all equipment and components are installed in accordance with the Manufacturer's requirements and installation instructions as described in these Specifications.
- C. Skilled craftsmen experienced in installation of the equipment or similar equipment shall be used. Applicable specialized tools and equipment, such as precision machinist levels, dial indicators, and gauges shall be utilized as required in the installations. The Work shall be accomplished in a workmanlike manner to produce satisfactory equipment installation free of vibration or other defects.
 - D. CONTRACTOR shall install all OWNER furnished equipment in accordance with the installation instructions, Shop Drawings and submittals provided by the equipment manufacturers and available at the OWNER'S offices for CONTRACTOR'S use.
 - E. Prior to installation of equipment, all sacking and concrete preparation shall be completed and the Work area shall be maintained in a broom-clean condition during the equipment installation.
 - F. No equipment and materials shall be altered or repaired, and no burning or welding shall be permitted on any parts having machined surfaces, except by written permission of the ENGINEER.
 - G. No rigging shall be done from any structure without the permission of the ENGINEER. Responsibility for any damage to the structure resulting from this operation belongs to the CONTRACTOR.
 - H. Only such equipment and materials as will not damage the structure or equipment and materials shall be used on the Work.

1.6 SPECIAL TOOLS

- A. All special tools that are required to assemble, disassemble, repair, and maintain any item of equipment furnished under the terms of this Contract shall be furnished with the equipment. When special tools are provided, they shall be marked or labeled and a list of such tools shall be included with the maintenance and operation instructions for the equipment.

1.7 COORDINATION

- A. CONTRACTOR shall take all measurements for Work at the installation sites, verify all subcontractor's and manufacturer's drawings, shall be responsible for the proper installation within the available space of the apparatus specified and shown on the Drawings and shall inform the ENGINEER of any variations and shall submit all proposed changes for review before making any changes.

1.8 SERVICES OF MANUFACTURERS' REPRESENTATIVE

- A. Equipment furnished under Divisions 11, 13, 14, 15, 16 and 17 shall include the cost of competent, qualified representatives of manufacturers of all equipment to supervise the installation, adjustment and testing of the equipment and to instruct the OWNER'S operating personnel on operation and maintenance. The training time and additional requirements for furnishing services of manufacturers' representatives are specified in the appropriate Sections. If no time is specified, the training time shall be at least one day. Supervision may be divided into two or more time periods as required by CONTRACTOR'S schedule or as directed by ENGINEER.
- B. Upon completion of the equipment installation, submit "Equipment Information Form", Form 01600-A located in Section 01331, Reference Forms. The completed form shall also be included in the individual Operation and Maintenance Manuals.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01651

TRANSPORTATION AND HANDLING OF MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section includes the General Requirements for the Transportation and Handling of Products.
- B. CONTRACTOR shall make all arrangements for transportation, delivery and handling of equipment and materials required for prosecution and completion of the Work.
- C. Shipments of materials to CONTRACTOR or subcontractors shall be delivered to the site only during regular working hours and shall conform to the requirements of Section 01413, CONTRACTOR'S Hazardous Materials Management Program. Shipments shall be addressed and consigned to the proper party giving name of Project, street number and city. Shipments shall not be delivered to OWNER, except where otherwise directed.
- D. If necessary to move stored materials and equipment during construction, CONTRACTOR shall move materials and equipment without any additional compensation.

1.2 PREPARATION FOR SHIPMENT

- A. When practical, factory assemble products. Matchmark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with a strippable protective coating.
- B. Package products to facilitate handling and protect from damage during shipping, handling, and storage. Mark or label outside of each package or crate to indicate its purchase order number, bill of lading number, contents by name, OWNER'S contract name and number, CONTRACTOR, equipment number, and approximate weight. Include complete packing lists and bills of materials with each shipment.
- C. Protect products from exposure to the elements and keep thoroughly dry and dust free at all times. Protect painted surfaces against impact, abrasion, discoloration, or other damage. Grease or oil all bearings and similar items.
- D. Advance Notice to ENGINEER of Shipments: Upon receipt of manufacturer's advance notice of shipment, provide ENGINEER seven-day advance notice of anticipated date and place of arrival of the following:
 - 1. Vitrified Clay Pipe.

- E. Do not have products shipped until:
 - 1. Related Shop Drawings have been approved by ENGINEER.
 - 2. Related factory test results, required in the individual Specification Sections, have been reviewed and accepted by ENGINEER.
 - 3. Required storage facilities have been provided.
- F. Items shall be supported, packaged and stored in such a way so as not to impose undue stress/force to couplings, connections, supports, valves, equipment and instruments.

1.3 DELIVERY

- A. CONTRACTOR shall arrange, with the United States Postal Service, a special address for the Project. All deliveries shall be made to that address.
- B. CONTRACTOR shall arrange deliveries of products in accordance with construction schedules and in ample time to facilitate inspection prior to installation.
- C. CONTRACTOR shall coordinate deliveries to avoid conflict with Work and conditions on site and to accommodate the following:
 - 1. Work of other contractors, or OWNER.
 - 2. Limitations of storage space.
 - 3. Availability of equipment and personnel for handling products.
 - 4. OWNER'S use of premises.
- D. CONTRACTOR shall not have products delivered to Project site until related Shop Drawings have been approved by the ENGINEER.
- E. CONTRACTOR shall not have products delivered to Project site until required storage facilities have been provided.
- F. CONTRACTOR shall have products delivered to site in manufacturer's original, unopened, labeled containers. Keep ENGINEER informed of delivery of all equipment to be incorporated in the Work.
- G. CONTRACTOR shall have partial deliveries of component parts of equipment clearly marked to identify the equipment, to permit easy accumulation of parts and to facilitate assembly.
- H. Immediately on delivery, CONTRACTOR shall inspect shipment to assure:
 - 1. Product complies with requirements of Contract Documents and reviewed submittal.
 - 2. Quantities are correct.
 - 3. Containers and packages are intact, and labels are legible.
 - 4. Products are properly protected and undamaged.
 - 5. Verify that the accelerometer recordings were made during shipment.

- I. CONTRACTOR shall promptly remove damaged products from the Project site and expedite delivery of new undamaged products, and remedy incomplete or lost products to provide that specified, so as not to delay progress of the Work.

1.4 PRODUCT HANDLING

- A. CONTRACTOR shall provide equipment and personnel necessary to handle products, including those provided by OWNER, by methods to prevent soiling or damage to products or packaging.
- B. CONTRACTOR shall provide additional protection during handling as necessary to prevent scraping, marring or otherwise damaging products or surrounding surfaces.
- C. CONTRACTOR shall handle products by methods to prevent bending or overstressing.
- D. CONTRACTOR shall lift heavy components only at designated lifting points.
- E. Materials and equipment shall at all times be handled in a safe manner and as recommended by manufacturer or supplier so that no damage will occur to them. Do not drop, roll or skid products off delivery vehicles. Hand carry or use suitable materials handling equipment.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01661

STORAGE OF MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall store and protect materials in accordance with manufacturer's recommendations and requirements of Specifications.
- B. CONTRACTOR shall make all arrangements and provisions necessary for the storage of materials and equipment. All excavated materials, construction equipment, and materials and equipment to be incorporated into the Work shall be placed so as not to injure any part of the Work or existing facilities and so that free access can be maintained at all times to all parts of the Work and to all public utility installations in the vicinity of the Work. Materials and equipment shall be kept neatly and compactly stored in locations that will cause a minimum of inconvenience to other contractors, public travel, adjoining owners, tenants and occupants. Arrange storage in a manner to provide easy access for inspection.
- C. Areas available on the site for storage of materials and equipment shall be as shown or approved by the ENGINEER.
- D. Materials and equipment, which are to become the property of the OWNER, shall be stored to facilitate their inspection and ensure preservation of the quality and fitness of the Work, including proper protection against damage by freezing, moisture and summer temperatures with ambient temperatures as high as 120°F. They shall be placed in inside climate storage areas, unless otherwise acceptable to OWNER. When placing orders to suppliers for equipment and controls containing computer chips, electronics and solid-state devices, request and coordinate specific temperature limitations on equipment since cabinets and components stored in the summer can approach temperatures of 200°F.
- E. CONTRACTOR shall be fully responsible for loss or damage, including theft, to stored materials and equipment.
- F. CONTRACTOR shall not open manufacturer's containers until time of installation, unless recommended by the manufacturer or otherwise specified.
- G. CONTRACTOR shall not store products in the structures being constructed, unless approved in writing by the ENGINEER.

- H. Lawns, grass plots or other private property shall not be used for storage purposes without written permission of the OWNER or other person in possession or control of such premises.

1.2 PROTECTION

- A. Equipment shall be boxed, crated or otherwise completely enclosed and protected during shipment, handling and storage. Each container or piece of equipment shall be clearly marked with CONTRACTOR'S name, project name and location. Equipment shall be stored on raised supports protected from exposure to the elements and shall be kept thoroughly dry at all times. Pumps, motors, drives, electrical equipment, instrumentation equipment (controls, devices, panels, etc.) and other equipment having anti-friction or sleeve bearings shall be stored in weathertight storage facilities, such as warehouses. Covering with visquine or similar material shall not be considered as a weathertight enclosure.
- B. Painted surfaces shall be protected against impact, abrasion, discoloration and other damage. Painted equipment surfaces, which are damaged prior to acceptance, shall be repainted in entirety to the satisfaction of the ENGINEER.
- C. Electrical equipment, controls, and instrumentation shall be protected against moisture, water damage, heat or dust. Space heaters provided in the equipment shall be connected and operating at all times until equipment is placed in operation.
- D. Items shall be stored in such a way so as not to impose undue stress/forces to couplings, connections, supports, valves, equipment and instruments.

1.3 UNCOVERED STORAGE

- A. The following types of materials may be stored outdoors without cover:
 - 1. Masonry units.
 - 2. Reinforcing steel.
 - 3. Structural steel.
 - 4. Piping, except PVC.
 - 5. Precast concrete items.
 - 6. Castings.
- B. Store the above materials on wood blocking so there is no contact with the ground.

1.4 COVERED STORAGE

- A. The following types of materials may be stored outdoors if covered with material impervious to water:
 - 1. Rough lumber.
 - 2. Handrailing.
 - 3. PVC Piping.

- B. CONTRACTOR shall tie down covers with rope and slope to prevent accumulation of water on covers.
- C. CONTRACTOR shall store materials on wood blocking or skids.
- D. CONTRACTOR shall store loose granular materials, covered with materials impervious to water, in a well-drained area or solid surfaces to prevent mixing with foreign matter.

1.5 FULLY PROTECTED STORAGE

- A. CONTRACTOR shall store all products not named above in buildings or trailers which have a concrete or wooden floor, a roof, and fully closed walls on all sides.
- B. CONTRACTOR shall provide heated storage space for materials which could be damaged by freezing.
- C. CONTRACTOR shall provide air-conditioned storage space for materials that could be damaged by Arizona's severe high temperatures.
- D. CONTRACTOR shall protect mechanical and electrical equipment from being contaminated by dust, dirt and moisture.
- E. Maintain humidity at levels recommended by manufacturers for electrical and electronic equipment.

1.6 HAZARDOUS PRODUCTS

- A. CONTRACTOR shall prevent contamination of personnel, the storage area and the site. Comply with the requirements of the Specification Section 01413, CONTRACTOR'S Hazardous Materials Management Program, codes and manufacturer's instructions.

1.7 MAINTENANCE OF STORAGE

- A. CONTRACTOR shall maintain periodic system of inspection of stored products on a scheduled basis to assure that:
 - 1. State of storage facilities is adequate to provide required conditions.
 - 2. Required environmental conditions are maintained on a continuing basis.
 - 3. Products exposed to elements are not adversely affected.
- B. Mechanical and electrical equipment which require long term storage shall have complete manufacturer's instructions for servicing each item with notice of enclosed instructions shown on exterior of package.
 - 1. CONTRACTOR shall comply with manufacturer's instructions on a scheduled basis.
 - 2. Space heaters which are part of electrical equipment shall be connected and operated continuously until equipment is placed in service.

1.8 PANEL AND INSTRUMENTATION STORAGE

- A. All panels, microprocessor-based equipment and all other devices subject to damage or useful life decrease, because of temperatures below 40°F or above 100°F, relative humidity above 90 percent, or exposure to rain or exposure to blowing dust shall not be stored on site.
- B. Storage shall be in an insured, climate-controlled warehouse within Maricopa County. The OWNER shall have the right to inspect the equipment during normal working hours. Placed inside each panel or device shall be a desiccant, volatile corrosion inhibitor blocks (VCI), a moisture indicator and maximum-minimum indicating thermometer. The panels and equipment shall be checked once per month. The desiccant, VCI and moisture indicator shall be replaced as often as required or every six months, whichever occurs first. A certified record of the daily maximum and minimum temperature and humidity in the warehouse shall be available for inspection by the OWNER. A certified record of the monthly inspection, noting maximum and minimum temperature for the month, condition of desiccant, VIC and moisture indicator, shall also be available for inspection by the OWNER.
- C. All costs for the storage shall be at no additional cost to the OWNER. Any panel or device which has been damaged by any cause or for which the storage temperatures or humidity range has been exceeded shall be replaced at no additional cost to the OWNER and shall not be cause for a delay in Contract completion.
- D. The panels and equipment shall not be shipped to the site until field conditions are ready for installation, including all slabs, walls, roofs, and environmental controls. The failure to have the site ready for installation shall not relieve CONTRACTOR from conforming to all of the Contract requirements.

1.9 RECORDS

- A. CONTRACTOR shall keep a running account of products in storage to facilitate preparation of progress payments, if Agreement provides for payment for products delivered, but not installed in the Work.
- B. A record shall be kept of the storage requirements and a continuous maintenance log for all stored equipment. A tag shall be applied to each piece of equipment showing all service dates and who did the service.

CITY OF PHOENIX: Water Services Department
PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
PROJECT NUMBER: WS90500307 & WS90501004

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01721

PROTECTION OF THE WORK AND PROPERTY

PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall be responsible for taking all precautions, providing all programs, and taking all actions necessary to protect the Work and all public and private property and facilities from damage as specified in the General Conditions and herein.
- B. In order to prevent damage, injury or loss, CONTRACTOR'S actions shall include, but not be limited to, the following:
 - 1. Store apparatus, materials, supplies, and equipment in an orderly, safe manner that will not unduly interfere with the progress of the Work or the work of any other contractor or utility service company.
 - 2. Provide suitable storage facilities for all materials which are subject to injury by exposure to weather, theft, breakage, or otherwise.
 - 3. Place upon the Work or any part thereof only such loads as are consistent with the safety of that portion of the Work.
 - 4. Clean up frequently all refuse, rubbish, scrap materials, and debris caused by his operations, to the end that at all times the site of the Work shall present a safe, orderly and workmanlike appearance.
 - 5. Provide barricades and guard rails around openings, for scaffolding, for temporary stairs and ramps, around excavations, elevated walkways and other hazardous areas.
- C. CONTRACTOR shall not, except after written consent from proper parties, enter or occupy privately-owned land with personnel, tools, materials or equipment, except on easements provided herein.
- D. CONTRACTOR shall assume full responsibility for the preservation of all public and private property or facility on or adjacent to the site. If any direct or indirect damage is done by or on account of any act, omission, neglect or misconduct in the execution of the Work by CONTRACTOR, it shall be restored by CONTRACTOR, at his expense, to a condition equal to that existing before the damage was done.
- E. CONTRACTOR shall be responsible for any staking/roping needed to identify the contractual limits of construction activities.

1.2 BARRICADES AND WARNING SIGNALS

- A. Where Work is performed on or adjacent to any roadway, right-of-way, or public place, CONTRACTOR shall provide barricades, fences, lights, warning signs, danger signals, watchmen, and shall take other precautionary measures for the protection of persons or property and of the Work. Barricades shall be painted to be visible at night. From sunset to sunrise, furnish and maintain at least one light at each barricade. Sufficient barricades shall be erected to keep vehicles from being driven on or into Work under construction. Furnish watchmen in sufficient numbers to protect the Work. CONTRACTOR'S responsibility for the maintenance of barricades, signs, lights, and for providing watchmen shall continue until the Project is accepted by OWNER.

1.3 TREE AND PLANT PROTECTION

- A. CONTRACTOR shall protect existing trees, shrubs and plants on or adjacent to the site that are shown or designated to remain in place against unnecessary cutting, breaking or skinning of trunk, branches, bark or roots.
- B. Materials or equipment shall not be stored or parked within the drip line.
- C. Temporary fences or barricades shall be installed to protect trees and plants in areas subject to traffic.
- D. Fires shall not be permitted.
- E. Within the limits of the Work, water trees and plants that are to remain, in order to maintain their health during construction operations.
- F. CONTRACTOR shall cover all exposed roots with burlap which shall be kept continuously wet. Cover all exposed roots with earth as soon as possible. CONTRACTOR shall protect root systems from mechanical damage and damage by erosion, flooding, run-off or noxious materials in solution.
- G. If branches or trunks are damaged, CONTRACTOR shall prune branches immediately and protect the cut or damaged areas with emulsified asphalt compounded specifically for horticultural use in a manner approved by the ENGINEER.
- H. All damaged trees and plants that die or suffer permanent injury shall be removed and disposed of off-site when ordered by the ENGINEER and replaced by a specimen of equal or better quality.
- I. Coordinate Work in this Section with requirements of Section 02220, Demolition, and Section 02230, Clearing.
- J. CONTRACTOR shall erect and maintain temporary construction fence per the Contract Drawings to protect area from construction traffic and activities.

1.4 PROTECTION OF EXISTING STRUCTURES

A. Underground Structures:

1. Underground structures are defined to include, but are not limited to, all sewer, water, gas, and other piping, and manholes, chambers, electrical conduits, tunnels and other existing subsurface work located within or adjacent to the limits of the Work.
2. All underground structures known to ENGINEER, except water, gas, sewer, electric, and telephone service connections, are shown. This information is shown for the assistance of CONTRACTOR, in accordance with the best information available, but is not guaranteed to be correct or complete.
3. Explore ahead of trenching and excavation Work and shall uncover all obstructing underground structures sufficiently to determine their location, to prevent damage to them and to prevent interruption to the services which such structures provide. If CONTRACTOR damages an underground structure, he shall restore it to original condition at his expense.
4. Necessary changes in the location of the Work may be made by ENGINEER to avoid unanticipated underground structures.
5. If permanent relocation of an existing underground structure or other subsurface facility is required and is not otherwise provided for in the Contract Documents, ENGINEER will direct CONTRACTOR, in writing, to perform the Work, which shall be paid for under the provisions of the General Conditions.

B. Surface Structures:

1. Surface structures are defined as all existing buildings, structures and other facilities above the ground surface. Included with such structures are their foundations or any extension below the surface. Surface structures include, but are not limited to, buildings, tanks, walls, bridges, roads, dams, channels, open drainage, piping, poles, wires, posts, signs, markers, curbs, walks and all other facilities that are visible above the ground surface.

C. Protection of Underground and Surface Structures:

1. CONTRACTOR shall sustain in their places and protect from direct or indirect injury all underground and surface structures located within or adjacent to the limits of the Work. Such sustaining and supporting shall be done carefully and as required by the party owning or controlling such structure. Before proceeding with the Work of sustaining and supporting such structure, CONTRACTOR shall satisfy the ENGINEER that the methods and procedures to be used have been approved by the party owning same.
2. CONTRACTOR shall assume all risks attending the presence or proximity of all underground and surface structures within or adjacent to the limits of the Work. CONTRACTOR shall be responsible for all damage and expense for direct or indirect injury caused by his Work to any structure. Repair immediately all damage caused by his Work, to the satisfaction of the owner of the damaged structure.

- D. All other existing surface facilities, including but not limited to, guard rails, posts, guard cables, signs, poles, markers, and curbs, which are temporarily removed to facilitate installation of the Work, shall be replaced and restored to their original condition at CONTRACTOR'S expense.

1.5 PROTECTION OF FLOORS AND ROOFS

- A. CONTRACTOR shall protect floors and roofs during entire construction period.
- B. Proper protective covering shall be used when moving heavy equipment, handling materials or other loads, when painting, handling mortar and grout and when cleaning walls and ceilings.
- C. CONTRACTOR shall use metal pans to collect all oil and cuttings from pipe, conduit, or rod threading machines and under all metal cutting machines.
- D. Concrete floors less than 28 days old shall not be loaded without written permission of the ENGINEER. No floor, roof or slab shall be loaded in excess of its design loading.
- E. Roofs shall not be loaded without written permission of the ENGINEER.
- F. CONTRACTOR shall restrict access to roofs and keep clear of existing roofs, except as required by the Work.
- G. If access to roofs is required, roofing, parapets, openings and all other construction on or adjacent to roof shall be protected with suitable plywood or other approved means.

1.6 PROTECTION OF INSTALLED PRODUCTS AND LANDSCAPING

- A. CONTRACTOR shall provide protection of installed products to prevent damage from subsequent operations. Remove protection facilities when no longer needed prior to completion of Work.
- B. CONTRACTOR shall control traffic to prevent damage to equipment, materials and surfaces.
- C. CONTRACTOR shall provide coverings to protect equipment and materials from damage.
 - 1. Cover projections, wall corners and jambs, sills and soffits of openings, in areas used for traffic and for passage of products in subsequent work.

CITY OF PHOENIX: Water Services Department
PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
PROJECT NUMBER: WS90500307 & WS90501004

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01722

FIELD ENGINEERING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. The CONTRACTOR will establish a base line for the Project and two benchmarks for use by the ENGINEER and CONTRACTOR during the project. The ENGINEER and CONTRACTOR will coordinate the location of the benchmarks and base line to suit the Work.
- B. CONTRACTOR shall:
1. Develop and make all detail surveys and measurements needed for construction including slope stakes, batter boards, and all other working lines, elevations and cut sheets.
 2. Provide all material required for bench marks, control points, batter boards, grade stakes, structure and pipeline elevation stakes, and other items.
 3. Be solely responsible for all locations, dimensions and levels. No data other than written orders of the ENGINEER shall justify departure from the dimensions and levels required by the Contract Documents.
 4. Safeguard all points, stakes, grade marks, monuments and bench marks made or established on the Work. Re-establish same with the exception of primary control monuments if disturbed and rectify all Work improperly installed because of not maintaining, not protecting or removing without authorization established points, stakes, marks and monuments.
 5. Provide such facilities and assistance as may be necessary for ENGINEER to check line and grade points placed by CONTRACTOR. Do not perform any excavation or embankment work until all cross-sectioning necessary for determining pay quantities has been completed and checked by ENGINEER.
 6. CONTRACTOR shall provide notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the Work. If CONTRACTOR observes that the Contract Documents are at variance therewith, promptly notify the ENGINEER, in writing.

1.2 CONTRACTOR'S DAILY REPORTS

- A. CONTRACTOR shall provide:
1. Provide daily reports of Project activity. Reports to be submitted to the ENGINEER with all pertinent information pertaining to the project as follows:
 - a. Number of employees.
 - b. Subcontractor employees.
 - c. Breakdown of employees by trades.

- d. Major equipment and materials installed.
 - e. Major construction equipment utilized.
 - f. Location of all areas in which construction was done.
 - g. Materials and equipment received.
 - h. Work and tests performed.
 - i. Weather conditions.
 - j. Safety.
 - k. Delays.
 - l. Instructions received.
2. CONTRACTOR shall submit two copies of CONTRACTOR'S daily reports. The daily report is due at the ENGINEER'S field office by 9:00 a.m. the next working day after the Work was performed and shall be signed by a responsible member of CONTRACTOR'S staff.
 3. CONTRACTOR shall check all formwork, reinforcing, inserts, structural steel, bolts, sleeves, piping, other materials and equipment.
 4. CONTRACTOR shall maintain field office files and drawings, Record Drawings, and coordinate engineering services with subcontractors. Prepare layout and coordination drawings for construction operations.
 5. CONTRACTOR shall check and coordinate Work for conflicts and interferences and immediately advise ENGINEER of all discrepancies noted.
 6. CONTRACTOR shall cooperate with ENGINEER in field inspections, as required.
 7. CONTRACTOR shall review and coordinate Shop Drawings and other submittals.

1.3 CONTRACTOR'S SURVEYOR

- A. CONTRACTOR shall employ and retain, as needed and requested by the ENGINEER at the Work site a surveyor with the experience and capability of performing all surveyor and layout tasks required of CONTRACTOR. The surveyor shall be a land surveyor registered in the State of Arizona. Tasks included are:
 1. CONTRACTOR shall provide all surveying equipment required including transit, level, stakes and required surveying accessories.
 2. CONTRACTOR shall furnish all required lines and grades for construction of all facilities, structures, pipelines and site improvements.
 3. CONTRACTOR shall keep professional, accurate, well organized, and legible notes of all measurements and calculations made while surveying and laying out the Work.
 4. CONTRACTOR shall survey, locate, and record and redline Drawings to accurately represent all utilities and buried structures prior to backfilling.
- B. Any primary control survey monuments damaged or destroyed, will be re-established by the ENGINEER, at CONTRACTOR'S expense.
- C. CONTRACTOR shall perform such surveys and computations as are necessary to determine quantities of Work performed or placed during each progress payment period,

and shall perform all surveys necessary for the ENGINEER to determine final quantities of Work in place.

- D. CONTRACTOR shall notify the ENGINEER at least 24 hours before performing a quantity survey and, unless waived in writing by the ENGINEER, quantity surveys shall be performed in the presence of the ENGINEER.
- E. From established primary control points, establish all lines and grades, and elevations necessary to control the Work, and shall be responsible for all measurements that may be required for execution of the Work to the tolerances prescribed in the Contract Documents.
- F. Establish, place, and replace as required, such additional stakes, markers, and other controls as may be necessary for control, intermediate checks, and guidance of construction operations.
- G. Upon completion of the final grade, CONTRACTOR shall perform a survey as-built of the project disturbed areas to confirm that the final grade matches the contract drawings. The survey shall be at 1-foot contours and shall identify all exposed yard piping, valve boxes, electrical equipment, facility corners (i.e. facility pump station corners, PRV station corners, building corners, etc), retention basin, and existing booster station, sewage lift station, or PRV station outline and centerline of exposed piping. The CONTRACTOR shall submit the point file and a base file to the ENGINEER with the as-built drawings. In the event the finished grade determined by the survey does not match the contract drawings or if there are low spots that cause a drainage issue such as ponding, the CONTRACTOR shall re-grade the area at their own expense until the area is corrected and satisfied by the ENGINEER and OWNER.
- H. Upon completion of buried piping and electrical ductbank installation and prior to backfill, CONTRACTOR shall perform a survey and provide survey point data for the centerline of all piping, for the width of electrical ductbanks, changes of elevation, changes in width or pipe size, at each direction change, at valves and fittings, and at a minimum of 25-ft intervals on straight runs. CONTRACTOR shall provide a point file identifying location by northing, easting, and elevation and be included with the as-built documents in AutoCAD format, version 2012.

1.4 SURVEYING

- A. CONTRACTOR shall follow the following construction surveying guidelines for this project:
 - 1. Alignment Staking: Each 50 feet on tangent; each 25 feet on curves.
 - 2. Slope Staking: Each 50 feet on tangent; each 25 feet on curves; restake every 10 feet in elevation.
 - 3. Structure: Stake out structures, including elevations; checkouts prior to and during construction.

4. Pipeline: Stake out pipelines including elevations; checkout prior to and during construction. Survey shots shall be taken on pipeline change of elevation and direction and shall be as-built.
 5. Road: Tops each 50 feet on tangent and each 25 feet on curves.
 6. Cross-Section: Original, final and intermediate as required, for the structure sites and other locations as necessary for quantity surveys.
 7. Easement Staking: Each 50 feet on tangent; each 25 feet on curves. Also wooden laths with flagging at 100 feet maximum spacing.
 8. Record Staking: Provide permanent stake where blind flanges or caps are provided for future connecting, with a material acceptable to the ENGINEER.
 9. Survey shots shall be taken on all duct bank change of elevation and direction and shall be as-built.
- B. Temporary survey references set by CONTRACTOR for CONTRACTOR'S own use shall be established to at least second order accuracy (e.g., 1:10000). Construction staking used as a guide for the actual Work shall be set at least third order accuracy (e.g., 1:5000). The basis on which such orders are established shall be sufficient to provide the absolute margin for error specified below.
- C. The horizontal accuracy of easement staking shall be plus or minus 0.1 feet. The accuracy of all other staking shall be plus or minus 0.04 feet horizontally and plus or minus 0.02 feet vertically.
- D. Survey calculations shall include an error analysis sufficient to demonstrate the required accuracy.
- E. Survey Records:
1. Maintain a complete, accurate log of all control and survey Work as it progresses.
 2. All survey data shall be in accordance with recognized professional surveying standards. All original field notes, computations, and other surveying data shall be recorded by CONTRACTOR'S surveyor in CONTRACTOR furnished hard-bound field books, and shall be signed and sealed by CONTRACTOR'S surveyor. The completeness and accuracy of all survey Work, and the completeness and accuracy of the survey records, including the field books, shall be the responsibility of CONTRACTOR. Failure to organize and maintain survey records in a professional manner to allow reasonable and independent verification of all calculations by the ENGINEER, and to allow reasonable identification by the ENGINEER of all elevations, dimensions, and grades of the Work shall be cause for rejection of the survey records, including the field books.
 3. Illegible notes or data, or erasures on any page of the field books are not acceptable. Copied notes or data shall not be permitted. Corrections by ruling or lining out errors will be satisfactory only if initialed by the surveyor. Violation of the above may require resurveying the data in question.
- F. Survey Submittal:

1. Survey submittal shall be made as described herein. Submittal shall be signed and sealed by CONTRACTOR'S surveyor and shall include:
 - a. A complete survey plan that shall be submitted ten days prior to beginning survey Work.
 - b. Resumes shall be submitted of the Registered Land Surveyors conducting the Work ten days prior to beginning survey Work. During the course of the Work, a resume shall be submitted for each new Registered Land Surveyor working on the project at least ten days prior to the beginning of Work by such new Registered Land Surveyor.
 - c. A sample of the proposed survey field books to be maintained by CONTRACTOR'S surveyor. The sample shall have sufficient information and detail, including example calculations and notes, to demonstrate that the field books will be organized and maintained in a professional manner, meeting the requirements of Article 1.3 and Article 1.4 of this Section.
 - d. The original field books shall be submitted within two days upon completion of the Work.

1.5 SOILS AND MATERIAL TESTING

- A. Refer to 00700 General Requirements for Soils and Materials Testing.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01723

CUTTING AND PATCHING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section includes administrative and procedural requirements for the cutting and coring, and rough and finish patching of holes and openings in existing construction.
- B. The CONTRACTOR shall adhere to all applicable safety guidelines in accordance with Federal, State and local ordinances.
- C. All cutting, coring and rough patching shall be performed by CONTRACTOR requiring the opening. Finish patching shall be the responsibility of CONTRACTOR and shall be performed by the trade associated with the application of the particular finish.
- D. CONTRACTOR shall provide cutting, coring, fitting and patching, including attendant excavation and backfill required to complete the Work, or to:
 - 1. Remove and replace defective Work or Work not conforming to requirements of the Contract Documents.
 - 2. Remove samples of installed Work as specified or required for testing.
 - 3. Remove all constructions required to provide for specified alterations or addition to existing work.
 - 4. Uncover Work to provide for ENGINEER'S observation of covered Work or observation by regulatory agencies having jurisdiction.
 - 5. Connect to completed Work that was not accomplished in the proper sequence.
 - 6. Remove or relocate existing utilities and pipes that obstruct the Work in locations where connections must be made.
 - 7. Make connections or alterations to existing or new facilities.
- E. CONTRACTOR shall coordinate the requirements of the Work in this Section along with the requirements of the Sections listed below which includes Work that is directly related to this Section.
 - 1. Division 2, Site Work, through 17, Instrumentation, Sections for specific requirements and limitations applicable to cutting and patching individual parts of the Work.

1.2 QUALITY ASSURANCE

- A. Structural Work: CONTRACTOR shall not cut or patch structural elements in a manner that would change their load-carrying capacity as load-deflection ratio.

- B. Operating Elements: CONTRACTOR shall not cut or patch operating elements in a manner that would result in reducing their capacity to perform as intended. Do not cut or patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.

1.3 SUBMITTALS

- A. CONTRACTOR shall submit a written request to ENGINEER well in advance of executing any cutting or alteration which affects:
1. Design function or intent of Project.
 2. Work of OWNER or any other contractor.
 3. Structural value or integrity of any element of the Project.
 4. Integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
 5. Efficiency, operational life, maintenance or safety of operational elements.
 6. Visual qualities of sight-exposed elements.
- B. Request shall include:
1. Identification of Project.
 2. Description of affected Work of CONTRACTOR and work of others.
 3. Necessity for cutting.
 4. Effect on work of OWNER or any other contractor, or on structural or weatherproof integrity of Project.
 5. Description of proposed Work, describing:
 - a. Scope of cutting and patching.
 - b. Trades who will be executing the Work.
 - c. Products proposed to be used.
 - d. Extent of refinishing.
 - e. Schedule of operations.
 6. Alternatives to cutting and patching, if any.
 7. Designation of party responsible for cost of cutting and patching, when applicable.
 8. Written permission of any other contractor whose work will be affected.
- C. Should conditions of Work, or schedule, CONTRACTOR shall indicate a change of materials or methods, submit written recommendation to ENGINEER, including:
1. Conditions indicating change.
 2. Recommendations for alternative materials or methods.
 3. Submittals as required for substitutions.
- D. CONTRACTOR shall submit written notice to ENGINEER, designating time Work will be uncovered, to provide for observation. Do not begin cutting or patching operations until authorized by ENGINEER.
- E. CONTRACTOR shall conform to all applicable specifications for application and installation of materials used for patching.

- F. Shop Drawings: Submit for approval the following:
1. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
 2. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
 3. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

1.4 WARRANTY

- A. CONTRACTOR shall replace, patch and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials in such a manner as to not void required or existing warranties.

PART 2 - PRODUCTS

2.1 MATERIALS, GENERAL

- A. Use materials identical to existing materials. For exposed surfaces, use materials that visually match existing adjacent surfaces to fullest extent possible. If identical materials are unavailable or cannot be used, use materials whose installed performance will equal or surpass that of existing materials.

PART 3 - EXECUTION

3.1 GENERAL

- A. Perform all cutting and coring in such a manner as to limit the extent of patching.
- B. Core drill all holes to be cut through concrete and masonry walls, slabs or arches, unless otherwise approved by the ENGINEER.

3.2 INSPECTION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed before cutting.
- B. Report unsatisfactory or questionable conditions to ENGINEER, in writing. Do not proceed with Work until the ENGINEER has provided further instructions.

3.3 PREPARATION

- A. Provide temporary support as required to maintain structural integrity of Project, to protect adjacent Work from damage during cutting, and to support the Work to be cut.
- B. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of the Project that will be exposed during cutting and patching operations.
 - 1. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
 - 2. Do not cut existing pipe, conduit or ductwork serving facilities scheduled to be removed or relocated until provisions have been made to bypass them.

3.4 CORING

- A. Perform coring with a non-impact rotary tool using diamond core drills. Size holes for pipe, conduit, sleeves, equipment or mechanical seals, as required.
- B. Protect existing equipment, utilities and adjacent areas from water and other damage covered by drilling operations.
- C. Vacuum or otherwise remove slurry or tailings from the Work area following drilling.

3.5 CUTTING

- A. Cut existing construction using methods least likely to damage elements retained or adjoining construction and that will provide proper surfaces to receive installation or repair.

1. In general, use hand or small power tools designed for sawing or grinding, not hammering and chopping.
2. Cut through concrete and masonry using a concrete wall saw with diamond saw blades.
 - a. Provide for control, on both sides of walls, of slurry generated by sawing.
- B. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Provide temporary covering over openings where not in use.
- C. To avoid marring existing finished surfaces, cut or drill from exposed or finished side into concealed side.
- D. Provide adequate bracing of area to be cut prior to start of cutting.
- E. Provide equipment of adequate size to remove cut panel.

3.6 PATCHING

- A. Patch construction by filling, repairing, refinishing, closing-up and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible. Provide materials and comply with installation requirements specified, in other Sections of these Specifications.
- B. Where feasible, test patched areas to demonstrate integrity of installation.
- C. Fit Work airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.
- D. Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will eliminate evidence of patching and refinishing.
 1. For continuous surfaces, refinish to nearest intersection.
 2. For an assembly, refinish entire unit.
- E. Patch, repair or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.

3.7 CLEANING

- A. Clean areas and spaces where cutting, coring and patching are performed. Clean piping, conduit or similar constructions before applying paint or other finishing materials. Restore damaged pipe covering to original condition.

++ END OF SECTION ++

SECTION 01724

CONNECTIONS TO EXISTING FACILITIES

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Perform all construction necessary to complete connections and tie-ins to existing facilities.
- B. Keep existing facilities in operation unless otherwise specifically permitted in these Specifications or approved by OWNER.
- C. Perform all construction activities so as to avoid interference with operations of the facility and the work of others.

1.2 BYPASSING

- A. Bypassing or interruption of flow will be permitted only for brief intermittent periods necessary to make the connections, as outlined below:
 - 1. Installation of junction structure connection to the existing 47th Ave sewer line.

1.3 SEQUENCING AND OPERATIONS

- A. All operations of existing valves and gates required for the Work shall be done by OWNER.
- B. Insofar as possible, all equipment shall be tested and in operating condition before the final tie-ins are made to connect equipment to the existing facility.
- C. Carefully coordinate all Work and schedules and shall provide OWNER written notice at least 120 hours before shut-downs or by-passes are required.
- D. Work Sequence: Sequence of Work and Schedule of Completion is specified under Section 01111, Schedule of Completion, Section 01143, Coordination with OWNER'S Operations, and shown on the Construction Sequence Diagrams included in the Drawings.

1.4 SUBMITTALS

- A. For any tie-ins/connections or required shutdowns to existing mains and systems, the CONTRACTOR shall submit a shutdown/tie-in plan to Water Distribution personnel and Engineering and shall be approved at least two weeks prior to the start of the event.

- The plan shall include dates, durations, procedures, staffing, and any other information pertinent to shutting down the system and connecting to a new system.
- B. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01731

INSTALLATION DATA

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Installation data is defined as written instructions; drawings; illustrative, wiring and schematic diagrams; diagrams identifying external connections, terminal block numbers and internal wiring; and all other such information pertaining to installation of materials and equipment that is not furnished with Shop Drawings. Included are all printed manufacturers installation instructions, including those that may be attached to equipment and for which approval by the ENGINEER is not required.

1.2 SUBMITTALS

- A. CONTRACTOR shall submit four copies of all such data to the ENGINEER for each piece of equipment which he furnishes and for all other construction products for which such information is available from manufacturer. Data shall be acceptably identified and accompanied with a letter of transmittal. Three copies shall be transmitted to the ENGINEER, in accordance with Section 01332, Shop Drawing Procedures, and one copy shall be transmitted to the ENGINEER at the Engineer's Field office. Copies shall be transmitted at least two weeks prior to the start of the equipment installation.
- B. A copy of the installation data shall be provided in each copy of the Operation and Maintenance Manuals for the covered materials and equipment.
- C. Shop Drawings: Submit for approval the following:
1. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
 2. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
 3. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for

determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

- D. CONTRACTOR shall submit hard copies and soft copy per Specification Section 01332, Shop Drawing Procedures. Soft copies shall be in CD format and shall include all information provided in hard copy. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01751

STARTING AND PLACING EQUIPMENT IN OPERATION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall initially start-up and place all equipment installed into successful operation according to manufacturer's written instructions and as instructed by manufacturer's field representative. CONTRACTOR shall provide all material, labor, tools, equipment, chemicals, lubricants, and expendables required to complete start-up.
- B. No system or subsystem shall be started up for continuous operation unless all components of that system or subsystem, including instrumentation, have been tested and proven to be operable as intended by the Contract Documents.
- C. General Activities Include:
 - 1. Cleaning.
 - 2. Removing temporary protective coatings.
 - 3. Flushing and replacing greases and lubricants, where required by manufacturer.
 - 4. Lubrication.
 - 5. Check shaft and coupling alignments and reset where needed.
 - 6. Check and set motor, pump and other equipment rotation, safety interlocks, and belt tensions.
 - 7. Check and correct if necessary leveling plates, grout, bearing plates, anchor bolts, fasteners, and alignment of piping which may put stress on pumping equipment connected to it.
 - 8. All adjustments required.
- D. Provide chemicals and lubricants and all other required operating fluids.
- E. Provide fuel, electricity, water, filters, and other expendables required for start-up of equipment, unless otherwise specified.
- F. OWNER shall provide sufficient personnel to assist CONTRACTOR in the start-up, but the prime responsibility for proper mechanical operation shall belong to CONTRACTOR. Manufacturer's representatives shall be present during initial start-up and operation, unless otherwise acceptable to ENGINEER.
- G. Start-up of either the heating or air conditioning systems is dependent upon the time of year that the start-up is initiated. CONTRACTOR shall make arrangements with OWNER to return at the beginning of the next heating or air conditioning season (whichever is applicable) to start the appropriate system.

- H. No system, unit process or any piece of equipment shall be started up for continuous operation without the approved Operation and Maintenance Manuals being turned over to the OWNER.
- I. Training shall be provided prior to turning the operation of a system, unit process or piece of equipment over to the OWNER. Training shall be scheduled for each plant staff work shift accordingly. Training shall conform to the requirements of Section 01821, Instruction of Operations and Maintenance Personnel.
- J. Completion of start-up shall be when the OWNER assumes responsibility for operation of the equipment. If the OWNER does not assume operational responsibility and in the opinion of the ENGINEER start-up tasks are completed, the ENGINEER will notify CONTRACTOR, in writing, of the completion of the start- up period.

1.2 MINIMUM START-UP REQUIREMENTS

- A. Bearings and Shafting:
 - 1. Inspect for cleanliness, and clean and remove all foreign materials.
 - 2. Verify alignment.
 - 3. Replace defective bearings and those which run rough or noisy.
 - 4. Grease as necessary and in accord with Manufacturer's recommendations.
- B. Drives:
 - 1. Adjust tension in V-belt drives, and adjust varipitch sheaves and drives for proper equipment speed.
 - 2. Adjust drives for alignment of sheaves and V-belts.
 - 3. Clean and remove foreign materials before starting operation.
- C. Motors:
 - 1. Check each motor for comparison to amperage manufacturer nameplate value.
 - 2. Correct conditions which produce excessive current flow and exist due to equipment malfunction.
- D. Pumps:
 - 1. Check glands and seals for cleanliness and adjustment before running pump.
 - 2. Inspect shaft sleeves for scoring.
 - 3. Inspect mechanical faces, chambers, and seal rings, and replace if defective.
 - 4. Verify that piping system is free of dirt and scale before circulating liquid through the pump.
- E. Valves:
 - 1. Inspect both hand and automatic control valves, and clean bonnets and stems.
 - 2. Tighten packing glands to assure no leakage, but permit valve stems to operate without galling.
 - 3. Replace packing in valves to retain maximum adjustment after system is determined to be complete.

4. Replace packing on any valve that continues to leak.
 5. Remove and repair bonnets that leak.
 6. Coat packing gland threads and valve stems with a surface preparation of “Moly-Cote” or “Fel-Pro” after cleaning.
- F. Verify that control valve seats are free from foreign material and are properly positioned for intended service.
- G. Tighten flanges and all other pipe joints after system has been placed in operation.
- H. Replace gaskets which show any sign of leakage after tightening.
- I. Inspect all joints for leakage.
1. Promptly remake each joint that appears to be faulty; do not wait for rust to form.
 2. Clean threads on both parts, and apply compound and remake joints.
- J. After system has been placed in operation, clean strainers, drives, pockets, orifices, valve seats and headers in fluid system to assure freedom from foreign materials.
- K. Open steam traps and air vents, where used, and remove operating elements.
- L. Clean thoroughly, replace internal parts and put back into operation.
- M. Remove rust, scale and foreign materials from equipment and renew defaced surfaces.
- N. Set and calibrate draft gages of air filters and other equipment.
- O. Inspect fan wheels for clearance and balance.
1. Provide factory-authorized personnel for adjustment when needed.
- P. Check each electrical control circuit to assure that operation complies with Specifications and requirements and to provide desired performance.
- Q. Inspect each pressure gage and thermometer for calibration.
1. Replace items which are defaced, broken, or which read incorrectly.
- R. Repair any damaged insulation.
- S. Vent gasses trapped in any part of systems.
1. Verify that liquids are drained from all parts of gas or air systems.

CITY OF PHOENIX: Water Services Department
PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
PROJECT NUMBER: WS90500307 & WS90501004

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01752

EQUIPMENT AND SYSTEM STARTUP AND PERFORMANCE TESTING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. This Section contains requirements for CONTRACTOR'S performance in documenting testing Work required under this Contract. In addition, this Section contains requirements for CONTRACTOR'S performance testing during installed startup and performance testing of all mechanical, electrical, instrumentation, and HVAC equipment and systems. This Section supplements, but does not supersede specific testing requirements, found elsewhere in the Contract Documents.
- B. Upon completion of design, CONTRACTOR shall submit a testing, startup and commissioning plan, and schedule to the OWNER for review and approval prior to any system or equipment startup. There shall be a minimum of three (3) 3-hour work sessions to work through the development of a thorough testing plan. A draft testing, startup and commissioning plan shall be submitted to the OWNER and ENGINEER for review and comment at 30 percent of project construction. A revised draft of the plan shall be submitted to the OWNER and ENGINEER for review and comment at 60 percent of project construction. A final plan shall be submitted at 90 percent of project construction.
- C. Refer to the City of Phoenix Equipment Setup/System Testing Guidance Manual (Guidance Manual) to assist in development of a testing program that will fulfill the requirements of the specification.

1.2 QUALITY ASSURANCE

- A. CONTRACTOR'S Quality Assurance Manager: CONTRACTOR shall appoint an operations engineer or equally qualified operations specialist as Quality Assurance Manager to manage, coordinate, and supervise CONTRACTOR'S Quality Assurance Program. The Quality Assurance Manager shall have at least five years of total experience, or experience on at least five separate projects, in managing the startup and performance testing of mechanical, electrical, instrumentation, HVAC, and piping systems. Operations engineers shall be graduates from a minimum four year course in mechanical or civil engineering. Operations specialists shall have equivalent experience in plant operation and maintenance. The quality assurance program shall include:
 - 1. A testing plan setting forth the sequence in which all testing Work required under the Contract Documents will be implemented.
 - 2. A documentation program to record the results of all equipment and system tests.

3. An installed startup and performance testing program for all mechanical, electrical, instrumentation, and HVAC equipment and systems installed under this Contract.
 4. A calibration program for all instruments, meters, monitors, gages, and thermometers installed under this Contract.
 5. A calibration program for all instruments, gages, meters, and thermometers used for determining the performance of equipment and systems installed under this Contract.
 6. A testing schedule conforming to the requirements specified in Paragraph 2.2 C., below.
- B. For the purposes of this Section, a system shall include all required items of equipment, devices and appurtenances connected in such a fashion as their operation or function complements, protects or controls the operation or function of the others. The Quality Assurance Manager shall coordinate through the CONTRACTOR the activities of all subcontractors and suppliers to implement the requirements of this Section.
- C. Calibration:
1. All test equipment (gages, meters, thermometers, analysis instruments, and other equipment) used for calibrating or verifying the performance of equipment installed under this Contract shall be calibrated and certified to within plus or minus two percent of actual value at full scale. Test equipment employed for individual test runs shall be selected so that expected values as indicated by the detailed performance specifications will fall between 60 and 85 percent of full scale. Pressure gages shall be calibrated in accordance with ANSI/ASME B40.1. Thermometers shall be calibrated in accordance with ASTM E77 and shall be furnished with a certified calibration curve.
 2. Liquid flow meters, including meters installed in pipelines with diameters greater than 2-inches shall be calibrated insitu using either the total count or dye dilution methods, as approved by the ENGINEER. Gas flow meters installed in piping systems with diameters greater than 6-inches shall be calibrated insitu using the pitot tube velocity averaging method. Flow meter calibration work shall be performed by individuals skilled in the techniques to be employed. Calibration tests for flow metering systems shall be performed over a range of not less than 10 percent to at least 75 percent of system full scale. At least five confirmed valid data points shall be obtained within this range. Confirmed data points shall be validated by not less than three test runs with results which agree within plus or minus two percent.
- D. References:
1. This Section contains references to the following documents. They are a part of this Section as specified and modified. In case of conflict between the requirements of this Section and those of the listed documents, the requirements of this Section shall prevail.
 2. Unless otherwise specified, references to documents shall mean the documents in effect at the time of Advertisement for Bids or Invitation to Bid. If referenced

documents have been discontinued by the issuing organization, references to those documents shall mean the replacement documents issued or otherwise identified by that organization or, if there are no replacement documents, the last version of the document before it was discontinued. Where document dates are given in the following listing, references to those documents shall mean the specific document version associated with that date, whether or not the document has been superseded by a version with a later date, discontinued or replaced.

3. Equipment Setup / System Testing Guidance Manual should be used as a resource to assist with understanding the detail the OWNER is requiring to ensure all equipment and system are operational with respect to the contract documents. The Guidance Manual shows how to assemble a systematic equipment and system testing program that will satisfy the contract requirement. The Guidance Manual shall be used as a tool to assist the development of an equipment setup, testing plans, and documentation binder. The Guidance Manual is not all encompassing requirements that will need to be added to the document, plus modification to the type of project, refer to project specifications for additional information.

<u>Reference</u>	<u>Title</u>
ANSI/ASME B40.1	Gauges Pressure Indicating Dial Type--Elastic Element
ASTM E77	Method for Verification and Calibration of Liquid-in-Glass Thermometers
ASHRAE 41.8	Standard Methods of Measurement of Flow of Gas
City of Phoenix	Guidance Manual Equipment Setup / System Testing Plan

1.3 SUBMITTALS

- A. Submit for approval the following:
 1. A complete description of CONTRACTOR'S plan for documenting the results from the test program in conformance with the requirements of Paragraph 2.2.A., below, including:
 - a. Proposed plan for documenting the calibration of all test instruments.
 - b. Proposed plan for calibration of all instrument systems, including flow/level meters and all temperature, pressure, weight, and analysis systems.
 - c. Sample forms for documenting the results of field pressure and performance tests. Forms located in Section 01331, Reference Forms.
 - d. A list of all CMMS Tag numbers as provided in Section 01630, Computerized Maintenance Management System Tags.
 2. The credentials and certification of the testing laboratory proposed by CONTRACTOR for calibration of all test equipment.

3. Pre-startup check out procedures, reviewed and approved by the respective equipment manufacturers.
4. Detailed testing plans, setting forth step-by-step descriptions of the procedures proposed by CONTRACTOR for the systematic startup and performance testing of all equipment and systems installed under this Contract.
5. A schedule and subsequent updates, presenting CONTRACTOR'S plan for startup and performance testing the equipment and systems installed under this Contract.
6. A schedule establishing the expected time period (calendar dates) when CONTRACTOR plans to commence performance testing of the completed systems, along with a description of the temporary systems and installations planned to allow operational testing to take place.
7. A summary of the Quality Assurance Manager's qualifications, conforming to the requirements of Paragraph 1. 2. A, above.
8. All records produced during the startup and testing program.
9. Systems or unit process or any piece of equipment shall not be started up without the approved Operation and Maintenance Manuals being turned over to the OWNER.
10. Written notice to ENGINEER a minimum of 72 hours prior to beginning of any test.
11. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

1.4 ADJUSTMENTS

- A. Until final tests are completed and approved, make all necessary changes, adjustments and replacements.

PART 2 - PRODUCTS

2.1 GENERAL

- A. CONTRACTOR shall prepare test plans and documentation plans as specified in the following paragraphs. The OWNER and ENGINEER will not witness any test work for the purpose of acceptance until all test documentation and calibration plans and the specified system or equipment test plans have been submitted and approved.

2.2 DOCUMENTATION

A. Documentation Plans:

1. Equipment Setup / System Testing Guidance Manual format shall be used to develop and document test plans.
2. CONTRACTOR shall develop a records keeping system to document compliance with the requirements of this Section. Calibration documentation shall include identification (by make, manufacturer, model, and serial number) of all test equipment, date of original calibration, subsequent calibrations, calibration method, and test laboratory.
3. Equipment and system documentation shall include date of test, equipment number or system name, nature of test, test objectives, test results, test instruments employed for the test and signature spaces for the OWNER'S and ENGINEER'S witnesses and CONTRACTOR'S Quality Assurance Manager. A separate file shall be established for each system and item of equipment. These files shall include the following information as a minimum:
 - a. Metallurgical tests.
 - b. Factory performance tests.
 - c. Accelerometer recordings made during shipment.
 - d. Field calibration tests¹.
 - e. Field pressure tests¹.
 - f. Field performance tests¹.
 - g. Field operational tests¹.

¹ Each of these tests are required even though not specifically noted in detailed specification Section.

4. Section 01331, Reference Forms, contains samples showing the format and level of detail required for the documentation forms. These are samples only and are not specific to this Project or to any item of equipment or system to be installed under this Contract. CONTRACTOR shall develop test documentation forms specific to each item of equipment and system installed under this Contract. Acceptable documentation forms for all systems and items of equipment shall be submitted for review by the OWNER and ENGINEER as a condition precedent to CONTRACTOR'S receipt of progress payments in excess of 50 percent of the Contract amount. Once the OWNER and ENGINEER has reviewed and approved the forms proposed by CONTRACTOR, CONTRACTOR shall produce sufficient

forms, at his expense, to provide documentation of all testing work to be conducted as a part of this Contract.

B. Test Plans:

1. CONTRACTOR shall develop test plans detailing the coordinated, sequential testing of each item of equipment and system installed under this Contract. Each test plan shall be specific to the item of equipment or system to be tested. Test plans shall identify by specific equipment or CMMS Tag number each device or control station to be manipulated or observed during the test procedure and the specific results to be observed or obtained. Test plans shall also be specific as to support systems required to complete the test work, temporary systems required during the test work, subcontractors and manufacturers' representatives to be present and expected test duration. As a minimum, the test plans shall include the following features:
 - a. Step-by-step proving procedure for all control and electrical circuits by imposing low voltage currents and using appropriate indicators to affirm that the circuit is properly identified and connected to the proper device.
 - b. Calibration of all analysis instruments and control sensors.
 - c. Performance testing of each individual item of mechanical, electrical, and instrumentation equipment. Performance tests shall be selected to duplicate the operating conditions described in the Contract Documents.
 - d. System performance tests designed to duplicate, as closely as possible, operating conditions described in the Contract Documents.
2. Test plans shall contain a complete description of the procedures to be employed to achieve the desired test environment.
3. As a condition precedent to receiving progress payments in excess of 75 percent of the Contract amount, or in any event, progress payments due to CONTRACTOR eight weeks in advance of the proposed date the CONTRACTOR intends to begin any testing work (whichever occurs earliest in the Project Schedule), have submitted all test plans required for the systematic field performance and operational tests for all equipment and systems installed under this Contract. Once the ENGINEER has reviewed and approved CONTRACTOR'S test plans, reproduce the plans in sufficient number for CONTRACTOR'S purposes and an additional ten copies for delivery to the ENGINEER. No test work shall begin until CONTRACTOR delivers the specified number of final test plans to the ENGINEER.
4. Test Plans shall be developed and formatted according to the Equipment Setup / System Testing Guidance Manual.

C. Testing Schedule: CONTRACTOR shall provide a startup and testing schedule setting forth the sequence contemplated for performing the test work. The schedule shall be a CPM format, plotted against calendar time, shall detail the equipment and systems to be tested, and shall be coordinated with CONTRACTOR'S Progress Schedule specified in Section 01321, Progress Schedule (CPM). The schedule shall show the contemplated start date, duration of the test and completion of each test. The test schedule shall be

submitted no later than four weeks in advance of the date testing is to begin. The ENGINEER will not witness any testing work for the purpose of acceptance until CONTRACTOR has submitted a test schedule and the ENGINEER approves. The test schedule shall be updated weekly, showing actual dates of test work, indicating systems and equipment testing completed satisfactorily and meeting the requirements of the Contract Documents.

D. Binder Format:

1. Prepare data in the format detailed in the forms provided. Forms shall be modified with project specific details.
2. Binders: Commercial quality, 8-1/2 inch by 11 inch (size A4), three D side ring binders with durable plastic covers; 2 inch (50 millimeter) maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
3. Cover: Identify each binder with typed project number, name, and subject matter of contents. Titles shall be placed both on the front and binder edge of the binder.
4. Provide tabbed card stock material for each separate section and subsection. With ½ inch extended tabs and typed description on the tabs for the main sections.
5. Text: Printed data or type written data on 20 pound, minimum, white punched paper. Computer generated data shall be printed by letter quality 150dpi resolution printers unless approved otherwise.

- E. Drawings: Provide with reinforced punched binder tab. Bind in with text; Reduce larger drawings and fold to size of text pages but not larger than 11-inches by 17-inches.

2.3 SYSTEM AND EQUIPMENT PERFORMANCE TESTS

- A. Each item of mechanical, electrical, instrumentation and HVAC equipment installed under this Contract shall be tested to demonstrate compliance with the performance requirements of the Contract Documents. Each electrical, instrumentation, mechanical, piping, and HVAC system installed or modified under this Contract shall be tested in accordance with the requirements of the Contract Documents.
- B. Once all equipment and systems have been tested individually, defined in the Guidance Manual as Contractor Testing. CONTRACTOR shall proceed with performance testing in accordance with the requirements of Article 3.3, below, simulating actual operating conditions to the greatest extent possible. Install temporary connections, bulkheads and make other provisions to recirculate process fluids or otherwise simulate anticipated operating conditions. Performance testing is broken into two (2) groups of testing in the Guidance Manual, Verification and Demonstration Testing. During the operational testing period, CONTRACTOR'S Quality Assurance Manager and testing team shall monitor the characteristics of each machine and system and report any unusual conditions to the ENGINEER.

PART 3 - EXECUTION

3.1 GENERAL

- A. Quality Assurance Manager: Organize teams made up of qualified representatives of equipment suppliers, subcontractors, CONTRACTOR'S independent testing laboratory, and others, as appropriate, to efficiently and expeditiously calibrate and test the equipment and systems installed and constructed under this Contract. The objective of the testing program shall be to demonstrate, to the OWNER'S and ENGINEER'S complete satisfaction, that the structures, systems, and equipment constructed and installed under this Contract meets all performance requirements and the facility is Substantially Complete and ready for the commissioning process to commence. In addition, the testing program shall produce baseline-operating conditions for the OWNER to use in a Preventive Maintenance Program.

3.2 CALIBRATION OF FIXED INSTRUMENTS

- A. Calibration of analysis instruments, sensors, gauges, and meters installed under this Contract shall proceed on a system-by-system basis. No equipment or system performance test shall be performed until all instruments, gauges, and meters to be installed in that particular system have been calibrated and the calibration work has been witnessed by the OWNER and ENGINEER.

3.3 EQUIPMENT SETUP / SYSTEM TESTING

- A. General: Performance tests shall consists of the following:
1. Supplier Equipment Setup, Calibration, and Checkout shall consist of but not be limited to
 - a. Pressure or leakage tests.
 - b. Electrical testing as specified in Division 16, Electrical.
 - c. Wiring and piping, individual component, loop, loop commissioning and tuning testing, as specified in Division 17, Instrumentation.
 - d. Pre-startup check out for all mechanical and HVAC equipment. Pre-startup check out procedures shall be reviewed and accepted by the respective equipment manufacturer. Supplier Equipment Setup, Calibration, and Checkout is further explained in the Guidance Manual.
 2. Contractor testing shall consist of but not limited to the individual and system tests of all mechanical, electrical, HVAC, and instrumentation equipment and systems shall demonstrate compliance with the performance requirements of the Contract Documents to the CONTRACTOR. Testing required by the CONTRACTOR is further explained in the Guidance Manual.
 3. Verification Testing: To verify to the ENGINEER that all equipment and systems will function as designed. The Verification Testing is to be designed to duplicate, as closely as possible, the operating design. Verification testing is further explained in the Guidance Manual.

4. Demonstration Testing: To show the OWNER all equipment as a system will function as designed. The testing will simulate various operating conditions to allow the system as a whole to react. The plan will clearly show the system works in various conditions as described in the Control descriptions and detailed in the Process and Instrumentation drawings. Demonstration testing is further explained in the Guidance Manual.
- B. Performance tests for any individual system shall be performed in the order listed above. The order may be altered only on the specific written authorization of the ENGINEER after receipt of a written request, complete with justification for the change in sequence.
 - C. Pressure and Leakage Tests: Pressure and leakage tests shall be conducted in accordance with applicable Sections. All acceptance tests shall be witnessed by the ENGINEER. Evidence of successful completion of the pressure and leakage tests shall be the ENGINEER'S signature on the test forms prepared by CONTRACTOR.
 - D. Equipment Checkout: Prior to energization (in the case of electrical systems and equipment), all circuits shall be rung out and tested for continuity and shielding in accordance with the requirements of Division 16, Electrical.
 - E. Component Calibration and Loop Testing: Prior to energization (in the case of instrumentation system and equipment), all loops and associated instruments shall be calibrated and tested, as specified in Division 17, Instrumentation.
 - F. Electrical Resistance: Electrical resistance testing shall be in accordance with the requirements of Division 16, Electrical.
 - G. Pre-Startup Tests: Pre-startup tests shall include the following:
 1. Alignment of equipment using reverse dial indicator method.
 2. Pre-operation lubrication.
 3. Tests in accordance with the manufacturers' recommendations for pre-start preparation and pre-operational check out procedures.
 4. Pre-Startup tests shall conform to the requirements of Section 01751, Starting and Placing Equipment in Operation.
 - H. System Performance Tests:
 1. System Performance Tests are broken into (2) groups of tests. Verification and Demonstration Testing. Refer to the Guidance Manual for further definition of how to develop System Performance Tests.
 2. General: Once all affected equipment has been subjected to the required pre-operational check out procedures and the ENGINEER has witnessed and has not found deficiencies in that portion of the Work, individual items of equipment and systems may be started and operated under simulated operating conditions to determine, as nearly as possible, whether the equipment and systems meet the requirements of these specifications.

3. For each system performance test phase, the equipment shall be operated a sufficient period of time to determine machine operating characteristics, including noise, temperatures and vibration; to observe performance characteristics; and to permit initial adjustment of operating controls and shall last no less than 7 continuous days. When testing requires the availability of auxiliary systems such as looped piping, electrical power, compressed air, control air, or instrumentation which have not yet been placed in service, provide acceptable substitute sources, capable of meeting the requirements of the machine, device, or system, at no additional cost to the OWNER. Disposal methods for test media shall be subject to review and approval by the OWNER and ENGINEER. During the performance test period, obtain baseline-operating data on all equipment with motors greater than one horsepower to include amperage, bearing temperatures, and vibration. The baseline data shall be collected for the OWNER to enter in a Preventive Maintenance Program.
4. Test results shall be within the tolerances set forth in the detailed specification Sections of the Contract Documents. If no tolerances have been specified, test results shall conform to tolerances established by recognized industry practice. Where, in the case of an otherwise satisfactory performance test, any doubt, dispute, or difference should arise between the ENGINEER and CONTRACTOR regarding the test results or the methods or equipment used in the performance of such test, then the ENGINEER may order the test to be repeated. If the repeat test, using such modified methods or equipment as the ENGINEER may require, confirms the previous test, then all costs in connection with the repeat test will be paid by the OWNER. Otherwise, the costs shall be borne by CONTRACTOR. Where the results of any performance test fail to comply with the contract requirements for such test, then such repeat tests as may be necessary to achieve the contract requirements shall be made by CONTRACTOR at his expense.
5. CONTRACTOR shall provide, at no expense to the OWNER, all power, fuel, compressed air supplies, water, and chemicals, all labor, temporary piping, heating, ventilating, and air conditioning for any areas where permanent facilities are not complete and operable at the time of functional tests, and all other items and work required to complete the functional tests. Temporary facilities shall be maintained until permanent systems are in service.
6. Should the testing period be halted for any reason, the operational testing program shall be repeated, until the specified continuous period has been accomplished without interruption. All process units shall be brought to full operating conditions, including temperature, pressure, flow and level.
7. Record Documents shall conform to the requirements of Section 01782, Record Documents, of facilities involved shall be accepted and ready for turnover to the OWNER 72 hours prior to operational testing.
8. Phase Retesting: If under test, any portion of the Work should fail to fulfill the Contract requirements and is adjusted, altered, renewed, or replaced, tests on that portion when so adjusted, altered, removed, or replaced, together with all other portions of the Work as are affected thereby, shall, unless otherwise directed by the ENGINEER, be repeated within reasonable time and in accordance with the

- specified conditions. Pay to the OWNER all reasonable expenses incurred by the OWNER, including the costs of the ENGINEER, as a result of repeating such tests.
9. Post-Test Inspection: Once testing has been completed, all machines shall be rechecked for proper alignment and realigned, as required. All equipment shall be checked for loose connections, unusual movement, or other indications of improper operating characteristics. Any deficiencies shall be corrected to the satisfaction of the ENGINEER. All machines or devices which exhibit unusual or unacceptable operating characteristics shall be disassembled and inspected. Any defects found during the course of the inspection shall be repaired or the specific part or entire equipment item shall be replaced to the complete satisfaction of the ENGINEER, at no additional cost to the OWNER.
 10. After the CONTRACTOR has demonstrated and proven to the ENGINEER that all system are functioning properly and has been documented in the approved testing and startup plan, then the CONTRACTOR shall demonstrate this reliability to the OWNER. The OWNER demonstration shall be executed as agreed upon and documented per the approved testing and startup plan.
- I. Operational Availability Demonstration, defined as Commissioning in the Guidance Manual
1. Operational Availability Demonstration (OAD) shall begin following completion of the integrated system field test as specified above and shall continue until a time frame has been achieved wherein the equipment, instrumentation and control system hardware availability meets or exceeds 99.7 percent for 30 consecutive days and no system failures have occurred which result in starting the OAD over again. During the OAD the system shall be available to OWNER's operating personnel for use in normal operation of the Facility.
 2. For the purpose of the Operational Availability Demonstration, the system shall be defined as consisting of the following systems and components:
 - a. 51st Ave Sewer
 3. The conditions listed below shall constitute system failures which are considered critical to the operability and maintainability of the system. The Operational Availability Demonstration shall be terminated if one or more of these conditions occur. Following correction of the problem, a new 30 consecutive day OAD shall begin.
 - a. Failure to repair a hardware or software problem within 120 consecutive hours from the time of notification of a system failure.
 - b. Recurrent hardware problems: If the same type of problem occurs three times or more.
 4. The following conditions shall constitute a system failure in determining the system availability based on the equation specified in Paragraph 1.5.E., below
 - a. Failure of the booster pumps or associated equipment including all instruments.
 - b. Loss of communications between devices on the communications network.
 - c. Failure of one or more input/output components.
 - d. Failures of any type affecting ten or more input/output points simultaneously.

- e. Failure of any type affecting one or more regulatory control loops or sequential control strategies thereby causing a loss of the automatic control of the process variable or process sequence operation.
 - f. Failure of power supply. Where redundant power supplies are provided, failure of one power supply shall not constitute a system failure provided the backup power supply operates properly and maintains supply power. Failure of the backup supply to operate properly and maintain supply power shall constitute a system failure.
5. The system availability shall be calculated based on the following equation:

$$A = \frac{\text{MTBF}}{\text{MTBF} + \text{MTTR}} \times 100\%$$

Where:

A = system availability in percent

MTBF = average time interval between consecutive system failures

MTTR = mean time required to repair system failures

- 6. Time between failures shall be the period between the time that a reported system failure has been corrected and the time of subsequent notification of CONTRACTOR that another system failure has occurred in terms of operating hours.
- 7. Time to repair shall be the period between the time that CONTRACTOR is notified of a system failure and the time that the system has been restored to proper operation in terms of hours with an allowance for the following dead times which shall not be counted as part of the time to repair period.
 - a. Actual travel time for service personnel to get to the Facility up to a maximum of two hours from the time CONTRACTOR is notified of a system failure.
 - b. Time for receipt of spare parts to the Facility once requested up to a maximum of 24 hours. No work shall be done on the system while waiting for delivery of spare parts.
 - c. Dead time shall not be counted as part of the system available period. The dead time shall be logged and the duration of the OAD extended for an amount of time equal to the total dead time.
- 8. Completion of a 30 consecutive day period without any restarts of the OAD and with a system availability in excess of 99.7 percent will constitute acceptance of the System by OWNER.
- 9. Submit a request of acceptance after 30 consecutive day period without any restarts to the ENGINEER for approval.
- 10. All parts and maintenance materials required to repair the system prior to completion of the OAD shall be supplied by CONTRACTOR, at no additional cost

to OWNER. If parts are obtained from the contractual spare parts inventory, they shall be replaced to provide a full complement of parts as specified.

11. A System Malfunction/Repair Reporting Form shall be completed by the OWNER and ENGINEER to document system failures, to record CONTRACTOR notification, arrival and repair times and CONTRACTOR repair actions. Format of the form shall be developed and agreed upon prior to the start of the OAD.

++ END OF SECTION ++

SECTION 01782

RECORD DOCUMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. CONTRACTOR shall maintain and provide the ENGINEER with Record Documents as specified below, except where otherwise specified or modified in Division 2, Site Work, through Division 17, Instrumentation.
- B. Definitions
1. Contract Documents: The contract documents include the drawings, specifications, and addenda developed and furnished to the CONTRACTOR at the beginning of construction.
 2. As-Built Drawings: As-built drawings are an annotated set of drawings prepared by the CONTRACTOR. They show, in red, as-constructed changes to the original Contract Documents that have been made during the construction process. The As-Built Drawings may include supplemental drawings to provide the necessary detail, comply with project standards or where annotation would otherwise be impractical.
 3. Record Drawings: Record Drawings are prepared by the ENGINEER and reflect as-constructed changes that the CONTRACTOR annotated in the As-Built Drawings.
 4. Record Documents: The Record Documents include Record Drawings, specifications, addenda, approved shop drawings, samples, photographs, change orders, other modifications to the Contract Documents, test records, survey data, field orders, Request for Information, submittals and all other documents pertinent to the CONTRACTOR'S Work.
- C. Maintenance of Documents:
1. Three sets of black line sets of plans, including any Addenda, of the Drawings will be furnished to CONTRACTOR by the OWNER.
 2. Maintain in CONTRACTOR'S field office in clean, dry, legible condition complete sets of the following: Drawings, Specifications, Addenda, approved Shop Drawings, Samples, Photographs, Change Orders, other modifications of Contract Documents, test records, survey data, Field Orders, and all other documents pertinent to CONTRACTOR'S Work.
 3. Provide files and racks for proper storage and easy access. File in accordance with filing format of Construction Specification Institute (CSI), unless otherwise approved by ENGINEER.
 4. Make documents available at all times for inspection by ENGINEER and OWNER.
 5. Record Documents shall not be used for any other purpose and shall not be removed from CONTRACTOR'S office without ENGINEER'S approval.

6. Any contractually required testing provided by others shall be thoroughly documented by the CONTRACTOR and maintained with the project Record Documents. All testing results shall be maintained in their own separate log for the project; being kept current weekly and made readily available for viewing at any time.
- D. Marking System: Changes, revisions, additions and deletions, to the record set of Drawings shall be marked in Red.
- E. Recording:
1. Submit as-built drawings and make a record of the locations of all work completed as part of the project. The as-builts must indicate the locations of the beginning(s) and end(s) of the construction, and all valves, fire hydrants, pipe fittings, service connections and appurtenances. They must also show locations and elevations where significant elevation changes occur or changes in direction in all pipe alignments. Their locations must be shown by stationing and dimensioning from appropriate monument lines or in their absence appropriate lot lines, property lines or easement line references.
 2. Label the Cover Sheet, Index and each supplemental sheets of each document “PROJECT RECORD” in 2-inch high printed letters.
 3. Keep the As-Built Drawings current. CONTRACTOR’S refusal, failure or neglect to maintain current As-Built Drawings shall constitute sufficient basis for the ENGINEER to recommend the withholding of some or all of any payment due.
 4. Do not permanently conceal any Work until required information has been recorded.
 5. Drawings: Legibly mark to record actual construction including:
 - a. Depths of various elements of foundation in relation to datum.
 - b. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
 - c. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
 - d. Field changes of dimensions and details.
 - e. Changes made by Change Order or Field Order.
 - f. Details not on original Drawings.
 6. Specifications and Addenda: Legibly mark up each Section to record:
 - a. Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
 - b. Changes made by Change Order or Field Order.
 - c. Other matters not originally specified.
- F. Record Drawings:
1. Record Drawings shall be prepared for all the Work included in the Contract. On a weekly basis, furnish to the ENGINEER a full size annotated copy of the As-Build Drawings that include changes from the previous week’s As-Build Drawing submittal. Annotations shall include redlined “clouds” of only those changes from

the previous week's submittal. The redlined As-Build Drawings shall show the actual in-place installation of the items installed under this Contract. The redlined As-Build Drawings shall show the Work in plan and sections as required for clarity with reference dimensions and elevations that will be used to develop complete Record Drawings.

2. Develop and furnish to the ENGINEER, redlined Instrumentation and Control and Electrical Drawings showing one line diagrams with all conduit and wire sizes shown of the distribution systems and the actual in-place grounding system, lighting arrangement, motor control centers, corrected wiring diagrams, equipment and conduit and cable plans.
 - a. The Contract Drawings may be used as a starting point in developing these Instrumentation and Control and Electrical As-Build Drawings. Subcontractor and manufacturer drawings may be included in this drawing package. The drawing package must be fully integrated and include the necessary cross references between drawings. The drawing package shall include interconnection and termination details to equipment furnished under this Contract.
 - b. All As-Build Drawings must be submitted on a weekly basis for approval of the ENGINEER. This shall include the following composite drawings for the system being furnished:
 - 1) Schematic (Elementary) Diagrams: This shall include, but not be limited to, complete schematics including items furnished by others for the following:
 - a) Motor Control Circuits for Starters furnished under this Contract.
 - b) HVAC Control Panels furnished under this Contract.
 - 2) Wiring (Connection) Diagrams: These shall be included for all pre-wired equipment furnished under this Contract.
 - 3) Interconnection Diagrams: These shall include all interconnections to be furnished under this Contract.
 - 4) Conduit and Cable Schedules: These shall include all conduit and cable furnished under this Contract.
 - 5) Dimension of Outline Drawings: These shall include all equipment furnished under this Contract.
 - 6) Power and Lighting Layout Drawings: These shall include all conduits and wiring furnished under this Contract.
3. Survey results shall be posted to the as-builts on a weekly basis.

G. Submittals:

1. Acceptance of CONTRACTOR'S monthly application for payment shall be dependent on the ENGINEER'S acceptance and agreement that CONTRACTOR'S As-Build Drawings and weekly submittals are complete, thorough and acceptable in showing all Work up through and including such work as CONTRACTOR is claiming for completion and payment on CONTRACTOR'S application for payment. Any items which do not appear on the As-Build Drawings in complete and acceptable form shall not be paid for in CONTRACTOR'S monthly payment.

2. Examination by the ENGINEER of CONTRACTOR'S As-Build Drawings will be made on a weekly basis to determine completion for consideration of monthly pay application. Also, make available all As-Build Drawings at all times to the ENGINEER for examination.
3. Prior to Completion of the Work, deliver final As-Build Drawings to ENGINEER. Substantial completion will not be made until satisfactory final As-Build Drawings are received by ENGINEER.
4. Accompany final and weekly submittals with transmittal letter containing:
 - a. Date.
 - b. Project title and number.
 - c. CONTRACTOR'S name and address.
 - d. Title and number of each As-Build Drawings.
 - e. Certification that each document as submitted is complete and accurate.
 - f. Signature of CONTRACTOR, or his authorized representative.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01783

SPARE PARTS AND MAINTENANCE MATERIALS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Submit a complete list of all spare parts required for the project for review and comments to the ENGINEER and OWNER by no later than 50 percent of the project construction completion. The list shall include details such as equipment identification, part description, manufacture, and manufacturer part number, location in system, local vendor, storage requirements, storage location, and approximate cost. This completed list will be used to inventory all parts at time of turn over to the OWNER.
- B. Spare parts and materials required to be supplied in the Contract Documents shall be furnished in manufacturer's unopened cartons, boxes, crates or other protective covering suitable for preventing corrosion or deterioration for the maximum length of storage which may be normally anticipated. They shall be clearly marked and identified as to the name of manufacturer or supplier, applicable equipment, part number, description and location in the equipment. All parts shall be protected and packaged for a shelf life of at least ten years.
- C. If required during construction, store parts in buildings or trailers with floor, roof and closed sides and in accordance with manufacturers' recommendations. Protect from weather, condensation and humidity.
- D. Parts and materials shall be delivered to the OWNER upon Substantial Completion of the Work or start-up. Until that occurs, place spare parts in permanent storage rooms or areas approved by the OWNER. The turnover procedures shall be developed by the ENGINEER.
- E. Provide a letter of transmittal along with the Spare Parts Receiver Form 01783-A in Specification 01331 – Reference Forms.
- F. Full responsibility for loss or damage to parts and materials until they are transmitted to the OWNER, belongs to CONTRACTOR.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

CITY OF PHOENIX: Water Services Department
PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
PROJECT NUMBER: WS90500307 & WS90501004

**SPARE PARTS RECEIVER
SPECIFICATION SECTION 01783**

CONTRACTOR TO FILL OUT:

MANUFACTURER: _____

ITEM DESCRIPTION: _____

COST: _____ PART NUMBER: _____

VENDOR/SUPPLIER NAME: _____

ADDRESS: _____

TELEPHONE NUMBER (including Fax): _____

PART TO BE USED ON
WHAT EQUIPMENT: _____

EQUIPMENT NUMBER: _____ SPECIFICATION SECTION: _____

CONTRACTOR REP DATE

CITY REP DATE

ENGINEER REP DATE

++ END OF SECTION ++

SECTION 01784

POST FINAL INSPECTION

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Approximately one year after Final Completion, ENGINEER will make arrangements with OWNER and CONTRACTOR for a Post-Final Inspection and will send a written notice to OWNER and CONTRACTOR advising of the date and time of the inspection.
- B. After the inspection, ENGINEER will inform CONTRACTOR of any corrections required.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01785

PREVENTIVE MAINTENANCE DATA

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Provide Preventive Maintenance Data for new assets for use by the OWNER'S personnel:
 - 1. To ensure assets reach their maximum potential life.
 - 2. To meet asset warranty condition.
 - 3. To perform preventive maintenance as recommended by the Asset Manufacturer.

- B. The asset commissioning process shall not commence until the asset's preventive maintenance information has been documented in the OWNER's Computer Maintenance Management System (CMMS) by the OWNER's Water Asset Management (WAM) Team and OWNER's operation and maintenance staff have been trained on the preventive maintenance procedures as described in Section 01821 - Instruction of Operations and Maintenance Personnel.

- C. To ensure that the project commissioning will not be delayed and to allow the OWNER adequate time to load all project data into the CMMS, the CONTRACTOR shall submit all required preventive maintenance data to the ENGINEER and the OWNER with the respective shop drawing package for each asset.

- D. Clarification:
 - 1. The term "preventive maintenance instructions" includes all information and instructions required to keep a product or piece of equipment properly maintained according to the manufacturer's recommendation to fulfill the equipment warranty conditions and ensure the equipment or asset reaches its maximum potential life.
 - 2. The maintenance tasks frequency are driven by calendar, run-time, or meter reading.

1.2 SUBMITTALS

- A. All preventive maintenance information described above in paragraph 1.1.C shall be provided to the ENGINEER separate from the Operations and Maintenance Manual submittal. The CONTRACTOR shall submit the preventive maintenance information package as part of the shop drawing submittal package to the ENGINEER for review and approval. **SHOP DRAWING SUBMITTAL PACKAGE WILL NOT BE APPROVED WITHOUT ACCEPTANCE OF PREVENTIVE MAINTENANCE INFORMATION AS DESCRIBED IN THIS SPECIFICATION SECTION.**

- B. All assets' preventive maintenance information shall be reviewed and approved by the ENGINEER and the OWNER and to be uploaded in the OWNER's CMMS by the OWNER's WAM Team. All information shall be submitted to the OWNER electronically following the OWNER's 01785-A – Preventive Maintenance Data Submittal Form in Section 01331 – REFERENCE FORMS, which is included at the end of this specification section as an example. The OWNER will provide this form in MS ACCESS form to the ENGINEER. The information shall be per the Asset's Manufacturer's Recommendation and includes the following:
1. Preventive maintenance task name.
 2. Estimated hours to perform the task itself. This does not include employee preparation, equipment access, or safety log-out/tag-out procedure time.
 3. Frequency of the task based on calendar days or run-hours, or metering log.
 4. Number of staff required to perform the task safely according to the Manufacturer's recommended procedure.
 5. Written procedure for every preventive maintenance task in MS WORD file format as recommended by the manufacturer that:
 - a. List the required specialty tools or equipment:
 - b. Include illustration or figure to aid staff's understanding of the asset maintenance
 - c. Describe the procedure for performing inspection of the equipment in operation as appropriate.
 - d. Describe component removal and/or installation and disassembly and/or assembly procedures.
 - e. Describe recommended measuring instruments and procedures, and provide instruction on interpreting alignment measurements, as appropriate.
 - f. Define recommended torque limited, mounting, calibration and/or alignment procedures and settings, as appropriate.
 - g. Describe components to evaluate or inspect when performing annual inspection
 - h. Provide lubricant and replacement part recommendations and limitations.
 6. Identify recommended predictive maintenance tasks such as oil analysis, vibration analysis, infrared thermal scanning, etc. and their frequency, estimated task duration, and number of staff required to perform the task safely.
 7. List all assets by asset IDs and description that will require preventive maintenance tasks.
 8. The ENGINEER shall format the preventive maintenance information and instructions into the MS ACCESS file format, to be provided by the OWNER, and arrange as indicated in the example below.
- C. Preventive Maintenance Training Plan:
1. Each Manufacturer shall submit a preventive maintenance lesson plan for each asset type according to Section 01821 – Instruction of Operations and Maintenance Personnel.

2. The preventive maintenance training plan for each asset type shall be submitted a minimum of 40 days prior to scheduled instruction or coordinate with the OWNER if this will conflict with construction schedule.

D. Example of Preventive Maintenance Information Form:

Project Name: "Cave Creek Water Reclamation Plant Rehabilitation"				City Project # WS85123456			
Engineer: "Preventive Engineering Company"				Contractor: "Preventive Maintenance Constructor"			
Asset Type Description: "Submersible Pumps"				Asset Manufacturer: "John Smith Pump Company"			
Preventive Maintenance Task Description	Class	Category	Task Duration (Hrs)	Est. Staff	Fre	Freq. Unit (Run-Time Hrs or Days)	Preventive Maintenance Procedure MS WORD File Name
1. Change oil	Preventive	Lubrication	2	1	185	Days	"1234"
2. Annual Inspection	Predictive	Condition Assessment	4	2	365	Days	"6789"
3. Major overhaul	Preventive	Re-build	8	2	1500	Hrs	"xyz"
4. ---			---	--	--	--	--
Assets IDs	Asset Description		Max. Life (yrs)	Warranty			Warranty Certificate Reference No.
				Start Date	End Date	Duration (Mos)	
12345678	Raw Water Pumping, Pump No.2		10	09/15/2014	09/15/2015	12	"jklmn"
98765432	Finished Water Pumping, Pump No. 4		15	01/01/2014	01/01/2017	36	"a12345"

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 01810

COMMISSIONING

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section Includes: Responsibility of the OWNER, ENGINEER and CONTRACTOR during the Commissioning Phase(s) of the Project.
- B. Start-up and Commissioning of the Work, or a specified part of the Work, under this Project shall be as described in Section 01111, Schedule of Completion. Work under this Section shall not start until the Work under Section 01111, Schedule of Completion, Section 01751, Starting and Placing Equipment in Operation, Section 01752, Equipment and System Start-Up and Performance Testing; Section 01781, Operation and Maintenance Data, Section 01782, Record Documents and Section 01821, Instruction of Operations and Maintenance Personnel. Also, Special Tests as defined under the individual technical specifications, Divisions 0 to 17 has been completed; and Notice of Substantial Completion for the Work as defined in the Supplementary Conditions has been completed and issued by the ENGINEER. Spare parts shall also be on-site and accepted prior to Commissioning.
- C. In addition to the testing required by this Section, the CONTRACTOR shall perform all other tests required by the detailed equipment specifications.

1.2 DEFINITIONS

- A. Commissioning: The sequential process in which a newly constructed facility is put into successful operation.
- B. Successful Operation: The resultant operation of all the processes and related controls in a manner that is consistent with the Contract Documents.
- C. Manual Operational Mode: This operational mode represents the lowest level of control philosophy utilized in the instrumentation and control system. For all practical purposes, it means that an operational control decision requiring equipment or process monitoring or control will require an individual to physically go to the local control for the associated task in order to operate the facility. In the manual operational mode, the focus will be on verifying that the equipment and processes function correctly, independent of the instrumentation system and control system. The estimated duration of the manual commissioning period is 25 percent of the total Work/Work area commissioning duration.

- D. Semi-Automatic Operational Mode: The highest level of control philosophy utilized in the facility instrumentation and control system.

1.3 SUBMITTALS

- A. Preventive and Unscheduled Maintenance Plan: Submit detailed plan prior to start of Commissioning for providing all preventive and unscheduled maintenance of all equipment in the facility to occur throughout the entire commissioning phase of the project. See Paragraph 1.5.B.3 for further clarification of the responsibilities to be included as part of the Preventive and Unscheduled Maintenance Plan. This plan is wholly separate from the Preventive Maintenance Submittal due as part of Sections 01332 and 01785.
- B. OWNER’S Personnel Training Schedule and Plan: Submit detailed plan and schedule for training OWNER’S personnel in accordance with Section 01821, Instruction of Operations and Maintenance Personnel.
- C. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

1.4 REQUIREMENTS

- A. Before the Commissioning Process may begin, the CONTRACTOR shall perform functional testing of the equipment. Functional testing of the equipment shall consist of the following:
1. Perform check out and performance testing as specified in the individual specification sections and as specified in Section 01752, Equipment and System Startup and Performance Testing.
 2. Functionally test mechanical and electrical equipment, and instrumentation, and control systems for proper operation after general startup and testing tasks have been completed.

3. Demonstrate proper rotation, alignment, speed, flow, pressure, vibration, sound level, adjustment, and calibration. Perform initial checks in the presence of and with the assistance of the manufacturer's representative.
 4. Demonstrate proper operation of each instrument loop function including alarms, local and remote controls, instrumentation, and other equipment functions. Generate signals with test equipment to simulate operating conditions in each control mode.
 5. The purpose of the functional testing is to demonstrate that the equipment is:
 - a. Properly installed.
 - b. Completely ready for operation by the OWNER.
 - c. In compliance with design conditions, material specifications, and all other requirements of the Contract Documents.
 6. The CONTRACTOR shall furnish all fuel and energy, labor, materials, instruments, chemicals, lubricants, and expendables required for tests, except where otherwise specified.
 7. Until the functional testing is completed and approved, the CONTRACTOR shall make all the necessary changes, adjustments, and replacements.
 8. The systems or unit processes or any piece of equipment shall not be started up without the approved Operation and Maintenance Manuals being turned over to the OWNER.
 9. The CONTRACTOR shall notify the OWNER and ENGINEER at least 48 hours prior to the beginning of tests. The CONTRACTOR shall keep notes and data on all tests, and shall submit a copy to the ENGINEER. The ENGINEER and OWNER'S operating personnel shall witness all tests.
 10. The CONTRACTOR shall conduct continuous eight-hour tests under full load conditions. Replace all parts that operate improperly.
 11. Functional tests shall be repeated for the full eight hours when malfunctions or deficiencies cause the shutdown of the equipment or result in performance that is less than specified.
- B. Commissioning process will commence after issuance of the Work/Work area Notice of Substantial Completion to CONTRACTOR.
- C. The commissioning process for the Project will be as defined per Specification 01752, Equipment and System Startup and Performance Testing and will consist of the following:

Commissioning Phases		
Work/Work Area	Commissioning Requirements	Commissioning Duration (Calendar Days)
51 st Ave Gravity Sewer	Completion of both Package 4A and 4B	7 consecutive uninterrupted days for Verification Test Phase (time does not include potential retest phase)
51 st Ave Gravity Sewer	Completion of both Package 4A and 4B	7 consecutive uninterrupted days for Demonstration Test Phase (time does not include potential retest phase)

- D. Items required to be completed prior to start of Commissioning include:
1. All Vendor Operations & Maintenance Manuals.
 2. All Preventive Maintenance Documentation as detailed in Section 01785.
 3. All required training.
 4. All required spare parts.
 5. After approval of the Specification 01630 – Computerized Maintenance Management System Tags, CONTRACTOR shall provide and install all tags.
 6. Any other items required under the contract.
- E. The CONTRACTOR shall immediately correct defects in material, workmanship, or equipment that become evident during the Commissioning Process.
- F. During the course of the Commissioning Process, the ENGINEER and OWNER will evaluate design related issues and recommend design modifications which shall be implemented by CONTRACTOR through the Change Order process.
- G. No system or subsystem shall be started up for continuous operation unless all components of that system or subsystem, including instrumentation, have been tested and proven to be operable as intended by the Contract Documents.

1.5 RESPONSIBILITIES

- A. Responsibilities listed do not relieve the CONTRACTOR from all other responsibilities and duties associated with project closeout as defined in Division 0 and Division 1, General Requirements of the Specifications.
- B. CONTRACTOR’S Responsibilities During the Commission Process:
1. Provide all staff (24 hours per day and seven days per week) for the Verification, Demonstration and Operational Availability Demonstration Testing Phase, labor, materials, equipment and appurtenances required for carrying out CONTRACTOR’S commissioning duties described above and as specified in Specification 01752, Equipment and System Startup and Performance Testing..

2. All Change Order work resulting from the evaluation of design-related issues by the ENGINEER and OWNER.
 3. All preventive and unscheduled maintenance of all equipment and facilities. This shall include, but not be limited to the following:
 - a. Providing all lubricants.
 - b. Lubrication of all equipment in accordance with Manufacturer's recommendations.
 - c. Perform all Manufacturer recommended preventive maintenance, including instrument calibrations.
 - d. Exercise all equipment not in use during Commissioning phase.
 - e. Repair all failed equipment.
 - f. Periodic check of all equipment alignment, vibration, and noise levels to ascertain conformance with Specifications.
 - g. Provide all parts required for equipment repair.
 - h. Provide all tools and miscellaneous equipment required for equipment repair.
 - i. Administration/logging/documentation of all preventive maintenance and repair work.
 - j. Cleanup associated with equipment failure and repair.
 - k. Daily cleanup of buildings and site.
 - l. Landscaping maintenance.
 - m. Roadway cleanup and maintenance.
 - n. Replacement of all HVAC filters.
 4. Maintain and submit the following records generated during the testing and commissioning phases of the Project:
 - a. Daily logs of equipment testing identifying all tests conducted and the outcome.
 - b. Logs of time spent by the manufacturer's representatives performing services on the job site.
 - c. Equipment lubrication records.
 - d. Electrical phase, voltage, and amperage measurements.
 - e. Insulation resistance measurements.
 - f. Datasheets of control loop testing, including testing and calibration of instrumentation devices and set points.
 5. Warranty related issues/items.
 6. Other contractual requirements including, but not limited to, incomplete Work list.
- C. OWNER'S Responsibilities During the Commissioning Process:
1. Provide all chemicals required for facility operations, including scheduling and securing of chemical deliveries to the facility and respective storage tanks.
 2. Perform all laboratory analysis required for operations.
 3. Assisting ENGINEER in the evaluation of design related issues and recommendations of modifications to be implemented by CONTRACTOR through the change order process.

D. ENGINEER'S Responsibilities During Commissioning Process:

1. Provide staff during normal work hours to assist the CONTRACTOR during the Commissioning Phases.
 2. Assist OWNER with Operation of facilities.
 3. Provide OWNER with systems training of the Commissioning Process.
 4. Provide liaison and coordination between CONTRACTOR and OWNER'S activities.
 5. Administer Change Order work performed by CONTRACTOR.
- E. Based upon the data compiled during the commissioning period modifications may be required. The ENGINEER and OWNER may issue a request for proposal to modify the Work, to change design or process related issues. CONTRACTOR shall respond to these requests as expected. Appropriate cost and time adjustment will be made to address the proposed changes.

1.6 MANUFACTURERS AND SUPPLIER'S FIELD AND TEST DATA

- A. An experienced, competent and authorized representative of the Manufacturer or supplier of each item of equipment as required in these Specifications shall visit the site of the Work and inspect, check, and approve the equipment installation. In each case, the equipment supplier's representative shall be present when the equipment is placed in operation. The equipment supplier's representative shall revisit the job site as often as necessary until all trouble is corrected and the equipment installation and operation is satisfactory to the OWNER.
- B. Six copies of all test and field data, collected by the Manufacturers/suppliers of equipment during installation supervision and start-up services, shall be submitted to the ENGINEER within 14 calendar days after the start-up services are complete. The test and field data shall be submitted, whether specified or not in the detailed equipment specifications, and shall include, but are not limited to, the motor amperage readings to verify drives are properly sized; tolerance and alignment measurements, where applicable to verify equipment has been satisfactorily installed; and all other information collected by the manufacturers/suppliers to satisfy themselves that equipment has been properly installed. The manufacturer shall submit to the ENGINEER a certification on the manufacturer's letterhead stating that the equipment has been properly installed and lubricated; is in accurate alignment; is free from any undue stress imposed by connecting piping or anchor bolts; operates within the allowable limits of vibration; controls, protective devices, instrumentation and control panels furnished as part of the equipment package are properly installed, calibrated, and functioning; control logic for start-up, shutdown, sequencing, interlocks, and emergency shutdown have been tested and are properly functioning, and has been operated under full-load conditions and it operated satisfactorily. In cases where the manufacturer/suppliers representative believes equipment is not properly installed, he shall include with this submittal a punch list detailing the problems noted which require correction. The information required under

this Section shall be furnished for all equipment and devices requiring installation and start-up services, as specified in these Specifications, including the detailed mechanical, electrical and instrumentation specifications.

- C. Furnish written report prepared and signed by the electrical and/or instrumentation subcontractor certifying:
1. Motor control logic that resides in motor-control centers, control panels, and circuit boards furnished by the electrical and/or instrumentation subcontractor has been calibrated and tested and is properly operating.
 2. Control logic for equipment start-up, shutdown, sequencing, interlocks, and emergency shutdown has been tested and is properly operating.
 3. Co-sign the reports, along with the Manufacturer's representative and subcontractors.
- D. The costs for this Work shall be included in the prices quoted by equipment suppliers. CONTRACTOR shall perform all Work required to install and place into operation the equipment in accordance with the manufacturer's recommendations.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

++ END OF SECTION ++

SECTION 02220

DEMOLITIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required for demolitions, removal and disposal Work.
2. Included, but not limited to, are demolition and removals of existing materials, equipment, or work necessary to install the Work as shown on the Drawings, specified and required to connect same with existing work in an approved manner. Demolition includes piping, paving, curbs, walks, fencing, and similar existing facilities.
3. Demolitions and removals which may be specified under other Sections shall conform to requirements of this Section.
4. Pay for all landfill disposal fees.

1.2 SUBMITTALS

- A. Schedule: Submit for approval proposed methods, equipment, and operating sequences. Include coordination for shut-off, capping, temporary services, continuation of utility services, and other applicable items to ensure no interruption of OWNER'S operations.
- B. Shop Drawings: Submit for approval the following:
 1. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
 2. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
 3. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is

rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

1.3 JOB CONDITIONS

A. Protection:

1. Perform all demolition and removal Work to prevent damage or injury to structures, occupants thereof and adjacent features which might result from falling debris or other causes, and so as not to interfere with the use, and free and safe passage to and from adjacent structures.
2. Closing or obstructing of roadways, sidewalks, and passageways adjacent to the Work by the placement or storage of materials will not be permitted, and all operations shall be conducted with a minimum interference to traffic on these ways.
3. Erect and maintain barriers, lights, sidewalk sheds, and other necessary protective devices.
4. Repair damage to facilities to remain, or to any property belonging to the OWNER or occupants of the facilities. Comply with requirements of Section 02230, Clearing.

B. Scheduling:

1. Carry out operations so as to avoid interference with OWNER'S operations and work in the existing facilities. Comply with requirements of Section 01143, Coordination with OWNERS Operations.

C. Notification:

1. At least 48 hours prior to commencement of a demolition or removal, notify ENGINEER, in writing, of proposed schedule therefore. OWNER will inspect the existing equipment and mark for identification those items which are to remain the property of the OWNER. Do not start removals without the permission of the ENGINEER.

D. Explosives:

1. Do not bring explosives on site.
2. Explosives are not approved.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL

- A. All materials and equipment removed from existing work, shall become the property of CONTRACTOR, except for those which OWNER has identified and marked for their use. The OWNER may identify the materials and equipment that they want to keep during a site visit prior to the demolition work. All materials and equipment marked by the OWNER to remain the property of the OWNER shall be carefully removed by CONTRACTOR, so as not to be damaged, and shall be cleaned and stored on or adjacent to the site in a protected place specified by the ENGINEER or loaded onto trucks provided by the OWNER.
- B. Dispose of all demolition materials, equipment, debris, and all other items not marked by the OWNER to remain off the site and in conformance with all existing applicable laws and regulations.
- C. Surfaces of walls, floors, ceilings, or other areas which are exposed by any of the removals specified herein, and which will remain as architecturally finished surfaces shall be repaired and re-finished by CONTRACTOR with the same or matching materials as the existing adjacent surface or as may be otherwise approved by the ENGINEER.
- D. Pollution Controls: Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
 - 1. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
 - 2. Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to conditions existing prior to the start of the Work.
- E. Building Demolition:
 - 1. Unless otherwise approved by ENGINEER, proceed with demolition from the top of the structure to the ground. Complete demolition Work above each floor or tier before disturbing supporting members of lower levels.
 - 2. Demolish concrete and masonry in small sections.
 - 3. Remove structural framing members and lower to ground by means of hoists, derricks, or other suitable methods.
 - 4. Break up and remove foundations and slabs-on-grade, unless otherwise shown on the Drawings to remain.

5. Locate equipment used for demolition Work, and remove demolished materials, so as to not impose excessive loads on supporting walls, floors or framing.

F. Pavement Demolition:

1. All asphalt and concrete pavement demolition shall terminate at cut edges. All edges shall be linear and have a vertical cut face.

3.2 STRUCTURAL REMOVALS

- A. Remove structures to the lines and grades shown on the Drawings, unless otherwise directed by the ENGINEER. Where no limits are shown on the Drawings, the limits shall be 4-inches outside the item to be installed. The removal of masonry beyond these limits shall be at CONTRACTOR'S expense and these excess removals shall be reconstructed to the satisfaction of the ENGINEER, with no additional compensation to CONTRACTOR.
- B. All concrete, brick, tile, concrete block, roofing materials, reinforcement, structural or miscellaneous metals, plaster, wire mesh and other items contained in or upon the structure shall be removed and taken from the site, unless otherwise approved by the ENGINEER. Demolished items shall not be used in backfill.
- C. After removal of parts or all of masonry walls, slabs and like work which tie into the Work or existing work, the point of junction shall be neatly repaired so as to leave only finished edges and surface exposed.
- D. The jambs, sills and heads of any windows, passageways, doors, or other openings cut into the Work or existing work, shall be dressed with new masonry, concrete or metal to provide a smooth, finished appearance.
- E. Where new anchoring materials, including bolts, nuts, hangers, welds and reinforcing steel, are required to attach the Work to the existing work they shall be included under this Section, except where specified elsewhere.

3.3 MECHANICAL REMOVALS

- A. Mechanical removals shall consist of dismantling and removing of existing piping, pumps, motors, equipment and other appurtenances as specified, shown, or required for the completion of the Work. Mechanical removals shall include cutting, capping, and plugging as required, except that the cutting of existing piping for the purpose of making connections thereto will be included under Division 15, Mechanical.
- B. Existing process, water, chemical, gas, fuel oil and other piping not required for the Work shall be removed where shown on the Drawings or where it will interfere with the Work. Piping not indicated to be removed or which does not interfere with the Work shall be removed to the nearest solid support, capped and left in place. Chemical and fuel lines and tanks shall be purged and made safe prior to removal or capping. Where

- pipng that is to be removed passes through existing walls, it shall be cut off and properly capped on each side of the wall.
- C. When underground piping is to be altered or removed, the remaining piping shall be properly capped. Abandoned underground piping shall be removed.
 - D. Waste and vent piping shall be removed to points shown. Pipe shall be plugged with cleanouts and plugs. Where vent stacks pass through an existing roof that is to remain, they shall be removed and the hole in the roof properly patched and made watertight.
 - E. Any changes to potable water piping and other plumbing and heating system work shall be made in conformance with all applicable codes and under the same requirements as other underground piping. All portions of the potable water system that have been altered or opened shall be pressure tested and disinfected in accordance with Section 15050, Piping Systems, and Section 15051, Buried Piping Installation, and local codes. Other plumbing piping and heating piping shall be pressure tested only.

3.4 ELECTRICAL REMOVALS AND DEMOLITION

- A. Electrical removals shall consist of the removal of existing transformers, distribution switchboards, control panels, motors, conduits and wires, poles and overhead wiring, panelboards, lighting fixtures, and miscellaneous electrical equipment all as shown on the Drawings, specified, or required to perform the Work.
- B. All existing electrical equipment and fixtures to be removed shall be removed with such care as may be required to prevent unnecessary damage, to keep existing systems in operation and to keep the integrity of the grounding systems.
- C. Motor Control Centers and Switchgear shall be removed or modified as shown on the Drawings. Motor Control Centers and Switchgear to be removed shall be disconnected and dismantled, and all components shall be disposed of off the site. Circuit breakers and other control equipment on modified Motor Control Centers and Switchgear that will no longer be used shall be removed, unless otherwise shown on the Drawings or specified. All new openings cut into the modified Motor Control Centers and Switchgear shall be cut square and dressed smooth to the dimensions required for the installation of the new equipment.
- D. Motors shall be disconnected and removed where shown on the Drawings or specified. Motors not designated by the OWNER to be salvaged shall be removed from the site. Motors or other electrical gear designated for reuse shall be stored in enclosed, heated storage.
- E. Abandoned Exposed Conduit and Wire: Generally, whenever a piece or groups of equipment are removed, all associated electrical power or control wiring which is no longer required shall be removed. The wire shall be removed back to the power source or control panel. The conduit, unless otherwise indicated, shall be removed back to the

- nearest junction box or point of conduit embedment. Abandoned conduits or direct-burial cable concealed in floor or ceiling slabs, or in walls, shall be cut flush with the slab or wall at the point of entrance. The conduits shall be suitably plugged and the area repaired in a flush, smooth, approved manner. Exposed conduits and their supports shall be disassembled and removed from the site. Repair all areas of work to prevent rust spots on exposed surfaces.
- F. Where shown on the Drawings or otherwise required, wiring in the underground duct or direct-burial cable system shall be removed. All such wiring shall be salvaged and stored as specified. Verify the function of all wiring before disconnecting and removing it. Ducts which are not to be reused shall be plugged where they enter buildings and made watertight.
- G. Existing panelboards where shown on the Drawings shall be removed and disposed of off the site. Where shown on the Drawings or specified, they shall be replaced with new panelboards at the same or adjacent locations. All cutting and patching necessary for the removal and replacement of panelboards shall be performed.
- H. Existing lighting fixtures shall be removed or relocated as shown on the Drawings. Fixtures not relocated shall be removed from the site. Relocated fixtures shall be carefully removed from their present location and reinstalled where shown on the Drawings.
- I. Existing wall switches, receptacles, starters and other miscellaneous electrical equipment, shall be removed and disposed of off the site, as required. Care shall be taken in removing all equipment so as to minimize damage to architectural and structural members. Any damage incurred shall be repaired by CONTRACTOR to the satisfaction of the ENGINEER, at no additional cost to the OWNER.

3.5 ALTERATIONS AND CLOSURES

- A. Alterations shall conform with the Contract Documents, and the directions and approvals of the ENGINEER.
- B. Where alterations require cutting or drilling into existing floors, walls, and roofs, the holes shall be repaired in a manner approved by the ENGINEER. Repair such openings with the same or matching materials as the existing floor, wall, or roof or as otherwise approved by the ENGINEER. All repairs shall be smoothly finished, unless otherwise approved by the ENGINEER.
- C. Openings in existing concrete slabs, ceilings, masonry walls, floors and partitions shall be closed and sealed as shown on the Drawings or otherwise directed by the ENGINEER. The Work shall be keyed into the existing work in a manner approved by the ENGINEER. Reinforcing steel shall be welded to the existing reinforcing. Welding shall conform to AWS D12.1, Reinforcing Steel Welding Code. In general, use the

same or matching materials as the existing adjacent surface. The finished closure shall be a smooth, tight, sealed, permanent closure acceptable to the ENGINEER.

3.6 CLEAN-UP

- A. Properly remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the Work, all materials, equipment, waste, and debris of every sort shall be removed and premises shall be left, clean, neat and orderly. Comply with requirements of Section 02315, Structural Excavation and Backfill, and Section 02230, Clearing.

++ END OF SECTION ++

SECTION 02230

CLEARING

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. Provide all labor, materials, equipment and incidentals required to perform all clearing and grubbing as shown on the Drawings and specified.
- B. The Work covered by this Section consists of removing and disposing of all trees, stumps, bush, roots, shrubs, vegetation, logs, rubbish, and other objectionable material from the site, as required to perform the Work.

1.2 QUALITY ASSURANCE

- A. Codes and Standards: State and local laws and code requirements shall govern the hauling and disposal of trees, shrubs, stumps, roots, rubbish, debris and other matter.

1.3 JOB CONDITIONS

- A. Protection:
1. Streets, roads, adjacent property and other works and structures shall be protected throughout the entire Project. Return to original condition, satisfactory to the ENGINEER, damaged facilities caused by CONTRACTOR'S operations.
 2. Trees, shrubs, grassed and landscaped areas, which are to remain, shall be protected by fences, barricades, wrapping or other methods as shown on the Drawings, specified or approved by the ENGINEER. Equipment, stockpiles, etc. shall not be permitted within tree branch spread. Trees shall not be removed without approval of the ENGINEER, unless shown or specified.
- B. Salvageable Improvements:
1. Unless specified elsewhere, carefully remove items to be salvaged and store on premises in approved location, all in accordance with recommendations of specialists recognized in the Work involved.

1.4 GUARANTEE

- A. Guarantee that Work performed under this Section will not permanently damage trees, shrubs, turf or plants designated to remain, or other adjacent work or facilities. If damage resulting from CONTRACTOR'S operations appears during the period up to 18 months after completion of the Project, replace damaged items, at no additional cost to OWNER.

1.5 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
 2. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
 3. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CLEARING AND GRUBBING

- A. Limits of clearing shall be all areas within the Contract limit lines, except as otherwise shown on the Drawings. Damage outside these limits caused by CONTRACTOR'S operations shall be corrected at CONTRACTOR'S expense.
- B. Remove from the site and properly dispose of all trees, shrubs, stumps, roots, brush, masonry, rubbish, scrap, debris, pavement, curbs, fences and miscellaneous other structures not covered under other Sections as shown on the Drawings, specified or otherwise required to permit construction of the Work. Comply with requirements of Section 02220, Demolition.

- C. No cleared or grubbed material may be used in backfills or structural embankments. Comply with requirements of Section 02315, Structural Excavation and Backfill.
- D. CONTRACTOR to remove existing trash and concrete pile-up from site and dispose them off to a safe location per the location per the local rules and regulations.
- E. Burning on the site will not be allowed.
- F. In order to avoid additional removal or damage, existing trees and shrubs shall be trimmed as required. Trimmed or damaged trees shall be treated and repaired by persons with experience in this specialty who are approved by ENGINEER. Trees and shrubs intended to remain, which are damaged beyond repair or removed, shall be replaced by CONTRACTOR at no additional cost to OWNER.
- G. Control air pollution caused by dust and dirt, and complies with governing regulations.

3.2 TOPSOIL REMOVAL

- A. Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4-inches. Topsoil shall be substantially free of subsoil, clay lumps, stones, and other objects over 2-inches in diameter, and without weeds, roots, and other objectionable material.
- B. Strip topsoil which is satisfactory to whatever depths are encountered, and in such manner as to prevent intermingling with the underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.
 - 1. Where trees are shown on the Drawings or directed by the ENGINEER to be left standing, stop topsoil stripping a sufficient distance from such trees to prevent damage to the main root system.
- C. Stockpile topsoil in storage piles in areas shown on the Drawings, or where otherwise approved by ENGINEER. Construct storage piles to freely drain surface water. Cover storage piles, if required, to prevent windblown dust.
- D. Dispose of excess topsoil as waste material off site.

++ END OF SECTION ++

SECTION 02310

TUNNEL EXCAVATION AND PRIMARY LINER

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. This Section specifies requirements for the design, procurement, and installation of tunnel casings or liners of either steel pipe (jacked), steel liner plate, or expandable liner with either wood or steel lagging using a shield or boring machine that allows access to the excavation face in the ground conditions encountered at the tunnel location. Excavation is accomplished by use of a Tunnel Boring Machine (TBM), shield excavator, or equal, or by hand excavation with spaders and hoes. With a steel casing, the casing is jacked from a jacking pit. With tunnel liners, the liner plates/rings are assembled behind the tunnel boring machine/shield and the TBM/Shield is jacked against the tunnel liner. Hand excavation methods may be used to install tunnel liner or casing in suitable ground conditions. In either method, excavated materials are transported to the jacking pit or shaft using either a short conveyor belt or muck apron at the face that empties excavated material into muck carts at the rear of the shield that are transported by a track-mounted locomotive, or other mechanical means.
- B. This Specification is intended to be primarily functional in nature and to define in general terms work to be accomplished. Contractor granted full discretion to select method of tunnel construction based on ground conditions described in the Geotechnical Report, subject to review by Engineer.
- C. All requirements of Maricopa Association of Governments (MAG) Standard Specification Section 602 Trenchless or Open Cut Installation of Steel Casing and MAG Standard Specification Section 607 Trenchless Installation of Smooth Wall Jacking Pipe applicable to the construction method chosen by the Contractor shall apply.
- D. Contractor shall install liner types as shown on the Drawings. Where not otherwise indicated, Contractor shall use techniques and liner methods appropriate for the prevailing ground conditions.

1.2 DEFINITION

- A. Tunneling Work Plan: The written description together with sketches, drawings, schedules, and other documents defining Contractor's planned methods and procedures to construct referenced item. Contractor's Construction Drawings defined as drawings by which Contractor proposes to furnish, construct, install, and operate referenced item. Submission of Tunneling Work Plans, including construction drawings, required for

providing Engineer sufficient details to verify that Contractor's planned work and work in progress is in accordance with intent of design and specification requirements.

- B. Tunnel Boring Machine (TBM): Mechanized excavating equipment that is steerable, guided, and articulated, with a wheel type cutterhead that provides man entry to the tunnel face. The TBM provides support during the excavation process and is propelled by either gripping the sidewalls of the tunnel or by pushing off initial support.
- C. Zone of Active Excavation. Area located within a radial distance about a surface point immediately above the face of excavation equal to the depth to the bottom of excavation.
- D. Critical Structure. Any building, structure, bridge, pier, or similar construction partially or entirely located within a zone of active excavation.
- E. Tunneling Methodology. A written description, together with supporting documentation that defines Contractor's plans and procedures for the tunneling operations.
- F. Open Face. The face of a heading or tunnel which is unsupported during excavation (e.g., in hand mining or shield excavation).
- G. Closed Face. The face of a heading or tunnel which is provided support during the excavation process from a TBM, where the cutter head allows both partial exposure of the face and full closure, by means of hydraulically operated gates.

1.3 SUBMITTALS

- A. Make submittals in accordance with all sections and provisions of these specifications.
- B. The following submittals are required:
 - 1. Tunneling Work Plan. A description of proposed tunnel methodology for review. The description should be sufficient to convey the following:
 - a. Proposed method of tunnel construction and type of face support and lining system.
 - b. Manufacturer and type of tunneling equipment proposed; type of lighting and ventilation systems.
 - c. Number and duration of shifts planned to be worked each day.
 - d. Sequence of operations.
 - e. Location of access shafts and work sites.
 - f. Method of spoil transportation from the face, surface storage and disposal location.
 - g. Method of installing pipe.
 - h. Identify critical utility crossings and special precautions proposed.
 - i. Manufacturer and type of any chemical grout proposed.

2. Drawings and Calculations. Submit for record purposes, drawing, and calculations for any tunnel support system designed by the Contractor. Drawings shall be adequate for construction, and include installation details. Documents must be signed and sealed by a Professional Engineer registered in the State of Arizona. Calculations shall include clear statement of criteria used for the design.
 3. Quality Control. Submit for review a brief description of quality control methods including:
 - a. Method and frequency of survey control.
 - b. Example of tunnel daily log.
 - c. Instrumentation plan showing location, and frequency of monitoring relative to critical structures within the zone of active excavation.
 - d. Settlement survey plan (may be included in instrumentation plan).
 4. Geotechnical Investigation. When geotechnical investigations are conducted by the Contractor, submit results to the Owner's Representative for record purposes.
 5. Monitoring Plans:
 - a. Instrumentation Monitoring Plan. Submit for review, prior to construction, a monitoring plan that includes a schedule of instrumentation design, layout of instrumentation points, equipment installation details, manufacturer's catalog literature, and monitoring report forms.
 - b. Surface Settlement Monitoring Plan. Submit a settlement monitoring plan for review prior to construction. The plan shall identify the location of settlement monitoring points, reference benchmarks, survey frequency and procedures, and reporting formats.
 6. Structures Assessment. Preconstruction and post-construction assessment reports shall be provided for critical structures, namely those located within the zone of active excavation from the proposed tunnel centerline. Photographs or a video of any existing damage to structures in the vicinity of the sewer alignment shall be included in the assessment reports.
 7. The readings of all monitoring shall be submitted to the Owner's Representative.
 8. Daily Reports. The shift log as defined in paragraph 3.4, Pipe-jacked Tunneling Data, shall be maintained by the Contractor and must be made available to the Owner's Representative on request.
- C. Submittals for tunneling operations within Arizona Department of Transportation (ADOT) Right of Way will also be reviewed by ADOT and Contractor shall comply with any additional requirements established by ADOT. Submittals for tunneling operations within City of Phoenix Right of Way will also be reviewed by the City of Phoenix Street Transportation Department and Contractor shall comply with any additional requirements established by City of Phoenix.

1.4 DESIGN CRITERIA

- A. The primary liner shall be designed by the Contractor's Professional Engineer for appropriate loading conditions and deflection criteria, including but not limited to: the overburden and lateral earth pressures, handling and installation stresses, loads

imposed by the tunnel shield or tunnel boring machine thrust jacks, subsurface soil and water loads, grouting, and other conditions of service. Contractor shall be responsible for the design of the primary liner to carry construction loads in combination with overburden, earth and hydrostatic loads.

- B. The criteria for truck loading shall be HS-20 vehicle loading distributions in accordance with AASHTO.

PART 2 - PRODUCTS

2.1 LINER AND SUPPORTS

- A. The primary tunnel liner may consist of steel ribs and lagging, steel liner plates, precast concrete segments, steel casing pipe, or combinations of these. Lagging may be timber or steel. Utilize additional support elements including shotcrete, steel sets, breasting, spilling, forepoling, crown bars, soil anchors, or fabrics, as required to provide safe, stable excavation.

2.2 MATERIALS

- A. Where use of following materials is required, conform to requirements of following minimum standards:

<u>Material</u>	<u>Reference Standards</u>
Cement	ASTM C150
Structural Concrete	See Section 03300
Reinforcing Steel Wire	ASTM A82 or A496
Reinforcing Steel Wire Fabric	ASTM A185 or A497
Reinforcing Steel Bars	ASTM A615, Grade 60
Sand and Aggregate	ASTM C33
Structural Steel	ASTM A36
Steel Piles, Sheets	ASTM A328
Rings and Ribs	ASTM A36
Steel Plates	ASTM A36 and A283
Lumber and Timber	Hardwood, sound or better, as defined by Commercial Standard C560
Steel Casing Pipe	AWWA C200

PART 3 - EXECUTION

3.1 PREPARATION

- A. Use methods for tunneling operations that will minimize ground settlement. Contractor shall be responsible for his means and methods of tunneling construction and shall ensure safety of work, Contractor's employees, public, and adjacent property, whether public or private.
- B. Execute work of excavating, lining, grouting, and construction of tunnel so that ground settlement or loss will be minimized. Completed primary tunnel lining shall have full bearing against earth with no voids or pockets left in Work. Fill peripheral space between support elements and excavated surface no less frequently than after each shore or close by expanding support elements against ground as shield advances.
- C. Conduct tunneling operations in accordance with applicable safety rules and regulations, OSHA standards and Contractor's safety plan. Use methods which include due regard for safety of workmen, adjacent structures, utilities, and the public.
- D. Maintain clean working conditions inside the tunnel and shafts.
- E. Support the ground continuously in a manner to prevent loss of ground and keep the perimeters and faces of the tunnel stable.
- F. The completed primary tunnel lining shall have full bearing against the ground. The peripheral space between the support elements and the excavated surface shall be grouted or shall be closed by expanding the support elements against the ground to achieve full bearing as the tunnel advances.
- G. Ground Conditions. The Contractor may perform additional exploration by geotechnical borings in advance of construction to define necessary parameters for design of the primary tunnel liner, planning and designing the ground water control system, and for selection of tunneling method and equipment to successfully complete each tunnel reach.

3.2 GROUND WATER CONTROL

- A. Contractor shall provide the necessary ground water control measures to perform the work and to provide safe working conditions.
- B. Contractor shall anticipate that portions of the tunnel excavation may be below the ground water table and in cohesionless soils, even if not indicated on the soil borings, and in conditions which may require a ground water control system for the tunneling operations. Contractor shall install filter fabrics, backer rods and other means as necessary to prevent piping of fines into tunnel.

- C. If the Contractor chooses pumping installations to control the ground water level or installs a pervious liner through water bearing layers, the Contractor shall install and maintain an instrumentation system to monitor the water level and to detect any movement in adjacent structures and property.
- D. The dewatering system for tunnels shall remain in operation until the carrier pipe has been installed and the annular space is fully grouted, or until a watertight liner designed for hydrostatic pressures is installed.
- E. Tunneling for which ground water control is necessary shall not proceed until monitoring data indicate that the ground water control system is operating in accordance with the Contractor's plan.

3.3 EQUIPMENT

- A. The Contractor shall be responsible for selection of tunneling equipment which, based on past experience, has proven to be satisfactory for excavation of the soils to be encountered.
- B. The Contractor shall employ tunneling equipment that will be capable of handling the various anticipated ground conditions and which minimizes loss of soil ahead of the face and allows satisfactory support of the excavated face.
- C. A TBM or shield shall conform to the shape of the tunnel with a uniform perimeter that is free of projections that could produce over excavation or voids. An appropriately sized over cutting bead may be provided to facilitate steering. In addition it shall:
 - 1. Be capable of full directional guidance.
 - 2. Be capable of full-face closure, or permit ready installation of breasting boards.
 - 3. Be equipped with appropriate tail in which liner is erected.
 - 4. Be capable of correcting roll.
 - 5. Be designed to handle adverse ground conditions including ground water ingress.
 - 6. Be equipped with visual display to show the operator actual position of TBM or shield relative to design reference.
- D. Air Quality. Provide equipment to maintain proper air quality of tunnel operations during construction in accordance with OSHA requirements.
- E. Enclose lighting fixtures in watertight enclosures with suitable guards. Provide separate circuits for lighting, and other equipment.
- F. Electrical systems shall conform to requirements of National Electrical Code- NFPA70.

3.4 TUNNELING DATA

- A. Submit shift logs of construction events and observations within 24 hours of operation on at least the following:

1. Location of face by station and progress of tunnel drive during shift.
2. Observation of lost ground and other signs of ground movement.
3. Location and elevation of significant soil strata boundaries and brief soil descriptions.
4. Ground water control operations, piezometric levels, ground water inflow location and rates.
5. Completed field forms for establishing and checking line and grade and achieved tolerance relative to design alignment.
6. Operation shut-down periods or other interruptions in work, and reason.
7. Any unusual condition or event.
8. Resolution to any problems that occur.

B. Clearly mark primary liner every twenty (20) feet along tunnel length.

3.5 TUNNEL EXCAVATION AND PRIMARY LINER INSTALLATION

A. Tunnel Excavation.

1. Conduct tunneling operations in accordance with applicable safety rules and regulations, and Contractor's safety plan. Use methods which include due regard for safety of workmen, adjacent structures, utilities, and the public.
2. Tunnel excavation shall remain within the easements and rights-of-way indicated on the Drawings, to the lines and grades designated on the Drawings. The excavation shall be of sufficient size to allow the installation of the sewer pipe to the lines and grades indicated on the Drawings.
3. Open-face excavations:
 - a. Keep the face breasted or otherwise supported and prevent falls, excessive raveling, or erosion. Maintain standby face supports for immediate use when needed.
 - b. During shutdown periods, support the face of the excavation by positive means; no support shall rely solely on hydraulic pressure.
4. Closed-face excavation:
 - a. Control volume of spoil removed. Determine that the advance rate and the excavation rate are compatible to avoid over excavation or loss of ground.
 - b. When cutting head is withdrawn for any purpose, keep excavated face supported and stabilized.
 - c. When the face of the machine is open for maintenance, monitor conditions that might threaten the stability of the heading. Take appropriate action to prevent or limit influx of soils and water which would threaten the stability of the heading.
5. Whenever there is an identified condition which could endanger the tunnel excavation or adjacent structures, operate continually for 24 hours a day, including weekends and holidays, without intermission until the condition no longer exists.

B. Determination of primary liner size and section shall be the sole responsibility of the Contractor, to match the construction methods and equipment described in the tunneling methodology submittal. Tunnels shall be of sufficient size to permit efficient

excavation operations, to provide sufficient working space for placing the primary tunnel liner, and to allow for installation of the sewer pipe.

C. Primary Liner Installation:

1. Contractor's method shall ensure full bearing of the soil against the primary liner without significant settlement or movement of the surrounding soil. To fill the void behind the primary liner, either an expandable liner (e.g., ring beams and timber lagging) or a nonexpandable liner (e.g., bolted steel liner plates) may be used provided grout is placed behind the nonexpandable liner. Box tunnel where the ground is excavated to a true shape may be ungrouted.
2. When using a TBM or tunnel shield, advance the equipment only far enough to permit construction of one primary liner set, entirely within the equipment shield.
3. Filter fabric shall be installed around the exterior of the primary liner when using steel ribs and lagging. Backer rods shall be installed at ribs as required to control migration of fines. Windows in lagging shall be closed.
4. After grouting, deflection of liner shall be no more than allowable, nor shall the liner be distorted by excessive pressure.

D. Seal blind headings with a temporary bulkhead.

3.6 CONTROL OF TUNNEL LINE AND GRADE

A. Construction Control.

1. The Owner's Representative will establish the baselines and benchmarks indicated on the Drawings. Contractor shall check baselines and benchmarks at the beginning of the Work and report any errors or discrepancies to the Owner's Representative.
2. Use the baselines and benchmarks established by the Owner's Representative to establish and maintain construction control points, reference lines, and grades for locating tunnel.
3. Establish control points sufficiently far from the face so as not to be affected by tunneling operations.

B. Benchmark Movement. The Contractor shall ensure that if settlement of the ground surface occurs during construction which affects the accuracy of the temporary benchmarks, the Contractor shall detect and report such movement and reestablish temporary bench marks. The locations of the permanent monumentation benchmarks are indicated on the Drawings. Advise the Owner's Representative of any settlement affecting the permanent monumentation benchmarks.

C. Line and Grade.

1. Maintain a means sufficient to check alignment and grade continuously.
2. Check the survey control for tunneling against an aboveground undisturbed reference at least once each week and once for each 250 feet of tunnel constructed.
3. If unable to maintain specified tolerances, Contractor shall bear full responsibility and expense of correction (redesign, easement acquisition, etc.).

- D. Earth Movement. The Contractor shall be responsible for damages due to settlement from any construction-induced activities or occurrences.
1. The Contractor shall survey the crown, invert, and springline on each side of the primary liner at 50-foot intervals, or a minimum of once per shift, or more frequently if line and grade tolerances have been exceeded, to ensure the alignment is within the tolerances specified. The survey shall be conducted immediately behind the tunnel excavation to allow immediate correction of misalignment.
 2. The Contractor should be aware that if settlement of the ground surface should occur during construction of the tunnel which will affect the accuracy of the temporary benchmarks established by the Owner's Representative, it shall be the Contractor's responsibility to detect and report such movement. The locations of the permanent monumentation benchmarks are indicated on the Drawings; the Contractor may use these to verify temporary benchmark accuracy. Advise the Owner's Representative of any settlement affecting the permanent monumentation benchmarks. Upon completion, the field books pertaining to monitoring of the permanent monumentation benchmarks shall be submitted to the Owner's Representative.

3.7 MONITORING

- A. Instrumentation Monitoring. Instrumentation requirements shall be established in the Monitoring Plan Submittal. Instrumentation specified shall be accessible at all times to the Owner's Representative. Readings shall be submitted promptly to the Owner's Representative
1. Install and maintain an instrumentation system to monitor and detect movement of the ground surface and adjacent structures. Establish vertical control points at a distance from the construction areas that avoids disturbance due to ground settlement.
 2. Installation of the instrumentation shall not preclude the Owner's Representative, through an independent contractor or consultant, from installing instrumentation in, on, near, or adjacent to the construction work. Access shall be provided to the work for such independent installations.
- B. Surface Settlement Monitoring
1. Establish monitoring points on all critical structures.
 2. Record location of settlement monitoring points with respect to construction baselines and elevations. Record elevations to an accuracy of 0.01 feet for each monitoring point location. Monitoring points should be established at locations and by methods that protect them from damage by construction operations, tampering, or other external influences.
 3. Ground surface elevations must be recorded on the centerline ahead of the tunneling operations at a minimum of 100-foot intervals or at least three locations per tunnel drive. For primary lined tunnels greater than 60 inches cut diameter also record similar data at approximately 20 feet each side of the centerline. Settlement monitoring points must be clearly marked by studs or paint for ease of locating.

4. Railroads. Monitor ground settlement of track subbase at centerline of each track.
 5. Utilities and Pipelines. Monitor ground settlement directly above and 10 feet before and after the utility or pipeline intersection.
- C. Reading Frequency and Reporting. The Contractor shall submit to the Owner's representative, records of readings from the various instruments and survey points.
1. Instrumentation monitoring results to be read at the frequency specified and unless otherwise specified, shall be started prior to the zone of active excavation has passed and until no further detectable movement occurs.
 2. Surface settlement monitoring readings shall be taken:
 - a. Prior to the zone of active excavation reaching that point,
 - b. When the tunnel face reaches the monitoring point (in plan), and
 - c. When the zone of active excavation has passed and no further movement is detected.
 3. All monitoring readings shall be submitted promptly to the Owner's Representative.
 4. Immediately report to the Owner's Representative any movement, cracking, or settlement which is detected.
 5. Following substantial completion but prior to final completion, make a final survey of all monitoring points.

3.8 DISPOSAL OF EXCESS MATERIAL

- A. Remove spoil from the job site and dispose in accordance with all local and federal requirements.

++ END OF SECTION ++

SECTION 02315

STRUCTURAL EXCAVATION AND BACKFILL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment and incidentals required to perform all excavating, backfilling, filling and grading, and disposing of earth materials as shown on the Drawings, specified, and required for construction of retaining walls, manholes, vaults, structure foundations, underground ductbanks, electrical manholes and handholes, and other structures and facilities required to complete the Work in every respect.
2. All necessary preparation of subgrade for slabs, foundations and pavements is included.
3. All temporary means required to prevent discharge of sediment to water courses from dewatering systems or erosion are included.
4. On-site excavated material will be classified for use as backfill material. Excavation materials include all materials regardless of type, character, composition, moisture, or condition thereof.
5. Perform all earthwork as specified in this Section.

- B. General: Native soils are generally suitable for use in grading fills but shall be screened to remove cobbles 4-inches and larger, and have less than 40% passing the No. 200 sieve. See more detailed gradation requirements in the relevant sections.

1.2 QUALITY ASSURANCE

A. Testing Services:

1. General: Testing of materials, testing for moisture content during placement and compaction of fill materials, and of compaction requirements for compliance with technical requirements of these Specifications shall be performed by a testing laboratory as designated in 00700 General Requirements.
2. OWNER'S Testing Agency Scope:
 - a. Test CONTRACTOR'S proposed materials in the laboratory and/or field for compliance with these Specifications.
 - b. Conduct gradation and plasticity testing on excavated spoils proposed for backfill
 - c. Perform field moisture content and density tests to assure that the specified compaction of backfill materials has been obtained.
 - d. Report all test results to the ENGINEER and CONTRACTOR.

3. Authority and Duties of OWNER'S Testing Agency: Technicians representing the testing laboratory shall inspect the materials in the field and perform tests and shall report their findings to the ENGINEER and CONTRACTOR. When the materials furnished or Work performed fails to fulfill Specification requirements, the technician will direct the attention of the ENGINEER and CONTRACTOR to such failure.
 - a. The technician shall not act as foreman or perform other duties for CONTRACTOR. Work will be checked as it progresses, but failure to detect any defective Work or materials shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the ENGINEER for final acceptance. Technicians are not authorized to revoke, alter, relax, enlarge, or release any requirements of the Contract Documents, nor to approve or accept any portion of the Work.
4. Responsibilities and Duties of CONTRACTOR:
 - a. The use of testing services shall in no way relieve CONTRACTOR of the responsibility to furnish materials and construction in full compliance with the Contract Documents.
 - b. To facilitate testing services:
 - 1) Secure and deliver to the ENGINEER or to the testing agency, without cost, preliminary representative samples of the materials he proposes to use and which are required to be tested.
 - 2) Furnish such casual labor as is necessary to obtain and handle samples at the Work site or at other sources of material.
 - 3) Advise the OWNER'S testing agency at least two days in advance of any backfill operations to allow for completion of quality tests and for the assignment of personnel.
 - c. CONTRACTOR'S Testing Service shall inspect and approve subgrades and fill layers before further construction Work is performed thereon.
 - d. Responsibility belongs to CONTRACTOR to accomplish the specified compaction for backfill, fill, and other earthwork, and to control his operations by confirmation tests to verify and confirm that CONTRACTOR has complied, and is complying at all times, with the requirements of these Specifications concerning compaction, control, and testing.
 - e. The frequency of CONTRACTOR'S confirmation tests shall be not less than as follows; each test location for trenches shall include tests for each layer, type, or class of backfill from bedding to finish grade.
 - 1) Trenches for structures, and underground ductbanks:
 - a) In Open Fields: Four locations every 200 linear feet, each lift.
 - b) Along Dirt or Gravel Roads or Off Traveled Right-of-way: Four locations every 200 linear feet, each lift.
 - c) Crossing Paved Roads: Two locations along each crossing.
 - d) Under Pavement Cuts or Within Two Feet of Pavement Edges: Two locations every 200 linear feet, each lift.
 - e) Compaction test shall be taken at least every 1 foot of total lift and 75 feet lineally.

- 2) For structural backfill: On 30-foot intervals on all sides of the structure for every compacted lift but no less than one per lift on each side of the structure for structures less than 60 feet long on a side.
 - 3) In embankment or fill: One per 1000 square feet on every compacted lift.
 - 4) Base material: Four per 1000 square feet on every compacted lift.
 - 5) Footing Subgrade: For each strata of soil on which footings will be placed, conduct at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to ENGINEER.
 - 6) Paved Areas and Building Slab Subgrade: Make at least one field density test of subgrade for every 250 square feet of paved area or building slab, but in no case less than three tests. In each compacted fill layer, make one field density test for every 250 square feet of overlaying building slab or paved area, but in no case less than three tests.
 - 7) Foundation Wall Backfill: Take at least six field density tests, at locations and elevations as directed by the ENGINEER.
- f. Copies of the test reports shall be submitted promptly to the ENGINEER. CONTRACTOR'S tests to be performed by a soils testing laboratory acceptable to the ENGINEER.
 - g. Demonstrate the adequacy of compaction equipment and procedures before exceeding any of the following amounts of earthwork quantities:
 - 1) 50 linear feet of trench backfill.
 - 2) 5 cubic yards of structural backfill.
 - 3) 100 cubic yards of embankment work.
 - 4) 10 cubic yards of base material.
 - h. Until the specified degree of compaction on the previously specified amounts of earthwork is achieved, no additional earthwork of the same kind shall be performed.
 - i. Periodic compliance tests will be made by the ENGINEER to verify that compaction is conforming to the requirements previously specified, at no cost to CONTRACTOR. Remove the overburden above the level at which the ENGINEER wishes to test and shall backfill and recompact the excavation after the test is complete.
 - j. If compaction fails to conform to the specified requirements, remove and replace the backfill at proper density or shall bring the density up to specified level by other means acceptable to the ENGINEER. Subsequent tests required to confirm and verify that the reconstructed backfill has been brought up to specified density shall be paid by CONTRACTOR. CONTRACTOR'S confirmation tests to be performed in a manner acceptable to the ENGINEER. Frequency of confirmation tests for remedial Work shall be double that amount specified for initial confirmation tests.

B. Permits and Regulations:

1. Obtain all necessary permits for Work in roads, rights-of-way, railroads, etc. Also, obtain permits as required by local, state and federal agencies for discharging water from excavations.
 2. Perform excavation Work in compliance with applicable requirements of governing authorities having jurisdiction.
- C. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown on the Drawings or specified. Where the requirements of more than one code or standard are applicable, the more restrictive will govern. The codes that will be in effect at the completion of the design phase of the project will be used.
1. ASTM A 36/A 36M, Specification for Carbon Structural Steel.
 2. ASTM A 328/A 328M, Specification for Steel Sheet Piling.
 3. ASTM D 422, Method for Particle-Size Analysis of Soils.
 4. ASTM D 427, Test Methods for Shrinkage Factors of Soils by the Mercury Method.
 5. ASTM D 698, Test Method for Laboratory Compaction Characteristics of Soil.
 6. ASTM D 1556, Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 7. ASTM D 2166, Test Method for Unconfined Compressive Strength of Cohesive Soils.
 8. ASTM D 2922, Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 9. ASTM D 4318, Test Method for Liquid Limit, Plastic Limit and Plasticity Index of Soils.
 10. AISC Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.
 11. OSHA Standard, Title 29, Code of Federal Regulations, Part 1926, Section .650 (Subpart P - Excavations).
 12. 2012 International Building Code as amended by the City of Phoenix, Building Construction Code.
 13. Uniform Standard Specifications for Public Work Construction by the Maricopa Association of Governments (MAG) as supplemented by the City of Phoenix, Section 206, Structure Excavation and Backfill, Section 604, Placement of Controlled Low Strength Material, Section 702, Base Materials, Section 725, Portland Cement Concrete, Section 728, Controlled Low Strength Material. Where there is a conflict between MAG Standard Specifications as supplemented by the City of Phoenix and this Specification, provisions of this Specification shall govern.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Excavation and Backfill Submittals:
 - a. Excavation Plan: Prior to start of excavation operations, a written plan shall be submitted to demonstrate compliance with OSHA Standard 29 CFR Part 1926.650. As a minimum, excavation plan shall include:

- 1) Name of competent person.
 - 2) Excavation method(s) or protective system(s) to be used.
 - 3) Copies of "Manufacturer's Data" or other tabulated data if protective system(s) are designed on the basis of such data.
 - b. Excavation and backfill requirements detailing sheeting and bracing, or other protective system(s), dewatering systems, cofferdams, and underpinning.
 - c. Shop Drawings shall be prepared by a Registered Professional Engineer, licensed in the State of Arizona, recognized as an expert in the specialty involved. Drawings shall be submitted to ENGINEER for record purposes only. Calculations shall not be submitted. Drawing submittals will not be checked and will not imply approval by ENGINEER of the Work involved. Sole responsibility for designing, installing, operating and maintaining whatever system is necessary to satisfactorily accomplish all necessary sheeting, bracing, protection, underpinning and dewatering belongs to CONTRACTOR.
 - d. Samples of all materials, including select backfill, general backfill, crushed stone and sand shall be submitted to the ENGINEER and the testing service. Samples of the proposed material shall be submitted at least 14 days in advance of its anticipated use.
2. Test Reports:
- a. Testing laboratory shall submit copies of the following reports directly to ENGINEER, with copy to CONTRACTOR:
 - 1) Tests on borrow material.
 - 2) Tests on footing subgrade.
 - 3) Field density tests.
 - 4) Optimum moisture - maximum density curve for each soil used for backfill.
 - 5) Tests of actual unconfined compressive strength or bearing tests of each strata.
 - 6) Reports of observations for conformance of borrow material to the Project Geotechnical Report.
- B. CONTRACTOR shall submit hard copies and soft copy per Specification Section 01332, Shop Drawing Procedures. Soft copies shall be in CD format and shall include all information provided in hard copy. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.

1.4 JOB CONDITIONS

- A. Subsurface Information: Refer to Section 00700, General Conditions, and Section 00800, Supplementary Conditions, for available data on subsurface conditions. The data is not intended as a representation or warranty of continuity of conditions between soil borings nor of groundwater levels at dates and times other than date and time when measured. OWNER will not be responsible for interpretations or conclusions by

- CONTRACTOR. Data is solely made available for the convenience of CONTRACTOR.
1. Additional test borings and other exploratory operations may be made by CONTRACTOR, at no additional cost to OWNER.
 2. Refer to and comply with the requirements of Section 02220, Demolitions.
- B. Existing Structures: The Drawings show certain surface and underground structures adjacent to the Work. This information has been obtained from existing records. It is not guaranteed to be correct or complete and is shown on the Drawings for the convenience of CONTRACTOR. Explore ahead of the required excavation to determine the exact location of all existing structures. Structures shall be supported and protected from damage by CONTRACTOR. If they are broken or damaged, restore them immediately, at no additional cost to the OWNER.
- C. Existing Utilities: Locate existing underground utilities in the areas of the Work. If utilities are to remain in place, provide adequate means of protection during all operations.
1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult piping or utility owner and ENGINEER immediately for directions as to procedure. Cooperate with OWNER and utility owner in keeping services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
 2. Do not interrupt existing utilities serving facilities occupied and used by OWNER or others, except when permitted in writing by ENGINEER and then only after acceptable temporary utility services have been provided.
 3. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.
- D. Use of Explosives:
1. The use of explosives will not be permitted.
 2. Do not bring explosives onto site or use in the Work without prior written permission from authorities having jurisdiction. Provide copy of authorization to ENGINEER. Sole responsibility for handling, storage, and use of explosive materials when their use is permitted belongs to CONTRACTOR.
- E. Protection of Persons and Property: Barricade open excavations occurring as part of the Work and post with warning lights. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.
- F. Dust Control: Conduct all operations meeting the requirements specified in 00700 General Requirements pertaining to Earthmoving and Dust Control.

- G. Roadways and Walks: Unless otherwise approved by ENGINEER, excavated material and materials of construction shall be so deposited, and the Work shall be so conducted, as to leave open and free for pedestrian traffic all crosswalks, and for vehicular traffic a roadway not less than ten feet in width. All hydrants, valves, fire alarm boxes, letter boxes, and other facilities which may require access during construction shall be kept accessible for use. During the progress of the Work, maintain such crosswalks, sidewalks, and roadways in satisfactory condition and the Work shall at all times be so conducted as to cause a minimum of inconvenience to public travel, and to permit safe and convenient access to private and public property along the line of the Work.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Backfill and Fill Materials:

1. Materials acceptable for use as backfill against walls, foundations, underground ductbanks, and other structures shall be stockpiled native sandy clay or granular soils obtained from on-site excavations and which are uniformly mixed, contain no organic matter, nor contain rocks or fragments greater than 4-inches in size, nor have greater than 40 percent passing the 200 sieve. The maximum expansion of on-site materials shall be 1.5 percent as performed on a sample remolded to approximately 95 percent of the maximum dry density as determined in accordance with ASTM D 698 at two percent below optimum moisture content under a 100 psf surcharge pressure.
2. Backfill and fill materials from off-site sources shall consist of silty or clayey sand soils which are uniformly mixed, contain no roots, branches, or other evident organic or deleterious matter and which have a Plasticity Index less than fifteen when tested in accordance with ASTM D 4318. The maximum particle size of imported soils or native fill shall be 4-inches with a grading required to provide compaction without nesting. The maximum expansion of off-site materials shall be 1.5 percent as performed on a sample remolded to approximately 98 percent of the maximum dry density as determined in accordance with ASTM D 698 at two percent below optimum moisture content under a 100 psf surcharge pressure.
3. All materials for use as backfill and fill material shall be tested by the laboratory and approved by the ENGINEER.
4. If on-site material is determined to be unsuitable as determined by the ENGINEER, select backfill or approved off-site backfill and fill materials shall be used.
5. Fill adjacent to structures is classified as backfill to a distance measured horizontally from the structure that is equal to the depth from the finished grade. Outside these limits the fill is classified as fill, unless otherwise specified.
6. Demolition spoils or materials shall not be used as or mixed with backfill material.

B. On-site Batched Flowable Backfill:

1. On-site soils shall be amended with cement and water to provide a flowable backfill as shown on the Drawings and per the general structural notes, specifically sheet S-1.1. On-site batched flowable backfill shall conform to slump requirement of 1 Sack Controlled Low Strength Material (CLSM), as specified in Section 728 of the MAG Specifications and the contract drawing S-1.1. Minimum cement content for on-site batched flowable backfill material shall be per contract drawing S-1.1. Alternative on-site batched flowable backfill material, designed by a qualified Geotechnical Engineer and supported with test results, may be submitted for consideration to OWNER.
2. The extent of the on-site batched flowable backfill shown/noted on the Drawings is based on a probable line of excavation.

C. Select Backfill:

1. Select backfill for use beneath concrete slabs, asphaltic pavements and building foundations shall be crushed aggregate conforming to the requirement below:

Sieve Sizes (Square Openings)	Percentage by Weight Passing Sieve
1-1/4-inch	100
No. 4	38-65
No. 8	25-60
No. 30	10-40
No. 200	3-12

The depth of select backfill shall be a minimum of 12-inches.

The plasticity index of the fraction of material passing the No. 40 sieve should be no more than 5 when tested in accordance with ASTM D4318. Coarse aggregate should have a present of wear, when subjected to the Los Angeles abrasion test (ASTM C131) of no greater than 45.

D. Fill Material for Embankments.

1. Fill materials for use as embankments, and as miscellaneous landscaping materials exterior to plant facilities, shall consist of soils obtained from on-site excavations or off-site sources that are uniformly mixed, contain no organic material, rocks or fragments greater than 3-inches in size.
2. All materials for use as described above shall be tested by the laboratory and approved by the ENGINEER prior to use.

E. Pipe Bedding and Pipe Backfill:

1. Refer to Specification 15051.

F. Drainage Fill: Washed, uniformly graded mixture of crushed stone, or crushed or uncrushed gravel, with 100 percent passing a 1-1/2 inch sieve and not more than five

percent passing a No. 4 sieve. Crushed stone or gravel shall be crushed rock or gravel conforming to the requirements of Section 02318, Crushed Stone and Gravel.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Provide ENGINEER with sufficient notice and with means to examine the areas and conditions under which excavating, filling, and grading are to be performed. ENGINEER will notify CONTRACTOR if conditions are found that may be detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner.

3.2 SITE PREPARATION

- A. Clear all areas to be occupied by permanent construction or embankments of all trees, brush, roots, stumps, logs, wood and other materials and debris. Clean and strip subgrades for fills and embankments of vegetation, sod, topsoil and organic matter. All waste materials shall be removed from site and properly disposed of by CONTRACTOR. Burning is not to be permitted. Refer to and comply with the requirements of Section 02230, Clearing.

3.3 TEST PITS

- A. General:
 1. Excavate and backfill, in advance of the construction, test pits to determine conditions or location of the existing utilities and structures. Perform all Work required in connection with excavating, stockpiling, maintaining, sheeting, shoring, backfilling and replacing pavement for the test pits.
 - a. Responsibility for the definite location of each existing facility involved within the area of his excavation for Work under this Contract belongs to CONTRACTOR. Care shall be exercised during such location work to avoid damaging and/or disrupting the affected facility. Responsibility for repairing, at his expense, damage to any structure, piping, or utility caused by his Work, belongs to CONTRACTOR.
 - b. No separate payment will be made for test pits shown on the Drawings.
 - c. Payment for test pits ordered by ENGINEER will be paid for under the unit price bid.
 - d. No separate payment will be made for test pits made by CONTRACTOR for his own use.

3.4 EXCAVATION

- A. Perform all excavation required to complete the Work as shown on the Drawings, specified and required. Excavations shall include earth, sand, clay, gravel, hardpan, boulders not requiring drilling and blasting for removal, decomposed rock, pavements, rubbish and all other materials within the excavation limits, except rock.
- B. Excavations for structures and underground ductbanks shall be open excavations. Provide excavation protection system(s) required by ordinances, codes, law and regulations to prevent injury to workmen and to prevent damage to new and existing structures or pipelines. Unless shown on the Drawings or specified otherwise, protection system(s) shall be utilized under the following conditions.
 - 1. Excavation Less Than Five Feet Deep: Excavations in stable rock or in soil conditions where there is no potential for a cave-in may be made with vertical sides. Under all other conditions, excavations shall be sloped and benched, shielded, or shored and braced.
 - 2. Excavations More Than Five Feet Deep: Excavations in stable rock where there is no potential for a cave-in may be made with vertical sides. Under all other conditions, excavations shall be sloped and benched, shielded or shored and braced.
 - 3. Excavation protection system(s) shall be installed and maintained in accordance with drawings submitted under Article 1.3, above.
- C. Where the structure or ductbank is to be placed below the ground water table, well points, cofferdams or other acceptable methods shall be used to permit construction of said structure under dry conditions. Dry conditions shall prevail until concrete has reached sufficient strength to withstand earth and hydrostatic loads. In addition, protect excavation from flooding until all walls and floor framing up to and including grade level floors are in place and backfilling has begun. Water level shall be maintained below top of backfill at all times.
- D. Pumping of water from excavations shall be done in such a manner to prevent the carrying away of unconsolidated concrete materials, and to prevent damage to the existing subgrade.
- E. The elevation of the bottom of footings shown on the Drawings shall be considered as approximate only and ENGINEER may order such changes in dimensions and elevations as may be required to secure a satisfactory footing. All structure excavations shall be hand-trimmed to permit the placing of full widths, and lengths of footings on horizontal beds. Rounded and undercut edges will not be permitted.
- F. When excavations are made below the required grades, without the written order of ENGINEER, they shall be backfilled with select backfill material, as directed by ENGINEER, at the expense of CONTRACTOR.

- G. Excavations shall be extended sufficiently on each side of structures, footings, etc., to permit setting of forms, installation of shoring or bracing or the safe sloping of banks.
- H. Subgrades for roadways and structures shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud, muck, and other soft or unsuitable materials; and shall remain firm and intact under all construction operations. Subgrades which are otherwise solid, but which become soft or mucky on top due to construction operations, shall be reinforced with select backfill material. The finished elevation of stabilized subgrades shall not be above subgrade elevations shown on the Drawings. Proof roll all subgrades prior to placing of select fill and general fill material.
- I. Material Storage: Stockpile satisfactory excavated materials in approved areas, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
 - 1. Locate and retain soil materials away from edge of excavations.
 - 2. Dispose of excess soil material and waste materials as specified hereinafter.
 - 3. Stockpiled excavated soils for use as subsequent fill shall be classified by laboratory as on-site granular or sandy clay soils. Use and placement of fill shall be performed as specified for each class.
 - 4. Excess soil from excavations shall be disposed of off-site. Disposal shall be in accordance with state and local regulatory requirements.
- J. Where ENGINEER considers the existing material beneath the bedding material unsuitable, CONTRACTOR shall remove same and replace it with select backfill.

3.5 UNAUTHORIZED EXCAVATION

- A. All excavation outside the lines and grades shown on the Drawings, and which is not approved by ENGINEER, together with the removal and disposal of the associated material shall be at CONTRACTOR'S expense. Unauthorized excavations shall be filled and compacted with select backfill by CONTRACTOR at their expense.

3.6 DRAINAGE, EROSION CONTROL AND DEWATERING

- A. Erosion Control:
 - 1. In general, the construction procedures outlined herein shall be implemented to assure minimum damage to the environment during construction. Take any and all additional measures required to conform to the requirements of applicable codes and regulations and the requirements specified in Section 01412, Stormwater Pollution Prevention Plan and Permit.
 - 2. Whenever possible, access and temporary roads shall be located and constructed to avoid environmental damage. Provisions shall be made to regulate drainage, avoid erosion and minimize damage to vegetation.
 - 3. Where areas must be cleared for storage of materials or temporary structures, provisions shall be made for regulating drainage and controlling erosion, subject to the ENGINEER'S approval.

4. Temporary measures shall be applied to control erosion and to minimize the silting of the existing waterways, and natural ponding areas. Such measures shall include, but are not limited to, the use of berms, baled straw silt barriers, gravel or crushed stone, mulch, slope drains and other methods. These temporary measures shall be applied to erodible materials exposed by any activities associated with the construction of this Work.
 - a. Special care shall be taken to eliminate depressions that could serve as mosquito pools.
 - b. Temporary measures shall be coordinated with the construction of permanent drainage facilities and other Work to the extent practicable to assure economical, effective, and continuous erosion and silt control.
 - c. Provide special care in areas with steep slopes. Disturbance of vegetation shall be kept to a minimum to maintain stability.
 5. Remove only those shrubs and grasses that must be removed for construction. Protect the remainder to preserve their erosion-control value.
 6. Install erosion and sediment control practices where shown on the Drawings and according to applicable standards, codes and specifications. The practices shall be maintained in effective working condition during construction and until the drainage area has been permanently stabilized.
 7. Mulching to be used for temporary stabilization.
 - a. Suitable Materials for Mulching:
 - 1) Unrotted straw or salt hay: 1-1/2 to 2 tons/acre.
 - 2) Asphalt emulsion or cutback asphalt: 600 to 1200 gal. /acre.
 - 3) Wood-fiber or paper-fiber (hydroseeding): 1500 lbs./ acre.
 - 4) Mulch netting (paper, jute, excelsior, cotton or plastic).
 - b. Straw or salt hay mulches should be immediately anchored using peg and twine netting or mulch anchoring tool or liquid mulch binders.
 8. After stabilization, remove all straw bale dikes, debris, etc., from the site.
 9. In the event of any temporary Work stoppage, take steps any temporary or environmental damage to the area undergoing construction.
 10. In the event CONTRACTOR repeatedly fails to satisfactorily control erosion and siltation, the OWNER reserves the right to employ outside assistance or to use its own forces to provide the corrective measures indicated. The cost of such work, plus engineering costs, will be deducted from monies due CONTRACTOR.
 11. Prevent blowing and movement of dust from exposed soil surfaces and access roads to reduce on and off-site damage and health hazards. Control may be achieved by irrigation in which the site shall be sprinkled with water until the surface is moist. The process shall be repeated as needed.
- B. Drainage and Dewatering:
1. Provide and maintain adequate drainage and dewatering equipment to remove and dispose of all surface water and ground water entering excavations, or other parts of the Work. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, therein is inspected by the ENGINEER and backfill operations have been completed and approved.

- a. The different working areas on the site shall be kept free of surface water at all times. Install drainage ditches and dikes and shall perform all pumping and other Work necessary to divert or remove rainfall and all other accumulations of surface water from the excavations and fill areas. The diversion and removal of surface water shall be performed in a manner that will prevent the accumulation of water behind temporary structures or at any other locations within the construction area where it may be detrimental.
 - b. Water used for working or processing, resulting from dewatering operations, or containing oils or sediments that will reduce the quality of the water downstream of the point of discharge, shall not be directly discharged. Such waters shall be diverted through a settling basin or filter before being discharged.
 - c. Responsibility belongs to CONTRACTOR for the condition of any pipe, conduit or channel used for drainage purposes and all such pipes, conduits or channels shall be left clean and free of sediment.
 - d. Remove water from excavations as fast as it collects.
2. Provide, install and operate sufficient trenches, sumps, pumps, hose, piping, well points, deep wells, etc., necessary to depress and maintain the ground water level below the base of the excavations during all stages of construction operations. The ground water table shall be lowered in advance of excavation, for a sufficient period of time so as to permit dewatering of fine grain soils, and maintained two feet below the lowest subgrade excavation made until the structure has sufficient strength and weight to withstand horizontal and vertical soil and water pressures from natural ground water. The system shall be operated on a 24-hour basis and standby pumping facilities and personnel shall be provided to maintain the continued effectiveness of the system. If, in the opinion of the ENGINEER, the water levels are not being lowered or maintained as required by these Specifications, install additional or alternate dewatering devices as necessary, at no additional cost to the OWNER.
- a. Elements of the system shall be located so as to allow a continuous dewatering operation without interfering with the construction of the permanent Work. Where portions of the dewatering system are located in the area of permanent construction, submit details of the methods he proposes to construct the permanent Work in this location for the approval of the ENGINEER. Controls of ground water shall continue until the permanent construction provides sufficient dead load to withstand the hydrostatic uplift of the normal ground water, until concrete has attained sufficient strength to withstand earth and hydrostatic loads, and until all waterproofing Work has been completed. Dispose of all water removed from the excavation in such a manner so as not to endanger any portion of the Work under construction or completed. Convey water from the excavations in a closed conduit. Before discontinuing dewatering operations or permanently permitting the rise of the ground water level, computations shall be made to show that any structure affected by the water level rise is protected by backfill or other means to sustain uplift. Use a safety factor of 1.25 when making these computations.

- b. Dewatering operations shall not be discontinued without the prior authorization of the ENGINEER.
- c. Design of dewatering system, including both drawings and calculations, shall be performed by a Registered Professional Engineer in the State of Arizona and shall be employed by CONTRACTOR. Dewatering system shall be designed so as to avoid settlement or damage to existing structures and utilities.

C. Disposal of Water Removed by Dewatering System:

1. CONTRACTOR'S Dewatering System will discharge to on-site storm drain system in accordance with State and Federal regulations.
2. Dispose of all water removed from the excavation in such a manner as not to endanger public health, property, or any portion of the Work under construction or completed.
3. Dispose of water in such a manner as to cause no inconvenience to OWNER, ENGINEER, or others involved in Work about the site.
4. Convey water from the construction site in a closed conduit. Do not use trench excavations as temporary drainage ditches
5. Meter the quantity of water discharged in a manner acceptable to the Arizona Department of Water Resources.
6. The discharged water from the Dewatering System shall be purchased from the Arizona Department of Water Resources at the prevailing rate.

3.7 SHEETING, SHORING AND BRACING FOR STRUCTURE EXCAVATIONS

A. General:

1. Used material shall be in good condition, not damaged or excessively pitted. All steel or wood sheeting designated to remain in place shall be new. New or used sheeting may be used for temporary work.
2. All timber used for breast boards (lagging) shall be new or used, meeting the requirements for Douglas Fir Dense Construction grade with a bending strength not less than 1500 psi or Southern Pine No. 2 Dense.
3. All steel work for sheeting, shoring, bracing, cofferdams etc., shall be designed in accordance with the provisions of the "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings", of the AISC except that field welding will be permitted.
4. Steel sheet piling shall be manufactured from steel conforming to ASTM A 328/A 328M. Steel for soldier piles, wales and braces shall be new or used and shall conform to ASTM A 36/A 36M.
5. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
6. Unless otherwise shown on the Drawings, specified, or ordered, all materials used for temporary construction shall be removed when Work is completed. Such removal shall be made in a manner not injurious to the structure or its appearance or to adjacent Work.

7. Provide permanent steel sheet piling or pressure creosoted timber sheet piling wherever subsequent removal of sheet piling might permit lateral movement of soil under adjacent structures. Cut off tops as required, but at least three feet below grade, and leave permanently in place.
 8. The clearances and types of the temporary structures, insofar as they affect the character of the finished Work, and the design of sheeting to be left in place, will be subject to the approval of ENGINEER; but responsibility for the adequacy of all sheeting, shoring, bracing, coffer-damming, etc., belongs to CONTRACTOR.
 9. Safe and satisfactory sheeting, shoring and bracing shall be the entire responsibility of CONTRACTOR.
 10. All municipal, County, State and Federal ordinances, codes, regulations and laws shall be observed.
- B. Removal of Sheeting and Bracing:
1. Remove sheeting and bracing from excavations, unless otherwise directed in writing by ENGINEER. Removal shall be done so as to not cause injury to the Work. Removal shall be equal on both sides of excavation to ensure no unequal loads on pipe or structure.
 2. Defer removal of sheeting and bracing, where removal may cause soil to come into contact with concrete, until the following conditions are satisfied:
 - a. Concrete has cured a minimum of seven days.
 - b. Wall and floor framing up to and including grade level floors are in place.

3.8 TRENCH SHIELDS

- A. Excavation of earth material below the bottom of a shield shall not exceed the limits established by ordinances, codes, laws and regulations.
- B. When using a shield for the installation of structures, the bottom of the shield shall not extend below the top of the bedding for the structures.
- C. When a shield is removed extreme care shall be taken to prevent damage to the structures or the disturbance of the bedding for structures. Structures that are disturbed shall be removed and reinstalled as specified.

3.9 PLACEMENT OF FILL AND BACKFILL

- A. General:
1. All select backfill and backfill required for structures, embankments, and ductbanks and required to provide the finished grades shown on the Drawings and as described herein shall be furnished, placed and compacted by CONTRACTOR. Refer to and comply with the requirements of Section 02318, Crushed Stone and Gravel.
 2. Backfill excavations as promptly as Work permits, but not until completion of the following:

- a. Acceptance by the ENGINEER of construction below finish grade, including damp proofing, waterproofing and perimeter insulation.
 - b. Inspection, testing, approval, and recording of locations of underground duct banks.
 - c. Removal of concrete formwork.
 - d. Removal of shoring and bracing, and backfilling of voids with satisfactory materials.
 - e. Removal of trash and debris.
3. Fill containing organic materials or other unacceptable material shall be removed and replaced with approved fill material as specified.
- B. Placement of Select Backfill, Backfill and Fill:
1. Select backfill shall be placed to the grades shown on the Drawings. The lift thickness and compaction moisture content range given herein are approximate. These values shall be finally determined from the laboratory test results on the fill materials. Testing requirements shall be as specified in Paragraph 3.8.E., below.
 2. All select backfill shall be placed in horizontal loose lifts, not exceeding 8-inches in thickness, and shall be mixed and spread in a manner assuring uniform lift thickness after placing. Each lift shall be compacted by not less than two complete coverage's of the specified compactor. Select backfill shall be placed to the underside of all concrete slabs. The fill material shall extend a minimum of two feet outside the face of each structure and be a minimum of 12-inches below finished grade on all structures unless shown otherwise on the Drawings. The maximum slope of select backfill to the subgrade shall be one vertical to one horizontal.
 3. Backfill and fill around and outside of structures and over select backfill shall be deposited in layers not to exceed 8-inches in uncompacted thickness and mechanically compacted, using platform type tampers. Compaction of structures backfilled by rolling will be permitted provided the desired compaction is obtained and damage to the structure is prevented. Compaction of select backfill and/or backfill by inundation with water will not be permitted. All materials shall be deposited as specified herein and as shown on the Drawings.
 4. The material shall be placed at a moisture content and density as specified under Paragraph 3.8.E., below. Provide equipment capable of adding measured amounts of water to the backfill and/or select backfill material to bring it to a condition within the range of the required moisture content. Provide equipment capable of discing, aerating, and mixing the soil to ensure reasonable uniformity of moisture content throughout the fill material and to reduce the moisture content of the borrow material by air drying, if necessary. If the subgrade or lift of earth material must be moisture conditioned before compaction, the fill material shall be sufficiently mixed or worked on the subgrade to ensure a uniform moisture content throughout the lift of material to be compacted. Materials at moisture content in excess of the specified limit shall be dried by aeration or stockpiled for drying.
 5. No backfill or fill material shall be placed when free water is standing on the surface of the area where the fill is to be placed. No compaction of fill will be permitted

with free water on any portion of the fill to be compacted. No fill shall be placed or compacted in a frozen condition or on top of frozen material. Any fill containing organic materials or other unacceptable material previously described shall be removed and replaced with approved fill material prior to compaction.

6. Compaction shall be performed with equipment suitable for the type of fill material being placed. Select equipment that is capable of providing the minimum density required by these Specifications. Hand operated compacting equipment shall be used within a distance of ten feet from the wall of any completed below grade structure. Equipment shall be provided that is capable of compacting in restricted areas next to structures and around piping. The effectiveness of the equipment selected shall be tested at the commencement of compacted fill Work by construction of a small section of fill within the area where fill is to be placed. If tests on this section of fill show that the specified compaction is not obtained, increase the amount of coverages, decrease the lift thicknesses and/or obtain a different type of compactor.
7. Levels of backfill against concrete walls shall not differ by more than two feet on either side of walls, unless walls are adequately braced or all floor framing is in place up to and including grade level slabs. Particular care shall be taken to compact structure backfill, which will be beneath pipes, roads, or other surface construction or structures. In addition, wherever a trench passes through structure backfill, the structure backfill shall be placed and compacted to an elevation 12-inches above the top of the pipe before the trench is excavated. Compacted areas, in each case, shall be adequate to support the item to be constructed or placed thereon.
8. The compaction requirements specified are predicated on the use of normal materials and compaction equipment. In order to establish criteria for the placement of a controlled fill so that it will have compressibility and strength characteristics compatible with the proposed structural loadings, a series of laboratory compaction and/or compressive strength tests shall be performed on the samples of materials submitted by CONTRACTOR. From the results of the laboratory tests, the final values of the required percent compaction, the acceptable compaction moisture content range, and the maximum permissible lift thickness will be established for the fill material and construction equipment proposed.
9. Control the water content of fill material during placement within the range necessary to obtain the compaction specified. In general, the moisture content of the fill shall be within two percent of the optimum moisture content for compaction as determined by laboratory tests. Perform all necessary work to adjust the water content of the material to within the range necessary to permit the compaction specified. Do not place fill material when free water is standing on the surface of the area where the fill is to be placed. No compaction of fill will be permitted with free water on any portion of the fill to be compacted.
10. Compact fill shall be compacted by at least two coverages of all portions of the surface of each lift by compaction equipment. One coverage is defined as the condition obtained when all portions of the surface of the fill material have been subjected to the direct contact of the compactor.

11. If the specified densities are not obtained because of improper control of placement or compaction procedures, or because of inadequate or improperly functioning compaction equipment, perform whatever Work is required to provide the required densities. This Work shall include complete removal of unacceptable fill areas, and replacement and recompaction until acceptable fill is provided.
12. If any settlement occurs, repairs will be at CONTRACTOR’S expense. Make all repairs and replacements necessary within 30 days after notice from ENGINEER or OWNER.
13. Special attention is required to assure compaction under all piping to spring line, if the compaction process is not satisfactory to the ENGINEER. The CONTRACTOR shall use half-sack slurry for backfill to springline if not identified already per the contract documents.

C. Backfill in Electrical Ductbank Trenches:

1. Compacted backfill shall be required for the full depth of the trench, below and above the electrical ductbank. Where the trench for one ductbank passes beneath the trench for another pipe or ductbank select backfill shall be placed to the level of the bottom of the upper trench.
2. Placement and compaction of backfill in electrical ductbank trenches shall conform to the requirements of Paragraph 3.8.B., above.

D. Crushed Stone Placement:

1. Crushed stone shall be placed where shown on the Drawings to the limits shown.
2. Crushed stone shall be place in hand tamped lifts, not to exceed 6-inches.

E. Compaction Density Requirements:

1. The degree of compaction required for all types of fills shall be as listed below. Material shall be moistened or aerated as necessary to provide the moisture content that will facilitate obtaining the specified compaction.

<u>Material Thick (in.)</u>	<u>Required Minimum Density- Percent Compaction (ASTM D 698)</u>	<u>*Maximum Uncompacted Lift (inches)</u>
Subgrade and Subbase Fill:		
Below concrete slabs on grade	95	8
Below base of footings or mats, structural slabs and tank floors	95	8
Below asphalt concrete paving	95	8
** Backfill and Fill:		
More than 5 feet below final grade	100	8
Less than 5 feet below grade	95	8
Aggregate Base Course (Select Backfill):		

Below concrete slabs or mats	95	8
Below asphalt paving	100	8
Trench Backfill, below and above ductbanks	95	8
Landscape Areas	95	8

- * Where applicable.
- ** Backfill shall not be used for support of facilities which are susceptible to damage from differential settlement of the fill section relative to walls.

All fill must be wetted and thoroughly mixed to achieve optimum moisture content, ±three percent, with the following exceptions: On site clayey soils optimum to plus three percent.

Natural undisturbed soils or compacted soil subsequently disturbed or removed by construction operations shall be replaced with materials compacted as specified above.

2. CONTRACTOR'S testing service shall perform tests necessary to provide data for selection of fill material and control of placement water content.
 3. Field density tests, to ensure that the specified density is being obtained, shall be performed by CONTRACTOR'S testing service during each day of compaction Work.
 4. If the tests indicate unsatisfactory compaction, provide the additional compaction necessary to obtain the specified degree of compaction. All additional compaction Work shall be performed by CONTRACTOR, at no additional cost to the OWNER, until the specified compaction is obtained. This Work shall include complete removal of unacceptable (as determined by the ENGINEER) fill areas and replacement and recompaction until acceptable fill is provided.
- F. Replacement of Unacceptable Excavated Materials: In cases where over-excavation for the replacement of unacceptable soil materials is required, the excavation shall be backfilled to the required subgrade with select backfill material and thoroughly compacted as specified in Paragraph 3.8.E., above. Sides of the excavation shall be sloped in accordance to the maximum inclinations specified for each structure location.

3.10 GRADING

- A. General: Uniformly grade areas within limits of grading under this Section, including adjacent transition areas. Smooth subgrade surfaces within specified tolerances, compact with uniform levels or slopes between points where elevations are shown on the Drawings, or between such points and existing grades.
- B. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish surfaces free from irregular surface changes, and as follows:
 1. Turfed Areas or Areas Covered with Gravel, Stone, Wood Chips, or Other Special Cover: Finish areas to receive topsoil or special cover to within not more than 1-inch above or below the required subgrade elevations.

2. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 1-inch above or below the required subgrade elevation.
 3. Pavements: Shape surface of areas under pavement to line, grade and cross-section, with finish surface not more than 1/2-inch above or below the required subgrade elevation.
- C. Grading Surface of Fill Under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2-inch when tested with a ten foot straightedge.
- D. Compaction:
1. After grading, compact subgrade surfaces to the depth and percentage of maximum density for each area classification.

3.11 PAVEMENT SUBBASE COURSE

- A. General: Place subbase material, in layers of specified thickness, over ground surface to support pavement base course.
1. Refer to Section 02742, Bituminous Paving, for paving Specifications.
- B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.
- C. Shoulders: Place shoulders along edges of base course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each base course layer. Compact and roll at least a 12-inch width of shoulder simultaneously with compacting and rolling of each layer of base course.
- D. Placing: Place base course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting base material during placement operations.
1. When a compacted base course is shown on the Drawings to be 6-inches thick or less, place material in a single layer. When shown on the Drawings to be more than 6-inches thick, place material in equal layers, except no single layer more than 6-inches or less than 3-inches in thickness when compacted.

3.12 DISPOSAL OF EXCAVATED MATERIALS

- A. Material removed from the excavations which does not conform to the requirements for fill or is in excess of that required for backfill shall be hauled away from the project site by CONTRACTOR and disposed of in compliance with ordinances, codes, laws and regulations at no additional cost to the OWNER. Refer to and comply with the requirements of Section 02230, Clearing.

3.13 RESTORING AND RESURFACING EXISTING ROADWAYS AND FACILITIES

- A. Place 1-1/2-inches of temporary bituminous pavement immediately after backfilling trenches in paved roadways which are to be retained for permanent use. Maintain the surface of the paved area over the trench in good and safe condition during progress of the entire Work, and promptly fill all depressions over and adjacent to the trench caused by settlement of backfilling. The permanent replacement pavement shall be equal to that of the existing roadways, unless otherwise specified.
- B. Pavement, gutters, curbs, sidewalks or roadways disturbed or damaged by the CONTRACTOR'S operations, except areas designated "Pavement" or "Proposed Pavement", shall be restored by CONTRACTOR at their own expense to as good condition as they were previous to the commencement of the Work and in accordance with applicable local and state highway specifications.

3.14 TEMPORARY FENCING

- A. Furnish and install a temporary fence surrounding his excavations and Work area, including the stockpile and storage areas. Fence shall have openings only at vehicular, equipment and worker access points.
- B. Furnish and install a temporary screening fence as shown on the Drawings.

3.15 FIELD QUALITY CONTROL

- A. Quality Control Testing During Construction: CONTRACTOR'S testing service shall inspect and approve subgrades and fill layers before construction Work is performed thereon. Tests of subgrades and fill layers shall be taken as follows:
 - 1. Footing Subgrade: For each strata of soil on which footings will be placed, conduct at least one test to verify required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with related tested strata, when acceptable to ENGINEER.
 - 2. Paved Areas and Building Slab Subgrade: Make at least one field density test of subgrade for every 500 square feet of paved area or building slab, but in no case less than three tests. In each compacted fill layer, make one field density test for every 2000 square feet of overlaying building slab or paved area, but in no case less than three tests.
 - 3. Foundation Wall Backfill: Take at least two field density tests, at locations and elevations as directed by the ENGINEER.
- B. If testing service reports or inspections show subgrade or fills are below specified density, provide additional compaction and testing at no additional cost to OWNER. This Work shall include complete removal of unacceptable fill areas (as determined by the ENGINEER), and replacement and recompaction until acceptable fill is provided.

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3.16 ENVIRONMENTAL PROTECTION AND RESTORATION

- A. Refer and comply with the requirements of Section 01412, Stormwater Pollution Prevention Plan and Permit.

++ END OF SECTION ++

SECTION 02318

CRUSHED STONE AND GRAVEL

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment and incidentals required to furnish and install crushed stone and gravel of the types specified at locations shown on the Drawings and as directed by the ENGINEER.

1.2 QUALITY ASSURANCE

- A. Conform to all applicable requirements of Section 701 of the Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Government (MAG) as supplemented by the City of Phoenix. Where there is a conflict between MAG Standard Specifications as supplemented by the City of Phoenix and these Specifications, the provisions of these Specifications shall govern.
- B. Sampling and sieve analysis shall be performed in accordance with ASTM D 75 and ASTM C 136.

1.3 SUBMITTALS

A. Submit for approval the following:

1. Furnish representative samples of the crushed stone and gravel to the ENGINEER and advise of the source location.
2. Test reports, including sieve analyses, showing material compliance with specified requirements.

B. Shop Drawings: Submit for approval the following:

1. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
2. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
3. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the

specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. Furnish and place crushed stone or screened gravel fill under pipe or structures where shown on the Drawings in addition to that required under other Sections. Comply with requirements of Section 15051, Buried Piping Installation.
2. Crushed stone and gravel shall be clean, hard, sound, durable, uniform in quality, and free of any detrimental quantity of soft, friable, thin elongated, or laminated pieces, disintegrated material, organic matter, oil, alkali, or other deleterious substance.
3. The loss by abrasion in the Los Angeles abrasion machine, determine as prescribed in ASTM C 131, Grading A, shall not exceed ten percent, by weight, after 100 revolutions nor 40 percent after 500 revolutions.

B. Crushed Stone:

1. Crushed stone shall consist of the product obtained by crushing rock, stone, or gravel so that at least 50 percent by weight of aggregate retained on the No. 4 sieve for 3/4-inch or larger maximum sizes, and 50 percent retained on the No. 8 sieve for maximum sizes less than 3/4-inch shall consist of particles which have at least one rough, angular surface produced by crushing.
2. The gradation of crushed stone shall comply with ASTM D 448.

C. Gravel:

1. Material designated herein as gravel shall be composed entirely of particles that are either fully or partially rounded and water-worn.
2. Crushed rock obtained by crushing rock which exceeds ASTM D 448 maximum gradation sizes may be combined provided it is uniformly distributed throughout and blended with the gravel. The quality and gradation requirements shall be as stated in this specification.

PART 3 - EXECUTION

3.1 PLACING

- A. Gravel shall be spread in layers of uniform thickness not exceeding 8-inches and shall be thoroughly compacted with suitable power driven tampers or other power driven equipment. The placing of crushed stone or gravel shall conform to applicable requirements of Section 02315, Structural Excavation and Backfill, except as noted above.
- B. Prior to placing decomposed granite, all areas to receive it shall be sprayed with a pre-emergent herbicide according to the manufacturer's recommendations within Maricopa Association of Governments (civil) requirements. Do not spray herbicide on any areas designated to receive seeding. Decomposed granite shall be rolled uniformly for depth and compacted to all areas designated on the DRAWINGS to a minimum depth of 3 – inches, see Section 02981, Decorative Stone Landscaping.

++ END OF SECTION ++

SECTION 02531

MANHOLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install all precast and cast-in-place manholes.

B. General:

1. Manholes shall conform in shape, size, dimensions, material, and other respects to the details shown on the Drawings or as directed by ENGINEER.
2. Cast iron frames, grates and covers shall be the standard frame and grate or cover, unless otherwise shown on the Drawings, and shall be as specified in MAG Standard Detail 423-2.
3. Concrete for cast-in-place manholes and for inverts in precast and masonry manholes shall be Type "1" and shall conform to the requirements specified under Section 03300, Cast-In-Place Concrete.
4. All manholes shall be precast construction, unless otherwise shown on the Drawings.

1.2 QUALITY ASSURANCE

A. Standard Specifications and Details:

1. Conform to all applicable requirements of Section 625 of the Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Governments (MAG) as supplemented by the City of Phoenix. If there is a conflict between MAG Standard Specifications as supplemented by the City of Phoenix and these Specifications, the provision of these Specifications shall govern.

B. Reference Standards: Comply with the applicable provisions and recommendations of the following, unless otherwise shown or specified.

1. ASTM C 139, Specification for Concrete Masonry Units for Construction of Catch Basins and Manholes.
2. ASTM C 140, Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
3. ASTM C 207, Specification for Hydrated Lime for Masonry Purposes.
4. ASTM C 478, Specification for Precast Reinforced Concrete Manhole Sections.
5. AWWA C 302, Reinforced Concrete Pressure Pipe, Noncylinder Type, for Water and Other Liquids.
6. MAG Section 625, as supplemented by the City of Phoenix.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
 2. Drawings showing design and construction details of all precast concrete and cast-in-place manholes, including details of joints between the manhole bases and riser sections and stubs or openings for connections.
 3. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
 4. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE MANHOLES

- A. Precast manholes shall conform to the details shown on the Drawings. Provide cast-in-place concrete bases where shown on the Drawings.
- B. Except where otherwise specified, precast manhole components shall consist of reinforced concrete pipe sections especially designed for manhole construction and manufactured in accordance with ASTM C 478, except as modified herein.
- C. Precast, reinforced concrete manhole bases, riser sections, flat slabs and other components shall be manufactured by dry cast when 60-inch diameter or less wet cast

- methods when 60-inch diameter or greater, using forms which will provide smooth surfaces free from irregularities, honeycombing or other imperfections.
- D. Joints between manhole components shall be the tongue and groove type employing a Ram-nek or approved equal preformed plastic material sealant. The circumferential and longitudinal steel reinforcement shall extend into the bell and spigot ends of the joint without breaking the continuity of the steel. Joints between the base sections, riser sections and top slabs of manholes 72-inches in diameter and less shall be rubber and concrete joints. Joints for manhole components greater than 72-inches in diameter shall be provided with steel bell and spigot rings.
- E. Design Criteria:
1. All precast manhole components shall be of approved design and of sufficient strength to withstand the loads imposed upon them. They shall be designed for a minimum earth cover loading of 130 pounds per cubic foot, an H-20 wheel loading, and an allowance of 30 percent in roadways and 15 percent in rights-of-way for impact. Manhole bases shall have two cages of reinforcing steel in their walls, each of the area equal to that required in the riser sections. Wall thickness shall not be less than 5-inches. Concrete top slabs shall not be less than 8-inches thick.
 2. Submit design drawings and calculations sealed by an engineer registered in the State of Arizona to the ENGINEER for review in accordance with deferred submittal requirements. Provide reinforcement information on drawings in sufficient detail to convey the intent of the calculations. Provide design and detailing consideration for penetrations through the manhole elements.
- F. Lifting holes, if used in manhole components, shall be tapered, and no more than two shall be cast in each section. Tapered, solid rubber plugs shall be furnished to seal the lifting holes. The lifting holes shall be made to be sealed by plugs driven from the outside face of the section only.
- G. The point of intersection (P.I.) of the sewer pipe centerlines shall be marked with 1/4-inch diameter steel pin firmly enclosed in the floor of each manhole base and protruding approximately 1-inch above the finished floor of the base.
- H. Mark date of manufacture and name or trademark of manufacturer on inside of barrel.
- I. The barrel of the manhole shall be constructed of various lengths of riser pipe manufactured in increments of one foot to provide the correct height with the fewest joints. Openings in the barrel of the manholes for sewers or drop connections will not be permitted closer than one foot from the nearest joint. Special manhole base or riser sections shall be furnished as necessary to meet this requirement.
- J. A precast or cast-in-place slab or precast eccentric cone, as shown on the Drawings or approved by the ENGINEER, shall be provided at the top of the manhole barrel to receive the cast iron frame and cover.

- K. No ladder or steps shall be installed / casted inside of a manhole.

2.2 MANHOLE COVERS

- A. Manhole cover shall be made of non-metallic composite materials capable of withstanding traffic loading requirements that meet or exceed HS-20 rating. The cover shall be inert to corrosion and have a built-in rubber gasket seal to reduce the escape of toxic gases and odors. The cover shall also meet the requirements of MAG Standard Detail 423.

PART 3 - EXECUTION

3.1 PLASTERING

- A. The outside of grading rings shall be neatly plastered with 1/2-inch of cement mortar as the Work progresses.

3.2 MANHOLE BASES

- A. Cast-in-place bases shall be placed on suitable foundations after the pipes are laid. They shall be cast monolithically to an elevation at least 12-inches above the top of the highest pipe entering the manhole, except where a drop connection is to be installed. Base, walls and bottom shall be at least of the thickness shown on the Drawings and reinforced to withstand the loads to be expected. Connections for sewer pipes shall conform to the details shown on the Drawings.

3.3 PRECAST MANHOLE SECTIONS

- A. Set sections vertical and in true alignment. The base of the bell or groove end at joints between components shall be buttered with 1:2 cement-sand mortar to provide a uniform bearing between components. All joints shall be sealed with cement mortar inside and out and troweled smooth to the contour of the wall surface. Raised or rough joint finishes will not be accepted.
- B. Install sections, joints and gaskets in accordance with manufacturer's recommendations.
- C. Lifting holes shall be sealed tight with a solid rubber plug driven into the hole from the outside of the barrel and the remaining void filled with 1 to 2 cement-sand mortar.

3.4 MANHOLE CHANNELS

- A. All invert channels through manholes shall be constructed of Type "1" concrete. Channels shall be properly formed to the sizes, cross sections, grades and shapes shown on the Drawings or as directed by the ENGINEER. Benches shall be built up to the heights shown on the Drawings or as directed by the ENGINEER and given a uniform

wood float finish. Care shall be taken to slope all benches for proper drainage to the invert channel.

3.5 GRADING RINGS

- A. Grading rings shall be used for all precast manholes, where required. Grade rings shall be a maximum of 12-inches in height, constructed on the roof slab or cone section on which the manhole frame and cover shall be placed. The height of the grade rings shall be such as is necessary to bring the manhole frame to the proper grade.
- B. Each grading ring shall be laid in a full bed of mortar and shall be thoroughly bonded.

3.6 STUBS FOR FUTURE CONNECTIONS

- A. As shown on the Drawings or required for connections, cast iron sleeves, ductile iron or reinforced concrete pipe stubs with approved watertight plugs shall be installed in manholes. Where pipe stubs, sleeves or couplings for future connections are shown on the Drawings or directed by the ENGINEER, provide all materials and labor in order to complete the Work.

3.7 GRADING AT MANHOLES

- A. All manholes in unpaved areas shall be built, as shown on the Drawings or directed by the ENGINEER, to an elevation higher than the original ground. The ground surface shall be graded to drain away from the manhole. Fill shall be placed around manholes to the level of the upper rim of the manhole frame, and the surface evenly graded on a 1 to 5 slope to the existing surrounding ground, unless otherwise shown on the Drawings or directed by the ENGINEER. The slope shall be covered with 4-inches of top soil, seeded and maintained until a satisfactory growth of grass is obtained.
- B. Manholes in paved areas and areas receiving gravel shall be constructed to meet the final surface grade as shown on the Drawings.
- C. Sole responsibility for the proper height of all manholes necessary to reach the final grade at all locations belongs to CONTRACTOR. Caution: ENGINEER'S review of Shop Drawings for manhole components will be general in nature, provide an adequate supply of random length precast manhole riser sections to adjust any manhole to meet field conditions for final grading.

3.8 MANHOLE WATERTIGHTNESS

- A. All manholes shall be free of visible leakage. Each manhole shall be tested for leaks and inspected, and all leaks shall be repaired in a manner subject to ENGINEER'S approval. Manhole testing shall conform with the requirements of Section 01453, Testing of Hydraulic Structures and Section 15051, Buried Piping Installation.

3.9 FLEXIBLE PIPE JOINT AT MANHOLE BASE

- A. An approved flexible joint shall be provided between each pipe entering and exiting the manhole. This may be accomplished by the installation in the manhole base of the bell end of a pipe or by other means subject to approval of ENGINEER. Joints shall be similar to the approved pipe joints. The joint into the manhole base shall be completely watertight.

++ END OF SECTION ++

SECTION 02532

POLYMER CONCRETE MANHOLES

PART 1 - GENERAL

1.1 SUMMARY

- A. This specification covers precast polymer concrete manholes, which are a bid alternative to the cast in place manholes bases and precast risers as shown in the Plans and Section 02531. The polymer concrete manholes shall adhere to all MAG standards, including but not limited to, Standard Specification Section 744 and Standard Detail 419.
- B. The contractor shall furnish and install all polymer concrete manholes and accessories for sanitary manholes as specified herein.

1.2 SECTION INCLUDES

- A. Polymer Concrete Manholes.

1.3 RELATED SECTIONS

- A. Section 01330, Submittals.
- B. Section 15051, Buried Piping.
- C. Section 15064, VCP Pipe.
- D. Section 15120, Pipe Specialties and Accessories.

1.4 REFERENCES

- A. ASTM C 478 (most current) Standard Specification for Precast Reinforced Concrete Manhole Sections.
- B. ASTM C 579 (most current) Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic, Surfacing, and Polymer Concretes.
- C. ASTM C 443 (most current) Standard Specification for Joints for Concrete Pipe and Manholes Using Rubber Gaskets.

- D. ASTM C 580 (most current) Standard Test Method for Flexural Strength and Modulus of Elasticity of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
- E. ASTM C 857 (most current) Standard Practice for Minimum Structural Design Loading for Underground Utility Structures.
- F. ACI 350-06 Code Requirements for Environmental Engineering Concrete Structures & Commentary.
- G. ACI 440.1R-15 Guide for the Design and Construction of Structural Concrete Reinforced with Fiber-Reinforced Polymer (FRP) Bars.
- H. ACI 548.6R-96 Polymer Concrete-Structural Applications State-of-the-Art Report.
- I. ASTM D 648 (most current) Test Method for Deflection Temperature of Plastics Under Flexural Load in Edgewise Position.
- J. ASTM D 6783 (most current) Standard Specification for Polymer Concrete Pipe.
- K. ASTM D 2584 (most current) Test Method for Ignition Loss of Cured Reinforced Resins.
- L. ASTM C 923 (most current) Standard Specifications for Resilient Connectors between Concrete Manholes Structures and Pipe.
- M. ASTM C 990 (most current) Standard Specification for Joints for Concrete Pipe, Manholes and Precast Box Sections using Preformed Flexible Joint Sealants.
- N. ASTM C 497 (most current) Test Methods for Concrete Pipe, Manhole Sections, or Tile.
- O. All other applicable ASTM and ANSI Standards.

1.5 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 - 1. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
 - 2. Drawings showing design and construction details of all precast concrete and cast-in-place manholes, including details of joints between the manhole bases and riser sections and stubs or openings for connections.
 - 3. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII

format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.

4. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 - PRODUCTS

2.1 MANHOLES

- A. Provide polymer concrete manhole sections, monolithic base sections and related components referencing to ASTM C 478. ASTM C 478 material and manufacturing is allowed compositional and dimensional differences required by a polymer concrete product.
- B. Provide base riser section with monolithic floors, unless shown otherwise.
- C. Provide riser sections joined with bell and spigot / ship-lap design seamed with butyl mastic and or rubber gaskets (ASTM C 990) so that on assembly, manhole base, riser and top section make a continuous and uniform manhole structure.
- D. Construct riser sections for polymer concrete manholes from standard polymer concrete manhole sections of the diameter indicated on drawings. Use various lengths of polymer concrete manhole sections in combination to provide correct height with the fewest joints.
- E. Design wall sections for depth and loading conditions with wall thickness as designed by polymer concrete manufacturer.

- F. Provide tops to support AASHTO HS-20 or HL-93 or vehicle loading or loads as required and receiving cast iron frame covers or hatches, as indicated on drawings.

2.2 DESIGN CRITERIA:

- A. Polymer Concrete Manhole risers, cones, flat lids, grade rings and manhole base sections shall be designed by manufacturer to meet the intent of ASTM C 478 with allowable compositional and sizing differences as designed by the polymer concrete manufacturer.
1. AASHTO HS-20 or HL-93 design or as required loading applied to manhole cover and transition and base slabs.
 2. Polymer manholes will be designed based upon live and dead load criteria in ASTM C 857 and ACI 350-06.
 3. Unit soil weight of 120 pcf located above portions of manhole, including base slab projections.
 4. Internal liquid pressure based on unit weight of 63 pcf.
 5. Dead load of manhole sections fully supported by polymer concrete manhole base.
 6. Per the geotechnical report for Package 4B as produced by Ninyo & Moore, the lateral pressures shall be based on the following values:
 - a. Lateral at-rest pressures = 60 psf/ft
 - b. Lateral active pressure = 40 psf/ft
 - c. Lateral passive pressure = 360 psf/ft

2.3 DESIGN:

- A. Polymer Concrete Manhole risers, cones, flat lids, grade rings and manhole base sections shall be designed by manufacturer to meet loading requirements of ASTM C 478, ASTM C 857 and ACI 350-06 as modified for polymer concrete manhole design as follows:
1. Polymer Concrete Mix Design shall consist of thermosetting resin, sand, and aggregate. No Portland cement shall be allowed as part of the mix design matrix. All sand and aggregate shall be inert in an acidic Environment.
 2. Reinforcement – Shall use acid resistant reinforcement (FRP Bar) in accordance with ACI 440.1R-06 as applicable for polymer concrete design.
 3. The wall thickness of polymer concrete structures shall not be less than that prescribed by the manufacturer's design by less than 95% of stated design thickness.
 4. Thermosetting Resin - The resin shall have a minimum deflection temperature of 158° F when tested at 264 psi (1.820 mPa) following Test Method D 648. The resin content shall not be less than 7% of the weight of the sample as determined by test method D 2584. Resin selection shall be suitable for applications in the corrosive conditions to which the polymer concrete manhole structures will be exposed.

5. Each polymer concrete manhole component shall be free of all defects, including indentations, cracks, foreign inclusions and resin starved areas that, due to their nature and degree or extent, detrimentally affect the strength and serviceability of the component part. Cosmetic defect shall not be cause for rejection. The nominal internal diameter of manhole components shall not vary more than 2%. Variations in height of two opposite sides of risers and cones shall not be more the 5/8 inch. The under run in height of a riser or cone shall not be more than ¼ in/ft of height with a maximum of ½ inch in any one section.
6. Marking and Identification - Each manhole shall be marked with the following information –
 - a. Manufacturer’s name or trademark,
 - b. Manufacturer’s location
 - c. and Production Date.
7. Manhole joints shall be assembled with a bell/spigot or shiplap butyl mastic and/or gasketed joint so that on assembly, manhole base, riser and top section make a continuous and uniform manhole. Joint sealing surfaces shall be free of dents, gouges and other surface irregularities that would affect joint integrity.
8. Minimum clearance between wall penetrations and joints shall be per manufacturer’s design.
9. Construct invert channels to provide smooth flow transition with minimal disruption of flow at pipe-manhole connections. Invert slope through manhole is as indicated on drawings. All precast base sections to be cast monolithically. Polymer bench and channel are to be constructed with all polymer concrete material. Extended ballast slab requirements for buoyancy concerns can be addressed with cementitious concrete material.
10. Provide resilient connectors conforming to requirements of ASTM C 923 or other options as available. All connectors are to be water tight. Install approved resilient connectors at each pipe entering and exiting manholes in accordance with manufacturer’s instructions.
11. Anti-float rings are not required for this project.
12. The manufacturer shall provide structural calculations for all manholes.

2.4 QUALITY CONTROL

- A. Facility Quality Control should be maintained by adhering to ISO 9001:2008 for manufacturing. All fabricators will be ISO 9001:2008 Certified. All fabrication will take place in an all polymer concrete fabrication facility. At no time will the polymer concrete fabrication facility share the facility with a cementitious precast product production facility. Fabricator is also to provide references of 5 previous projects in the last 5 years performed with both OWNER and CONTRACTOR for reference and review by owner. Polymer concrete shall be cast in a polymer only facility and shall not be manufactured in a cementitious concrete facility.

2.5 GROUTING

- A. All materials needed for grouting and patching will be a polyester mortar compound provided by the manufacturer or an approved equal by the manufacturer.

2.6 MANHOLE COVERS

- A. Manhole cover shall be made of non-metallic composite materials capable of withstanding traffic loading requirements that meet or exceed HS-20 rating. The cover shall be inert to corrosion and have a built-in rubber gasket seal to reduce the escape of toxic gases and odors. The cover shall also meet the requirements of MAG Standard Detail 423.

2.7 MANUFACTURER

- A. Polymer Concrete Manholes:
 - 1. Armorock LLC, Boulder City, Nevada.
 - 2. Approved equal.
- B. Manhole Rings:
 - 1. Ladtech Inc, Buffalo, MN.
 - 2. Approved equal.
- C. Manhole Covers:
 - 1. Composite Access Products, McAllen, TX.
 - 2. Approved equal.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. All manholes shall be constructed in accordance with MAG Standard Detail 419.
- B. Workmanship shall be of the highest grade throughout and in accordance with the best standard practice for this type of equipment.
- C. All manholes shall be free of visible leakage. Each manhole shall be tested for leaks and inspected, and all leaks shall be repaired in a manner subject to ENGINEER'S approval. Manhole testing shall conform with the requirements of Section 01453, Testing of Hydraulic Structures and Section 15051, Buried Piping Installation.
- D. An approved flexible joint shall be provided between each pipe entering and exiting the manhole. This may be accomplished by the installation in the manhole

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base of the bell end of a pipe or by other means subject to approval of ENGINEER. Joints shall be similar to the approved pipe joints. The joint into the manhole base shall be completely watertight.

++ END OF SECTION ++

SECTION 02742

BITUMINOUS PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install hot mix hot-laid bituminous paving.
2. The Work includes the following:
 - a. Preparation of subgrade.
 - b. Coarse graded base course.
 - c. Fine graded surface course.
 - d. Pavement marking.
 - e. Testing as specified.

1.2 QUALITY ASSURANCE

A. Standard Specifications and Details:

1. Conform to all applicable requirements of the Uniform Standard Specifications For Public Works Construction by the Maricopa Association of Governments (MAG) as supplemented by the City of Phoenix as follows:
 - a. Section 321, Asphalt Concrete Pavement.
 - b. Section 702, Base Materials.
 - c. Section 703, Emulsified Asphalts.
 - d. Section 710, Asphalt Concrete.
2. If there is a conflict between the MAG Standard Specifications as supplemented by the City of Phoenix and these Specifications, the provisions of these Specifications shall govern.
3. City of Phoenix, Streets and Traffic Department Standard Specifications.
 - a. S.S.P-2 - Water-Bourne Traffic Binder Paint.

B. Reference Standards: Comply with the applicable provisions and recommendations of the following, unless otherwise shown or specified.

1. ASTM C 117, Test Method for Materials Finer than No. 200 Sieve in Mineral Aggregates By Washing.
2. ASTM C 136, Test Method for Sieve Analysis of Fine And Coarse Aggregates.
3. ASTM D 698, Test Methods for Laboratory Compaction Characteristics of Soil using Standard Effort (12,400 ft-lbf/ft³).
4. MAG Standard Specifications, Section 301, as supplemented by the City of Phoenix.

5. MAG Standard Specifications, Section 321, as supplemented by the City of Phoenix.
6. MAG Standard Specifications, Section 702, as supplemented by the City of Phoenix.
7. MAG Standard Specifications, Section 710, as supplemented by the City of Phoenix.
8. Standard Specification S.S.P.-2, City of Phoenix Streets and Traffic Department.

C. Testing Services:

1. General: Testing of materials and of compaction requirements for compliance with technical requirements of the Specifications and Determination and testing of the proposed design mix for the hot-mix course shall be the duty of a testing laboratory provided by the OWNER, as described in 00700 General Requirements .
2. Testing Services: The OWNER'S testing laboratory shall:
 - a. Test CONTRACTOR'S proposed materials in the laboratory and field for compliance with the requirements of these Specifications.
 - b. Perform field density tests to assure that the specified compaction of base course materials has been obtained.
 - c. Report all test results to the ENGINEER and CONTRACTOR.
3. Authority and Duties of OWNER'S Testing Laboratory: Technicians representing the testing laboratory shall inspect the materials in the field and perform compaction tests, and shall report their findings to the ENGINEER and CONTRACTOR. When the materials furnished or Work performed by the CONTRACTOR fails to fulfill Specifications requirements, the technician shall direct the attention of the ENGINEER and CONTRACTOR to such failure.
 - a. The technician shall not act as foreman or perform other duties for CONTRACTOR. Work will be checked as it progresses, but failure to detect any defective Work or materials shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the ENGINEER for final acceptance. Technicians are not authorized to revoke, alter, relax, enlarge, or release any requirements of the Specifications, nor to approve or accept any portion of the Work.
4. Responsibilities and Duties of CONTRACTOR: The use of testing services shall in no way relieve CONTRACTOR of his responsibility to furnish materials and construction in full compliance with the Contract Documents. To facilitate testing services:
 - a. Secure and deliver to the ENGINEER and the testing laboratory representative samples of the materials he proposes to use and which are required to be tested.
 - b. Furnish such casual labor as is necessary to obtain and handle samples at the project or at other sources of material.
Advise the testing laboratory and ENGINEER sufficiently in advance of operations to allow for completion of quality tests and for the assignment of personnel.

D. Pre-Paving Meeting:

1. Prior to the placement of Bituminous Paving, arrange a meeting at the job-site with the paver and its foreman, general CONTRACTOR and its foreman, ENGINEER and other representatives directly concerned with placement. Record the discussions of the conference and the decisions and agreements (or disagreements) and furnish a copy of the record to each party attending. Review foreseeable methods and procedures relating to the paving work, including but not necessarily limited to, the following:
 - a. Review Project requirements, including Contract Documents, Project Schedule, approved Shop Drawings, pending and approved Change Orders and requests for information that may have been submitted by CONTRACTOR to ENGINEER.
 - b. Review required samples, submittals, and documentation procedures.
 - c. Review sub grade preparation.
 - d. Review availability of materials, tradesman, equipment and facilities needed to make progress, avoid delays and protect the Work from damaging conditions.
 - e. Review required inspection, testing, certifying and quality control procedures.
 - f. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 1. City of Phoenix Type C-3/4-inch 5.0% W/C mix and Type C-3/4-inch 5.5% W/C mix, giving complete data on materials, including source, location, percentages, temperatures and all other pertinent data.
 2. The submittal shall be reviewed by the ENGINEER and OWNER.
 3. Comply with the requirements of Section 01332, Shop Drawing Procedures.
 4. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
 5. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to

include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

6. The CONTRACTOR shall submit the preventive maintenance information package as part of the shop drawing submittal package to the ENGINEER for review and approval. **SHOP DRAWING SUBMITTAL PACKAGE WILL NOT BE APPROVED WITHOUT ACCEPTANCE OF PREVENTIVE MAINTENANCE INFORMATION AS DESCRIBED IN SPECIFICATION SECTION 01785.**

B. Material Certificates:

1. In lieu of laboratory reports required in the State Standards, CONTRACTOR may submit certificates of compliance for the following:
 - a. Coarse and fine aggregates from each material source and each required grading.
 - b. Asphalt for each penetration grade.
 - c. Job-mix design mixtures for each material or grade.
 - d. Density of uncompacted bituminous concrete.
 - e. Density of compacted bituminous concrete.
 - f. Density and voids analysis for each series of bituminous concrete mixture test specimens.
 - g. Bituminous concrete plant inspection.
2. Certificates that materials, mixtures and plant comply with Specification requirements.
3. Certificates signed by CONTRACTOR.

1.4 JOB CONDITIONS

A. Weather Limitations:

1. For base paving 2-inches thick or greater, atmospheric temperature shall be 40°F and rising. For surface paving or pavement less than 2-inches thick, the surface temperature shall be 50°F or greater.
2. No asphalt concrete shall be placed when the weather is foggy or rainy, or when the base on which the material is to be placed contains moisture in excess of the optimum. Asphalt concrete shall be placed only when the ENGINEER determines that weather conditions are suitable.

- B. Grade Control: Establish and maintain the required lines and grades, including crown and cross-slope for each course during construction operations.

PART 2 - PRODUCTS

2.1 PAVEMENT THICKNESS

- A. Provide a 5-inch thick aggregate base course compacted subgrade with a 2-inch asphalt base course and 1.5-inch asphalt surface course for a total depth of 8.5-inches for pavement areas where shown on the Drawings.
- B. All sides of the asphalt area shall be curbed flush with edge of asphalt, unless otherwise shown on the drawings, to retain the asphalt during placement and protect edges from damage by heavy equipment.

2.2 MATERIALS

- A. Base Course:
 - 1. Base course material shall be a hot mix asphalt concrete, consisting of a mixture of mineral aggregate and paving asphalt conforming to Section 710 of the MAG Standard Specifications. Gradation of the aggregate shall comply with the City of Phoenix Type C, 3/4-inch (High Volume).
 - 2. The City of Phoenix Type C, 3/4-inch (High Volume) asphalt shall contain a minimum of 1.5 percent cement and 5.1 percent oil.
- B. Surface Course:
 - 1. Surface course material shall be a hot mix asphalt concrete, consisting of mineral aggregate and paving asphalt conforming to Section 710 of the MAG Specifications. Gradation of the aggregate shall comply with the City of Phoenix Type C-3/4-inch (Low Volume).
 - 2. The City of Phoenix Type C-3/4-inch (Low Volume) asphalt shall contain a minimum of 5.1 percent oil.
- C. Tack Coat: The tack coat shall be emulsified asphalt Type SS-1h according to the City of Phoenix Supplement to MAG 329, unless directed otherwise by the ENGINEER.

2.3 TRAFFIC AND PARKING MARKING MATERIALS

- A. Traffic and parking marking materials shall be a water based paint conforming to the City of Phoenix Streets and Traffic Department Operations Division Specification S.S.P-2, Water-Bourne Traffic Binder Paint. Refer to paragraph 1.2.A.3.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the subgrade on which bituminous concrete will be installed. Notify ENGINEER, in writing, of conditions detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.
- B. No materials shall be placed on subgrades, which are muddy or have water thereon.

3.2 CONSTRUCTION OF ROADWAYS

- A. General:
 - 1. The pavement for bituminous-surfaced roads and parking areas shall consist of a 2-inch base course composed of aggregates and bituminous material, mixed hot in a central plant, and constructed on an aggregate base course prime coated with a rapid curing paving asphalt. A 2-inch surface course shall also be applied on top of the base course. The total thickness shall be 4-inches.
 - 2. The roadways shall be constructed to the lines, grades, and typical sections shown on the Drawings.
- B. Base and Surface Course:
 - 1. The base course mixture shall be transported to the site of paving and placed as soon as possible after mixing.
 - 2. The placement of the base course shall be completed over the full width of the section under construction on each day's run.
 - 3. Asphalt base and surface courses shall be spread and finished by means of self-propelled mechanical spreading and finishing equipment. The compacted thickness of layers placed shall not exceed 150 percent of the specified thickness except as approved, in writing, by the ENGINEER.
 - 4. Sufficient rolling equipment shall be furnished to satisfactorily compact and finish the amount of mixture being placed. However, there shall be a minimum of two rollers with two operators on the Project at all times. Upon direction of the ENGINEER, one of the rollers may be a pneumatic-tire roller. During rolling operations, the speed of the roller(s) shall not exceed three miles per hour. If ample number of rollers are not present, adjust the asphalt placement rate to accommodate the roller(s) speed. The type and required number of rollers shall be on the Project and in acceptable operating condition, prior to the placement of any asphalt material. All rollers shall be operated continuously from the breakdown through finish rolling. CONTRACTOR may use vibratory rollers in lieu of the steel-wheeled roller, however when the thickness of the asphalt is 1-inch or less, all rolling will be done in the static mode.
 - 5. When more than one width of asphalt concrete material will be placed, a 6-inch strip adjacent to the area on which future material is to be laid shall not be rolled

until such material has been placed but shall not be left unrolled more than two hours after being placed, unless the 6-inch unrolled strip is first heated with a joint heater. After the first strip or width has been compacted, the second width shall be placed, finished and compacted as provided for the first width, except that rolling shall be extended to include the 6-inches of the first width not previously completed.

6. At any place not accessible to the roller, the mixture shall be thoroughly compacted with tampers and finished, where necessary, with a hot smoothing iron to provide a uniform and smooth layer over the entire area compacted in this manner.
7. Breakdown rolling shall begin as soon as the mixture will bear the roller without undue displacement. Rolling shall be longitudinal, overlapping on successive trips by at least 1/2 but not more than 3/4 the width of the rear wheels. Alternate trips of the roller shall be of slightly different lengths. The motion of the roller shall at all time be slow enough to avoid displacement of the mixture. Finish rolling shall be done by means of a steel-wheeled roller or a vibratory steel-wheel roller operating in the static mode.

C. Tack Coat:

1. A tack coat shall be applied to all existing and to each new course of bituminous surfaces prior to the placing of a succeeding layer of bituminous mixed material. The tack coat may be deleted when a succeeding layer of asphalt concrete is being applied over a freshly laid course that has been subjected to very little traffic when approved by the ENGINEER.
2. The same material that is specified above for the tack coat shall be applied to the vertical surfaces of existing pavements, curbs, and gutters, against which asphalt concrete is to be placed.
3. Tack coat shall be diluted in the proportion of 50 percent emulsion and applied at the rate of 0.05 to 0.10 gallons per square yard. Application shall be made in advance of subsequent construction as directed by the ENGINEER.
4. Tack coat shall be applied by pressure-type distributor trucks with insulated tanks. Hand spray by means of hose or bar through a gear pump or air tank shall be acceptable for resurface work, corners or tacking of vertical edges. Care shall be taken to provide uniform coverage. Equipment that performs unsatisfactory shall be removed from the job.

D. Construction Joints:

1. Construction joints shall be made in such a manner as to ensure a neat junction, thorough compaction and bond throughout.
2. A transverse joint extending over the full width of the strip being laid and at right angles to its centerline shall be constructed at the end of each day's work and at any other times when the operations of placing the hot mixture are suspended for a period of time which will permit the mixture to chill. The forward end of a freshly laid strip shall be thoroughly compacted by rolling before the mixture has become chilled. When Work is resumed, the end shall be cut vertically for the full depth of the layer.

- E. Joining of Pavements: When pavement is to join existing or previously laid pavement, the existing or previously laid pavement shall be neatly and carefully edged to allow for overlapping and feathering of the surface course material. A tack coat of bituminous prime coat material shall be placed at the interface of pavement and existing or previously laid pavement.
- F. Curing: The pavement shall not be opened to traffic until directed by the ENGINEER. Construction traffic on the pavement shall be held to a minimum as allowed by the ENGINEER.

3.3 FRAME ADJUSTMENT

- A. Set frames of drainage structures to final grade in an approved manner. Include existing frames and frames furnished under other Sections of these Specifications. Comply with requirements of Section 02771, Concrete Curbs, Gutters and Sidewalks.

3.4 PAVEMENT QUALITY REQUIREMENTS

- A. General: In addition to other specified conditions, comply with the following minimum requirements:
 - 1. Provide final surfaces of uniform texture, conforming to required grades and cross sections.
 - 2. Take not less than one 4-inch diameter pavement specimen for each complete course for each 10,000 square feet of pavement, unless directed by ENGINEER.
 - 3. Repair holes from test specimens as specified for patching defective Work.
- B. Density:
 - 1. If directed by ENGINEER, compare density of in-place material against laboratory specimen or certificates on same bituminous concrete mixture. Use nuclear devices.
 - 2. Minimum acceptable density of in-place course material shall be 90 percent of the recorded laboratory specimen or certificate density. Maximum acceptable density shall be 98 percent.
- C. Thickness: In-place compacted thicknesses shall average not less than the thicknesses specified.
- D. Surface Smoothness:
 - 1. Test finished surface of each bituminous concrete course for smoothness, using a ten foot straightedge applied parallel to and at right angles to centerline of paved areas.
 - 2. Check surfaced areas at intervals as directed by ENGINEER.
 - 3. Surfaces will not be acceptable if exceeding the following:
 - a. Base Course: 3/8-inch in ten feet.
 - b. Surface Course: 1/4-inch in ten feet.
 - c. Crowned Surfaces:

- 1) Test crowned surfaces with a crown template, centered and at right angles to the crown.
- 2) Surfaces will not be acceptable if varying more than 1/4-inch from the template.

3.5 PATCHING

- A. As directed by ENGINEER, remove and replace all defective areas. Cut-out such areas and fill with fresh bituminous concrete. Compact to the required density.

3.6 CLEANING AND PROTECTION

- A. Cleaning: After completion of paving operations, clean surfaces of excess or spilled bituminous materials and all foreign matter.
- B. Protect newly finished pavement until it has become properly hardened by cooling.
- C. Cover openings of drainage structures in the area of paving until permanent coverings are placed.

3.7 MARKING PAVEMENT

- A. Cleaning:
 1. Sweep surface with power broom supplemented by hand brooms to remove loose material and dirt.
 2. Do not begin marking bituminous concrete pavement until approved by ENGINEER.
- B. Application:
 1. Using mechanical equipment, provide uniform straight edges in two separate coats. Apply in accordance with paint manufacturer's recommended rates. Refer to paragraph 1.2.A.3.

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CITY OF PHOENIX: Water Services Department
 PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
 PROJECT NUMBER: WS90500307 & WS90501004

CITY OF PHOENIX – 2021 APPROVED CONVENTIONAL ASPHALT MIX DESIGNS						
Plants	Dispatch Phone	A-1 1/2" 4.3% (High Volume)	C-3/4" 5.0% (High Volume)	C-3/4" 5.5% (Low Volume)	D-1/2" 5.1% (High Volume)	D-1/2" 5.6% (Low Volume)
Hanson #34 Higley	602 685-3450	3425PH	3419PH	3419PL	3412PH	3412PL
Hanson #35 (51st Ave)		3525PH	3519PH	3519PL	3512PH	3512PL
Southwest Asphalt #4 El Mirage	602 268-9011	452CH	432CH	432DH	422CH	422DH
Southwest Asphalt #10 New River		152CH	132CH	132DH	122CH	122DH
Vulcan Gomez (5223)	602 254-0081	18151G	28151G	28152G	38151G	38152G
Vulcan 19th Ave (5224)		18151H	28151H	28152H	38151H	38152H
Vulcan #117 West 43rd Ave (5182)		18151D	28151D	28152D	38151D	38152D
Vulcan #130 Sun City (5180)		18151S	28151S	28152S	38151S	38152S
Vulcan W. Broadway (5184)		18151W	28151W	28152W	38151W	38152W
Vulcan Deer Valley (5189)		18151K	28151K	28152K	38151K	38152K
Solterra Materials Coolidge	480 895-3555		S20-1-7HV	S20-1-7LV-H	S19-1-16	S19-1-16L
Solterra Materials Kilauea Pit			S21-2-9-HV-H	S21-2-9LV-H	S21-2-10HV-H	S21-2-10LV-H

++ END OF SECTION ++

SECTION 03100

CONCRETE FORMWORK

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment, and incidentals as shown, specified and required to furnish and install concrete formwork. The Work also includes:
 - a. Providing openings in formwork to accommodate the Work under this and other Sections and building into the formwork all items such as sleeves, anchor bolts, inserts and all other items to be embedded in concrete for which placement is not specifically provided under other Sections.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed with the formwork.
2. Coordinate formwork specifications herein with the requirements for finished surfaces specified in Section 03300, Cast-In-Place Concrete, and Section 03200, Concrete Reinforcement.

1.2 QUALITY ASSURANCE

A. Standard Specifications and Details:

1. Conform to all applicable requirements of Section No. 505 of the Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Governments (MAG) as supplemented by the City of Phoenix. Where there is conflict between MAG Standard Specifications as supplemented by the City of Phoenix and this Specification, provisions of this Specification shall govern.
2. Examine the substratum and the conditions under which concrete formwork is to be performed, and notify the ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to the ENGINEER.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified. Where conflicts may occur between the reference standards, the more restrictive provisions shall apply.

1. ACI 117, Standard Tolerances for Concrete Construction and Materials.
2. ACI 301, Standard Specifications for Structural Concrete.
3. ACI 347, Guide for Concrete Formwork.
4. US Product Standard, PS-1-83 for Construction and Industrial Plywood.

- C. Allowable Tolerances:
 - 1. Construct formwork to provide completed concrete surfaces complying with tolerances specified in ACI 347, Chapter 3.3, except as otherwise specified.
- D. Install all formwork and accessories for all facilities in accordance with manufacturers' instructions.

1.3 SUBMITTALS

- A. Samples:
 - 1. Plywood form material used for smooth form finish, 4-inch square minimum.
- B. Shop Drawings: Submit for approval the following:
 - 1. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
 - 2. Design of formwork for structural stability and sufficiency is CONTRACTOR'S responsibility.
 - 3. Taper tie installation, removal, and hole repair materials and procedures.
 - 4. Submit for information purposes the following:
 - a. Copies of manufacturer's data and installation instructions for proprietary materials, including form coatings, manufactured form systems, ties and accessories.
 - 5. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
 - 6. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials in the original sealed containers, clearly marked with the manufacturer's name, brand, type of material, batch number, and date of manufacture. On delivery to job site, place materials in area protected from weather, in accordance with manufacturers' recommendations.
- B. Store materials above ground on framework or blocking. Cover wood for forms and other accessory materials with protective waterproof covering. Provide for adequate air circulation or ventilation. Store materials in accordance with the manufacturers' recommendations.
- C. Handle materials to prevent damage in accordance with the manufacturers' recommendations.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

- A. Forms for Smooth Finish Concrete:
 - 1. Unless otherwise shown or specified, construct formwork for smooth concrete surfaces with plywood, metal, metal-framed plywood-faced, or other panel type materials acceptable to ENGINEER, to provide continuous, straight, smooth as-cast surfaces with no wood grain or other surface texture imparted by the formwork. Furnish in largest practical sizes to minimize number of joints and to conform to joint system shown or specified. Provide form material with sufficient thickness to withstand pressure of newly placed concrete without bow or deflection.
- B. Forms for Standard Finish Concrete:
 - 1. Form concrete surfaces designated to have a standard formed finish with plywood, lumber, metal, or other acceptable material. Provide lumber that is dressed on at least two edges and one side.
- C. Form Ties:
 - 1. Provide factory-fabricated, removeable or snap-off metal form ties, designed to prevent form deflection, and to prevent spalling of concrete surfaces upon removal. Materials used for tying forms will be subject to approval of ENGINEER.
 - 2. Unless otherwise shown, provide ties so that portion remaining within concrete after removal of exterior parts is at least 1.5-inch from the outer concrete surface. Unless otherwise shown, provide form ties that will leave a hole no larger than 1-inch diameter in the concrete surface.
 - 3. Ties for exterior walls, below grade walls, and walls subject to hydrostatic pressure shall have water stops.
 - 4. All ties shall leave a uniform, circular hole when forms are removed.

5. Provide stainless steel form ties for planned exposed tie hole locations, where shown on the Drawings. When used, tiebreak back point shall be at least 1-inch from outer concrete surface.
 6. Wire ties are not acceptable.
- D. Form Coatings:
1. Provide commercial water-based formulation form-coating compounds that will not bond with, stain, nor adversely affect concrete surfaces, and will not impair subsequent treatment of concrete surfaces requiring bond or adhesion, nor impede the wetting of surfaces to be cured with water or curing compounds. For concrete surfaces, which will be in contact with potable water, the form coating shall be a mineral oil base coating.

2.2 DESIGN OF FORMWORK

- A. Formwork drawings and calculations shall bear the seal and signature of a Professional Engineer (Structural) registered by the State of Arizona.
- B. Design, erect, support, brace and maintain formwork so that it shall safely support vertical and lateral loads that might be applied, until such loads can be supported by the concrete structure. Carry vertical and lateral loads to ground by formwork system or in-place construction that has attained adequate strength for this purpose. Construct formwork so that concrete members and structures are of correct size, shape, alignment, elevation and position.
- C. Design forms and falsework to include values of live load, dead load, weight of moving equipment operated on formwork, concrete mix, height of concrete drop, vibrator frequency, ambient temperature, foundation pressures, stresses, lateral stability, and other factors pertinent to safety of structure during construction.
- D. Provide shores and struts with positive means of adjustment capable of taking up formwork settlement during concrete placing operations, using wedges or jacks or a combination thereof. Provide trussed supports when adequate foundations for shores and struts cannot be secured.
- E. Support form facing materials by structural members spaced sufficiently close to prevent beyond tolerance deflection, in accordance with ACI 117. Fit forms placed in successive units for continuous surfaces to accurate alignment, free from irregularities and within allowable tolerances. For long span members without intermediate supports, provide camber in formwork as required for anticipated deflections resulting from weight and pressure of fresh concrete and construction loads.
- F. Design formwork to be readily removable without impact, shock or damage to concrete surfaces and adjacent materials.

- G. Provide formwork sufficiently tight to prevent leakage of cement paste during concrete placement. Solidly butt joints and provide backup material at joints as required to prevent leakage and fins.
- H. Do not omit side forms of footings and place concrete directly against excavation unless formally requested by CONTRACTOR, in writing, and accepted by ENGINEER, in writing. When omission of forms is accepted, provide additional concrete required beyond the minimum design profiles and dimensions of the footings as detailed. No additional compensation will be made to CONTRACTOR for additional concrete required.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the substrate and the conditions under which Work is to be performed and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 FORM CONSTRUCTION

- A. Construct forms complying with the requirements of ACI 347; to the exact sizes, shapes, lines and dimensions shown; as required to obtain accurate alignment, location and grades; to tolerances specified; and to obtain level and plumb work in finish structures. Provide for openings, offsets, keyways, recesses, moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required. Use selected materials to obtain required finishes. Finish shall be as determined by approved mock-up or sample panel, if specified.
- B. Fabricate forms for easy removal without damaging concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where the slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and assure ease of removal.
- C. Provide temporary openings where interior area of formwork is inaccessible for cleanout, for inspection before concrete placement, and for placement of concrete. Brace temporary closures and set tightly to forms to prevent loss of cement paste. Locate temporary openings on forms in locations as inconspicuous as possible, consistent with requirements of the Work. Form intersecting planes of openings to provide true, clean-cut corners, with edge grain of plywood not exposed as form for concrete.

D. Falsework:

1. Erect falsework and support, brace and maintain it to safely support vertical, lateral and asymmetrical loads applied until such loads can be supported by in-place concrete structures. Construct falsework so that adjustments can be made for take-up and settlement.
2. Provide wedges, jacks or camber strips to facilitate vertical adjustments. Carefully inspect falsework and formwork during and after concrete placement operations to determine abnormal deflection or signs of failure; make necessary adjustments to produce finished Work of required dimensions.

E. Forms for Smooth Finish Concrete:

1. Do not use metal cover plates for patching holes or defects in forms.
2. Provide sharp, clean corners at intersecting planes, without visible edges or offsets. Back joints with extra studs or girts to maintain true, square intersections.
3. Use extra studs, walers and bracing to prevent bowing of forms between studs and to avoid bowed appearance in concrete. Do not use narrow strips of form material that will produce bow.
4. Assemble forms so they may be readily removed without damage to exposed concrete surfaces.
5. Form molding shapes, recesses, rustication joints and projections with smooth-finish materials, and install in forms with sealed joints to prevent displacement.

F. Corner Treatment:

1. Form exposed corners of beams, walls, foundations, bases and columns to produce smooth, solid, unbroken lines, except as otherwise shown. Exposed corners shall be chamfered.
2. Form chamfers with 3/4-inch by 3/4-inch strips, unless otherwise shown, accurately formed and surfaced to produce uniformly straight lines and tight edge joints. Use rigid PVC chamfers for all architecturally formed concrete. Extend terminal edges to required limit and miter chamfer strips at changes in direction.
3. Reentrant and unexposed corners may be formed either square or chamfered.

G. Joints:

1. Comply with the requirements of Section 03251, Concrete Joints, of these Specifications for treatment of joints. Locate as shown and specified.

H. Openings and Built-In Work:

1. Provide openings in concrete formwork shown or required by other Sections. Refer to Paragraph 1.1.B., above, for the requirements of coordination.
2. Accurately place and securely support items to be built into forms.

I. Sealing Formwork:

1. All formwork joints shall be tight fitting or otherwise sealed to prevent loss of cement paste.

2. All formwork, which rests against concrete surfaces, shall be provided with a compressible gasket material between the concrete and edge of form to fill any irregularities and create a tight seal.
- J. Cleaning and Tightening:
1. Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is to be placed. Retighten forms immediately after concrete placement, as required to eliminate cement paste leaks.

3.3 FORM COATINGS

- A. Coat form contact surfaces with a water-based, non-staining form-coating compound before reinforcement is placed. Do not allow excess form coating material to accumulate in the forms or to come into contact with surfaces which will be bonded to fresh concrete. Apply in compliance with manufacturer's instructions.
- B. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.
- C. For concrete surfaces that will be in contact with potable water, the form coating shall be a mineral oil base coating.

3.4 INSTALLATION OF EMBEDDED ITEMS

- A. Set and build into the formwork, anchorage devices and other embedded items, shown, specified or required by other Sections. Refer to Paragraph 1.1.B., above, for the requirements of coordination. Use necessary setting drawings, diagrams, instructions and directions.
- B. Edge Forms and Screeds Strips for Slabs:
 1. Set edge forms or bulkheads and intermediate screed strips for slabs to obtain required elevations and contours in the finished slab surface. Provide and secure units to support screeds.

3.5 FIELD QUALITY CONTROL

- A. Before concrete placement, check the formwork, including tolerances, lines, ties, tie cones, and form coatings. Make corrections and adjustments to ensure proper size and location of concrete members and stability of forming systems.
- B. During concrete placement, check formwork and related supports to ensure that forms are not displaced and that completed Work shall be within specified tolerances.

- C. If CONTRACTOR finds that forms are unsatisfactory in any way, either before or during placing of concrete, placement of concrete shall be postponed or stopped until the defects have been corrected and reviewed by ENGINEER.

3.6 REMOVAL OF FORMS

- A. Conform to the requirements of ACI 301, Section 2 and ACI 347, Chapter 3.7, except as specified below.

Temperature (F)					
		Over 70°F	60°F-70°F	50°F-60°F	Below 50°F
a	Walls	1 day	2 days	3 days	Do not remove forms until site-cured test cylinder develops 75% of 28-day strength.
b	Columns	2 day	3 days	4 days	
c	Beam Soffits	4 days	5 days	6 days	
d	Suspended Slabs 5 in. thick or less	5 days	6 days	7 days	
e	Suspended Slabs over 5 in. thick	6 days	7 days	7 days	
f	Slabs on grade and foundation edges	1 day	1 day	2 days	

1. Removal of Forms and Supports: Continue curing in accordance with Section 03300, Cast-In-Place Concrete.
- B. When high-early strength concrete is specified, a schedule for removal of forms will be developed in the field from the age/strength relationships established for the materials and proportions used by tests in accordance with ACI 301.
- C. Form facing material shall remain in place a minimum of four days after concrete placement, unless otherwise approved by ENGINEER.
- D. Results of suitable control tests of field-cured specimens may be used as evidence that the concrete has attained sufficient strength and that supporting forms and shoring may be removed prior to the periods indicated herein.
- E. The time for removal of all forms will be subject to ENGINEER'S approval.

3.7 PERMANENT SHORES

- A. Provide permanent shores as defined in ACI 347.
- B. Reshores shall not be permitted.

3.8 RE-USE OF FORMS

- A. Clean and repair surfaces of forms to be re-used in the Work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. Apply new form coating compound material to concrete contact surfaces as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close all joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces. Form surfaces shall be subject to ENGINEER'S approval.

++ END OF SECTION ++

SECTION 03200

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment, and incidentals as shown on the Drawings, specified and required to furnish and install concrete reinforcement.
2. The extent of concrete reinforcement is shown.
3. The Work includes fabrication and placement of reinforcement including bars, ties and supports, and welded wire fabric for concrete, encasements and fireproofing.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:

1. ASTM A82, Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A184, Specification for Fabricated Deformed Steel Bar Mats for Concrete Reinforcement.
3. ASTM A185, Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
4. ASTM A496, Specification for Steel Wire, Deformed, for Concrete Reinforcement.
5. ASTM A497, Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
6. ASTM A615, Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
7. ASTM A706, Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement.
8. ASTM A775, Specification for Epoxy-Coated Reinforcing Steel Bars.
9. ASTM A790, Specifications for Headed Steel Bars for Concrete Reinforcement.
10. ACI 315, Manual of Standard Practice for Detailing Reinforced Concrete Structures.
11. ACI 350-06, Code Requirements for Environmental Engineering Concrete Structures.
12. ACI SP66, Detailing Manual.
13. ANSI/AWS D1.4, Structural Welding Code - Reinforcing Steel.
14. CRSI 1MSP, Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice.

B. Allowable Placing Tolerances: Comply with ACI 350, Chapter 7 - Details of Reinforcement except as specified below:

1. Concrete surfaces which are in contact with liquids: 2-inches minimum coverage.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Manufacturer's specifications and installation instructions for all materials and reinforcement accessories. Comply with the requirements of Section 01332, Shop Drawing Procedures.
2. Drawings for fabrication, bending, and placement of concrete reinforcement. Comply with ACI 315, Parts A and B. For walls, show elevations to a minimum scale of 1/4-inch to one foot. For slabs, show top and bottom reinforcing on separate plan views. Show bar schedules, stirrup spacing, diagrams of bent bars, arrangements and assemblies, as required for the fabrication and placement of concrete reinforcement unless otherwise noted. Splices shall be kept to a minimum. Splices in regions of maximum tension stresses shall be avoided whenever possible.
3. Drawings detailing the location of all construction and expansion joints as required under Section 03251, Concrete Joints, shall be submitted and approved before Shop Drawings for reinforcing steel are submitted.
4. Description of reinforcing weld locations and weld procedures.
5. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
6. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
7. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

B. Certificates:

1. Submit one copy of steel producer's certificates of mill analysis, tensile and bend tests for reinforcing steel.
2. Submit certification of welders and weld procedures for splices in accordance with ANSI/AWS D1.4 requirements.

1.4 DELIVERY, HANDLING AND STORAGE

- A. Deliver concrete reinforcement materials to the site bundled, tagged and marked. Use metal tags indicating bar size, lengths, and other information corresponding to markings shown on placement diagrams. Comply with the requirements of Section 01651, Transportation and Handling of Materials and Equipment.
- B. Store concrete reinforcement material at the site to prevent damage and accumulation of dirt or excessive rust. Store on heavy wood blocking so that no part of it will come in contact with the ground. Comply with the requirements of 01661, Storage of Materials and Equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Reinforcing Bars: ASTM A 615, and as follows:
 1. Provide Grade 60 for all bars, unless indicated otherwise.
- B. Mechanical Couplers: Reinforcement bars may be spliced with a mechanical connection. This connection shall be a full mechanical connection which shall develop in tension or compression, as required, at least 125 percent of specified yield strength (Fy) of the bar in accordance with ACI 350. Shear bolt coupling sleeve type couplers shall not be used in water bearing structures.
- C. Steel Wire: ASTM A 82.
- D. Welded Smooth Wire Fabric: ASTM A 185.
 1. Furnish in flat sheets, not rolls.
- E. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcement in place.
 1. Use wire bar type supports complying with CRSI "Manual of Standard Practice" recommendations, except as specified below. Do not use wood, brick, or other unacceptable materials.
 2. For slabs on grade, use precast concrete blocks, 4-inch square in plan, with embedded tie wire as specified by CRSI, "Manual of Standard Practice". The precast concrete blocks shall have the same or higher compressive strength as specified for the concrete in which they are located.

3. For all concrete surfaces, where legs of supports are in contact with forms, provide supports complying with CRSI "Manual of Standard Practice" as follows:
 - a. At formed surfaces in contact with soil, weather, or liquid or located above liquid, supports shall be CRSI Class 1 for maximum protection. The plastic coating on the legs shall extend at least 1/2-inch upward from the form surface.
 - b. At interior dry surfaces (not located above liquid), supports shall be either Class 1 or Class 2 for moderate protection.
 - c. At formed surfaces with an architectural finish, use stainless steel protected legs (Type B).
 4. Over waterproof membranes, use precast concrete chairs.
- F. Drilled Dowels:
1. Drilled dowels shall consist of reinforcing bars anchored with an adhesive system into hardened concrete. The adhesive system shall use a two component adhesive mix and shall be injected with a static mixing nozzle following manufacturer's written instructions. The embedment depth of the reinforcing bar shall provide minimum allowable bond strength no less than the allowable tensile capacity of the reinforcing bar, unless shown otherwise on the Drawings.
 2. Drilled dowel anchoring systems shall have ultimate capacity no less than 125 percent of the yield strength of the reinforcing steel at an embedment of 12 bar diameters.
 3. Product and Manufacturer: Provide one of the following:
 - a. HIT-RE 500 V3 Epoxy Adhesive Anchor System, by Hilti Inc.
 - b. SET-XP Structural Epoxy-Tie Anchor System by Simpson Strong-Tie.
 - c. Or equal.

2.2 FABRICATION

- A. General: Fabricate reinforcing bars to conform to required shapes and dimensions, with fabrication tolerances complying with CRSI, "Manual of Standard Practice". In case of fabricating errors, do not re-bend or straighten reinforcement in a manner that will injure or weaken the material.
- B. Unacceptable Materials: Reinforcement with any of the following defects will not be permitted in the Work:
 1. Bar lengths, bends, and other dimensions exceeding specified fabrication tolerances.
 2. Bends or kinks not shown on approved Shop Drawings.
 3. Bars with reduced cross-section due to excessive rusting or other cause.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the substrate and the conditions under which concrete reinforcement is to be placed, and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Comply with the applicable recommendations of specified codes and standards, and CRSI, “Manual of Standard Practice”, for details and methods of reinforcement placement and supports.
- B. Clean reinforcement to remove loose rust and mill scale, earth, ice, and other materials which reduce or destroy bond with concrete.
- C. Position, support, and secure reinforcement against displacement during formwork construction or concrete placement operations. Locate and support reinforcing by metal chairs, runners, bolsters, spacers, and hangers, as required.
 - 1. Place reinforcement to obtain the minimum concrete coverages as shown and as specified in ACI 350. Arrange, space, and securely tie bars and bar supports together with 16 gage wire to hold reinforcement accurately in position during concrete placement operations. Set wire ties so that twisted ends are directed away from exposed concrete surfaces.
 - 2. Prior to placement of concrete, demonstrate to ENGINEER that the specified cover of reinforcement has been attained, by using a surveying level or string line.
 - 3. Reinforcing steel shall not be secured to forms with wire, nails, or other ferrous metal. Metal supports subject to corrosion shall not touch formed or exposed concrete surfaces.
- D. Install welded wire fabric in lengths as long as practical. Lap adjoining pieces at least one full mesh but not less than 8-inches and lace splices with 16-gage wire. Do not make end laps midway between supporting beams, or directly over beams of continuous structures. Offset end laps in adjacent widths to prevent continuous laps.
- E. Provide a sufficient number of supports for strength required to carry reinforcement. Do not place reinforcing bars more than 2-inches beyond the last leg of any continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.
- F. Lap Splices:

1. Provide standard reinforcement splices by lapping ends, placing bars in contact, and tying tightly with wire. Comply with requirements for minimum lap of spliced bars as shown on the Drawings.

G. Mechanical Couplers:

1. Mechanical butt splices shall be in accordance with the recommendation of the manufacturer of the mechanical splicing device. Butt splices shall develop 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Bars shall be flame dried before butt splicing. Adequate jigs and clamps or other devices shall be provided to support, align, and hold the longitudinal centerline of the bars to be butt spliced in a straight line. Do not use shear bolt coupling sleeves couplers in water bearing structures.

H. Welded Splices:

1. When permitted by the ENGINEER, in writing, all welding of reinforcing bars shall conform to ANSI/AWS D1.4. Preheating and rate of cooling requirements shall be based on bar steel chemistry and ANSI/AWS D1.4 requirements. Welded splices shall be sized and constructed to transfer a minimum of 125 percent of the specified minimum yield tensile strength of the spliced bars or of the smaller bar in transition splices. Unless otherwise permitted by the ENGINEER, welding of crossing bars (tack welding) for assembly of reinforcement is prohibited.
2. Welding of wire to wire, and of wire or welded wire fabric to reinforcing bars or structural steels, shall conform to applicable provisions of ANSI/AWS D1.4 and any supplementary requirements by the ENGINEER for the particular application.
3. After completion of welding on coated reinforcing bars, coating damage shall be repaired as specified herein. All welds and all steel splice members when used to splice bars shall be coated with the same material used for repair of coating damage.

I. Drilled Dowels:

1. Installation of adhesive anchors shall be performed by personnel qualified for the adhesive anchor system and installation procedures being used. Qualified construction personnel shall be certified through a certification program. All post-installed anchors shall be installed in accordance with the Manufacturer's Printed Installation Instructions (MPII). Installation of adhesive anchors shall be performed only by personnel trained to install adhesive anchors.
2. Drilling and Installation of Adhesive Anchor shall occur after the concrete age has reached 21-days, with the minimum compressive concrete strength at 2500 psi, along with the concrete temperature at time of installation being at least 50-degrees Fahrenheit unless Manufacture's Installation Requirements state otherwise.
3. Drilled dowels shall be reinforcing dowels set in a resin adhesive in a hole drilled into hardened concrete.
4. Overhead installation shall not be used with a resin adhesive unless approved by the ENGINEER.
5. Holes shall be drilled to the adhesive anchor system manufacturer's recommended diameter and depth to develop the required pullout resistance but shall not be

greater in diameter than 1/4-inch more than the nominal bar diameter nor less than 12 times the nominal bar diameter in depth.

6. The hole shall be drilled by methods which do not interfere with the proper bonding of the resin. Only carbide type drill bits with rotary hammer drill shall be used. Existing reinforcing steel in the vicinity of proposed holes shall be located prior to drilling. The location of holes to be drilled shall be adjusted to avoid drilling through or nicking any existing reinforcing bars only after approval by the ENGINEER.
7. The hole shall be minimum twice cleaned by repeating the following method; brushed and blown clean with clean, dry, oil-free compressed air to remove all dust and loose particles and conforming to the manufacturer's written instructions (MPII).
8. Resin shall be injected into the hole through the injection system-mixing nozzle (and any necessary extension tubes) placed to the bottom of the hole. The discharge end shall be withdrawn as resin is placed but kept immersed to prevent formation of air pockets. The hole shall be filled to a depth that ensures that excess material is expelled from the hole during dowel placement. Use a piston plug on the nozzle to help prevent air voids when injecting adhesive into all horizontal holes, and deep downward holes.
9. Dowels shall be twisted during insertion into the partially filled hole so as to guarantee full wetting of the bar surface with resin. The bar shall be inserted slowly enough to avoid developing air pockets.

3.3 INSPECTION OF REINFORCEMENT

- A. Concrete shall not be placed until the reinforcing steel is inspected and permission for placing concrete is granted by ENGINEER. All concrete placed in violation of this provision will be rejected.
- B. Formwork for walls and other vertical members will not be closed up until the reinforcing steel is inspected and permission for placing concrete is granted by ENGINEER. All concrete placed in violation of this provision will be rejected.
- C. Testing of Drilled Dowels:
 1. Employ the services of an independent testing laboratory to perform field quality testing of installed drilled dowels. A minimum of 10 percent (but no less than 15 dowels) shall be chosen at random by the testing laboratory and confirmed by the ENGINEER. Unless otherwise directed by the ENGINEER, drilled dowels shall be tensioned to twice the manufacturer's rated capacity of the anchor. Where dowels are located less than eight dowel diameters from the edge of concrete the ENGINEER will determine the tensile load required for the test.
 2. Provide access for the testing agency to places where Work is being produced so that required inspection and testing can be accomplished.
 3. CONTRACTOR shall be responsible for the failure of any drilled dowel. If any dowel fails, the testing shall be increased to 100 percent.

4. Correct improper workmanship, remove and replace, or correct as directed by the ENGINEER, all drilled dowels found unacceptable or deficient, at no additional cost to the OWNER.
 5. Pay for all corrections and subsequent tests required to confirm the integrity of the drilled dowels.
 6. The independent testing and inspection agency shall complete a report for each area. The report shall summarize the observations made by the Inspector and be submitted to the ENGINEER.
- D. Inspection of Adhesive dowels shall be as required by the legally adopted general building code and as required by the ENGINEER. See Drawings for Inspection Requirements of Post-Installed Anchors in addition to the Requirements stated in the approved anchor Manufacturer's ES-Evaluation Report.
- E. Inspection of Welded Splices: Employ a testing agency to perform field quality control testing of the welded splices. All welded splices shall be visually inspected. A minimum of five percent of butt splice welds shall be radiographically tested. Any weld which is deficient in any way shall be repaired to be completely sound at the CONTRACTOR'S expense.

++ END OF SECTION ++

SECTION 03251

CONCRETE JOINTS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. Provide all labor, materials, equipment and incidentals as shown, specified and required to furnish and install concrete joints.
 2. The types of concrete joints required include the following:
 - a. Construction joints.
 - b. Expansion joints.
 - c. Control joints.
 - d. Isolation joints.
 - e. Waterstops.
- B. General: All joints subject to hydrostatic pressure or in contact with soil, except non-water bearing slabs-on-grade, shall be provided with continuous waterstop.

1.2 QUALITY ASSURANCE

- A. Standard Specifications Details:
1. Conform all applicable requirements of Sections No. 505 and 729 of the Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Governments (MAG) as supplemented by the City of Phoenix. Where there is a conflict between MAG Standard Specifications as supplemented by the City of Phoenix and this Specification, provisions of this Specification shall govern.
- B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified:
1. ACI 301, Standard Specifications for Structural Concrete.
 2. ASTM C 920, Standard Specification for Elastomeric Joint Sealants.
 3. ASTM D 412, Test Methods for Vulcanized Rubber and Thermoplastic Rubbers and Thermoplastic Elastomers-Tension.
 4. ASTM D 471 — Test Method for Rubber Properties – Effects of Chemicals.
 5. ASTM D 624, Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
 6. ASTM D 1752, Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.
 7. ASTM D 2240, Test Method for Rubber Property – Durometer Hardness.

8. CRD-C572, U.S. Army Corps of Engineers Specifications for Polyvinyl- Chloride Waterstop.
- C. All manufactured items shall be installed in accordance with manufacturer's instructions.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Manufacturer's specifications and installation instructions for all materials required.
 2. Layout of all construction and expansion joint locations prior to the submittal of steel reinforcement Shop Drawings. Comply with the requirements of Section 01332, Shop Drawing Procedures.
 3. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
 4. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
 5. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
- B. Samples: Submit for approval the following:
1. Polyvinyl chloride waterstops for joints for each cross section type used.
 2. Foam rubber and cork expansion joint fillers.
 3. Thermoplastic vulcanizate (TPV) or equivalent chemical resistance waterstops for joints used at the Generator concrete foundation structure.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All materials used for joints in concrete shall be stored on platforms or in enclosures and covered to prevent contact with the ground and exposure to the weather and direct sunlight. Storage and handling requirements of the manufacturer shall also be followed.

PART 2 - PRODUCTS

2.1 WATERSTOPS

- A. Polyvinyl Chloride:
1. Material Requirements:
 - a. Waterstops shall be extruded from an elastomeric polyvinyl chloride compound containing the plasticizers, resins, stabilizers, and other materials necessary to meet the requirements of these Specifications and the requirements of CRD-C572. No reclaimed or scrap material shall be used.
 - b. Tensile strength of finished waterstop: 1400 psi, minimum.
 - c. Ultimate elongation of finished waterstop: 280 percent, minimum.
 - d. Minimum thickness shall be 3/8-inch.
 - e. Waterstops shall be provided with a minimum of seven ribs equally spaced at each end on each side. The first rib shall be at the edge. Ribs shall be a minimum of 1/8-inch in height.
 2. Construction Joints: Waterstops shall be flatstrip ribbed type and 6-inches minimum in width, unless shown otherwise.
 3. Expansion Joints: Waterstops shall be centerbulb ribbed type and 9-inches minimum in width, unless shown otherwise. The centerbulb shall have a minimum outside diameter of 7/8-inch.
 4. Product and Manufacturer: Provide one of the following:
 - a. Greenstreak waterstops by Sika Corporation.
 - b. Or equal.

2.2 HYDROPHILIC WATERSTOP MATERIALS

- A. General Material Properties:
1. Hydrophilic waterstop materials shall be bentonite-free and shall expand by a minimum of 80 percent of dry volume in the presence of water to form a watertight joint seal without damaging the concrete in which it is cast. Provide only where indicated in the Contract Documents.
 2. The material shall be composed of resins and polymers which absorb water and cause an increase in volume in a completely reversible and repeatable process. The waterstop material shall be dimensionally stable after repeated wet-dry cycles with no deterioration of swelling potential.
 3. Select materials which are recommended by the manufacturer for the type of liquid to be contained.

B. Hydrophilic Rubber Waterstop:

1. The minimum cross sectional dimensions shall be 3/16-inch by 3/4-inch.
2. Product and Manufacturer: Provide one of the following:
 - a. Adeka Ultraseal MC-2010MN, by OCM Inc.
 - b. Hydrotite, by Sika Corporation.
 - c. Or equal.

C. Hydrophilic Sealant:

1. The hydrophilic sealant shall adhere firmly to concrete, metal, and PVC in dry or damp condition. When cured it shall be elastic indefinitely.
2. Product and Manufacturer: Provide one of the following:
 - a. Adeka Ultraseal P-201, by OCM Inc.
 - b. SikaSwell S, by Sika Corporation.
 - c. Leakmaster, by Sika Corporation.
 - d. Or equal.

D. Hydrophilic Injection Resin:

1. Hydrophilic injection resin shall be acrylate-ester based. The viscosity shall be less than 50 cps. The resin shall be water soluble in its uncured state, solvent free, and non-water reactive. In the cured state it shall form a solid hydrophilic flexible material which is resistant to permanent water pressure and shall not attack bitumen, joint sealants, or concrete.
2. Product and Manufacturer: Provide one of the following:
 - a. SikaFix HH+, by Sika Corporation.
 - b. Or equal.

2.3 PREFORMED EXPANSION JOINT FILLER

- A. Provide preformed expansion joint filler complying with ASTM D 1752, Type I (sponge rubber) or Type II (cork).

2.4 CONCRETE CONSTRUCTION JOINT ROUGHENER

- A. Provide a water-soluble non-flammable, surface-retardant roughener.
- B. Product and Manufacturer: Provide one of the following:
 1. Rugasol-S, as manufactured by Sika Corporation for horizontal joints only.
 2. Concrete Surface Retarder-Formula S, as manufactured by Euclid Chemical Company, for horizontal joints only.
 3. Concrete Surface Retarder-Formula F, as manufactured by Euclid Chemical Company, for vertical joints only.
 4. Or equal.

2.5 EPOXY BONDING AGENT

- A. Provide a two-component epoxy-resin bonding agent.

- B. Product and Manufacturer: Provide one of the following:
1. Sikadur 32 Hi-Mod LPL, as manufactured by Sika Corporation.
 2. Eucopoxy LPL, as manufactured by the Euclid Chemical Company.
 3. Or equal.

2.6 EPOXY-CEMENT BONDING AGENT

- A. Provide a three component epoxy resin-cement blended formulated as a bonding agent.
- B. Product and Manufacturer: Provide one of the following:
1. Sika Armatec 110 EpoCem, as manufactured by Sika Corporation.
 2. Duralprep A.C., as manufactured by the Euclid Chemical Company.
 3. Or equal.

2.7 RUBBER BONDING AGENT

- A. Product and Manufacturer: Provide one of the following:
1. Scotch-Grip 1300 Rubber Adhesive, as manufactured by 3M Company.
 2. Or equal.

2.8 JOINT SEALANT

- A. Sealant used in expansion joints and other locations where it is shown and which will be subject to being submerged by water for any period of time shall be a two part polyurethane type sealant meeting the requirements of ASTM C 920, Type M, Class 25. The sealant shall be specially formulated for continuous submerged conditions. The manufacturer's recommended primer must be used with the sealant. Sealant used shall be either non-sag or self-leveling depending on the location where the sealant is to be used. In horizontal joints exposed to vehicular or foot traffic use a traffic-grade polyurethane elastomeric sealant.
- B. The sealant shall meet the following requirements (measured at 73 degrees F and 50 percent RH):
1. Ultimate hardness (ASTM D 2240, Type A, Shore): 20 to 45.
 2. Tensile strength (ASTM D 412): 120 psi, minimum.
 3. Ultimate elongation (ASTM D 412): 300 percent, minimum.
 4. Tear strength (ASTM D 624, die C): 75 pounds per inch of thickness, minimum.
 5. Color: light gray.
- C. Product and Manufacturer: Provide one of the following:
1. Sikaflex-2c, as manufactured by Sika Corporation.
 2. Permapol RC-270 Reservoir Sealant, as manufactured by Polymeric Systems, Inc.
 3. Or equal.

2.9 SEALANT ACCESSORIES

- A. Backer Rod: Backer rod shall be an extruded closed-cell polyethylene foam rod. The material shall be compatible with the sealant material used and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25 percent at 8 psi. The rod shall be 1/8-inch larger in diameter than the joint width at joints less than 3/4-inch wide and 1/4-inch larger in diameter at joints 3/4-inch and wider.
- B. Primer: Non-staining type, recommended by sealant manufacturer to suit application.
- C. Joint cleaner: Noncorrosive, non-staining, compatible with joint forming materials and as recommended by sealant manufacturer.
- D. Bond Breaker Tape: Bond breaker shall be polyethylene or TFE-fluorocarbon self-adhesive tape, as recommended by the manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the substrate and the conditions under which Work is to be performed and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 CONSTRUCTION JOINTS

- A. Comply with the requirements of ACI 301 and as specified below.
- B. Locate and install construction joints as shown on the Drawings. Additional construction joints shall be located as follows:
 - 1. In walls locate joints at a spacing of 40 feet maximum and approximately 12 feet from corners.
 - 2. In foundation slabs and slabs on grade locate joints at a spacing of approximately 40 feet. Place concrete in a strip pattern, unless otherwise indicated on the Drawings.
 - 3. In mats and structural slabs and beams, at a spacing of approximately 40 feet. Locate joints in compliance with ACI 301, unless otherwise indicated on the Drawings.
 - 4. Provide other additional construction joints as required to satisfactorily complete all Work.
- C. Horizontal Joints:
 - 1. Roughen concrete at the interface of construction joints by abrasive blasting, hydroblasting, or the use of surface retardants and water jets to expose the aggregate

and remove accumulated concrete on projecting rebar immediately subsequent to form stripping, unless otherwise approved by ENGINEER. Immediately before placing fresh concrete, thoroughly clean the existing contact surface using a stiff brush or other tools and a stream of water under pressure. The surface shall be clean and wet, but free from pools of water at the moment the fresh concrete is placed.

2. Remove laitance, waste mortar or any other substance which may prevent complete adhesion. Where joint roughening was performed more than seven days prior to concrete placement or where dirt or other bond reducing contaminants are on the surface, additional light abrasive blasting or hydroblasting shall be done to remove laitance and all bond reducing materials just prior to concrete placement.
 3. Place a 2-inch thick coat of mortar, one part sand and one part cement with water added to a flowable consistency or a 6-inch layer of Construction Joint Grout, as specified in Section 03600, 2.3 Concrete Grouts,, over the contact surface of the old concrete. Place fresh concrete before the mortar or grout has attained its initial set. If the concrete mix has the slump increased to at least 6-inches by addition of a high range water reducer, the placement of mortar or grout may be omitted.
- D. Vertical Joints:
1. Apply roughener to the form in a thin, even film by brush, spray or roller in accordance with the manufacturer's instructions. After roughener is dry, concrete may be placed.
 2. When concrete has been placed, remove joint surface forms as early as is necessary to allow for removal of the surface retarded concrete. Forms covering member surfaces shall remain in place as required by Section 03100, Concrete Formwork. Wash loosened material off with high-pressure water spray to obtain roughened surface subject to approval by ENGINEER. Alternately, the surface shall be roughened by abrasive blasting or hydroblasting to expose aggregate. The outer 1-inch of each side of the joint face shall be masked and protected from the blasting to avoid damage to the member surface.

3.3 EXPANSION JOINTS

- A. Comply with the requirements of ACI 301 and as specified below.
- B. Locate and install expansion joints as shown. Install polyvinyl chloride expansion joint type waterstop, and joint filler in accordance with manufacturer's instructions. Sealants shall be installed as specified herein.

3.4 CONTROL JOINTS

- A. Control joints shall be provided in non-water bearing slabs on grade only where specifically shown. A 1/4-inch wide groove, with a depth of at least 25 percent of the member thickness, shall be formed or saw-cut in the concrete. This groove shall be filled with traffic grade joint sealant material.

- B. Where the control joint is formed by saw cutting, the cut shall be made immediately after the concrete has set enough to support the saw and be cut without being damaged. The concrete shall be kept continually moist until the cutting operation.
- C. Control joints may be formed with a tool or by insertion of a joint forming strip. After the concrete has gained its design strength, the upper portion of the joint forming strip shall be removed and the void filled with sealant.
- D. Provide control joints at all re-entrant corners.
- E. Where not shown on plans, provide control joints in slabs, with a minimum panel length to width ratio of 2:1, with a maximum length of 20 feet.

3.5 ISOLATION JOINTS

- A. Wherever a sidewalk or other slab on grade abuts a concrete structure and is not shown doweled into that structure, an isolation joint shall be provided. Such joint shall be formed by a 1/2-inch joint filler with the upper 1/2-inch of the joint filled with a self-leveling grade joint sealant.

3.6 WATERSTOPS

- A. General:
 - 1. Comply with the requirements of ACI 301 and as specified below. All joints shall be made in accordance with manufacturer's instructions.
 - 2. Obtain ENGINEER'S approval for waterstop locations not shown.
 - 3. Provide polyvinyl chloride waterstops in all joints in concrete which are intended to retain liquid or are located below grade up to an elevation at least 12-inches above grade or to an elevation at least 12-inches above overflow liquid level in tanks, whichever is higher, except where otherwise shown or noted.
- B. Polyvinyl Chloride Waterstop:
 - 1. Tie waterstop to reinforcement, at a maximum spacing of 18-inches, so that it is securely and rigidly supported in the proper position during concrete placement. Continuously inspect waterstops during concrete placement to ensure their proper positioning.
 - 2. Splices in waterstops shall be performed by heat sealing the adjacent waterstop sections in accordance with the manufacturer's printed recommendations. It is required that:
 - a. The material shall not be damaged by heat sealing.
 - b. The splices shall have a tensile strength of not less than 60 percent of the unspliced materials tensile strength.
 - c. The continuity of the waterstop ribs and of its tubular center axis shall be maintained.
 - 3. Only butt type joints of the ends of two identical waterstop sections shall be allowed to be made while the material is in the forms.

4. All joints with waterstops involving more than two ends to be jointed together, and all joints which involve an angle cut, alignment change, or the joining of two dissimilar waterstop sections shall be prefabricated by CONTRACTOR or manufacturer prior to placement in the forms, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated waterstop joint assemblies shall be installed in the forms and the ends of the 24-inch strips shall be butt welded to the straight run portions of waterstop in place in the forms.
 5. Where a centerbulb waterstop intersects and is jointed with a non-centerbulb waterstop, care shall be taken to seal the end of the centerbulb, using additional PVC material, if required.
 6. The symmetrical halves of the waterstops shall be equally divided between the concrete placements at the joints and centered within the joint width, unless shown otherwise. Centerbulb waterstops shall be placed in expansion joints so that the centerbulb is centered on the joint filler material.
 7. When any waterstop is installed in the forms or is embedded in the first concrete placement and the waterstop remains exposed to the atmosphere for more than four days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.
 8. Waterstop placed in joints intended for future concrete placement shall be protected from direct rays of the sun by temporary means until a permanent cover is installed so that the waterstop is not exposed to the direct rays of the sun for more than a total of four days.
- C. Hydrophilic Rubber Waterstop and Sealant:
1. Where a hydrophilic rubber waterstop or sealant is called for in the Contract Documents, or where approved by the ENGINEER, it shall be installed with the manufacturer's instructions and recommendations; except, as modified herein.
 2. When requested by the ENGINEER, the manufacturer shall provide technical assistance in the field.
 3. The waterstop or sealant shall be located as near as possible to the center of the joint and it shall be continuous around the entire joint. The minimum distance from the edge of the waterstop to the face of the member shall be 3-inches.
 4. Where a hydrophilic rubber waterstop is used in combination with PVC waterstop, the hydrophilic rubber waterstop shall overlap the PVC waterstop for a minimum of 6-inches. The contact surface between the hydrophilic rubber waterstop the PVC waterstop shall be filled with hydrophilic sealant.
 5. Where wet curing methods are used, hydrophilic rubber waterstop and sealant shall be applied after curing water is removed and just prior to the closing up of the forms for the concrete placement. Hydrophilic rubber waterstop and sealant shall be protected from the direct rays of the sun and from becoming wet prior to concrete placement. If the material does become wet and expands, it shall be allowed to dry until it has returned to its original cross sectional dimensions before concrete is placed.

6. The hydrophilic rubber waterstop shall be installed in a bed of hydrophilic sealant, before skinning and curing begins, so that any irregularities in the concrete surface are completely filled and the waterstop is bonded to the sealant. After the sealant has cured, concrete nails, with washers of a diameter equal to the waterstop width, shall be placed to secure the waterstop to the concrete at a maximum spacing of 18-inches.
7. Prior to installation of hydrophilic sealant, the concrete surface shall be wire brushed or sand blasted to remove any laitance or other materials that may interfere with the bonding. Surfaces of metal or PVC to receive sealant shall be cleaned of paint and any material that may interfere with bond. When sealant alone is shown on the Contract Documents, it shall be placed in a built up bead which has a triangular cross section with each side of the triangle at least 3/4- inch in length, unless indicated otherwise. Concrete shall not be placed until the sealant has cured as recommended by the manufacturer.

D. Thermoplastic Vulcanizate (TPV) Waterstop:

1. Tie waterstop to reinforcement, at a maximum spacing of 18-inches, so that it is securely and rigidly supported in the proper position during concrete placement. Continuously inspect waterstops during concrete placement to ensure their proper positioning.
2. Splices in waterstops shall be performed by heat sealing the adjacent waterstop sections in accordance with the manufacturer's printed recommendations. It is required that:
 - a. The material shall not be damaged by heat sealing.
 - b. The splices shall have a tensile strength of not less than 60 percent of the unspliced materials tensile strength.
 - c. The continuity of the waterstop ribs and of its tubular center axis shall be maintained.
3. Only butt type joints of the ends of two identical waterstop sections shall be allowed to be made while the material is in the forms.
4. All joints with waterstops involving more than two ends to be jointed together, and all joints which involve an angle cut, alignment change, or the joining of two dissimilar waterstop sections shall be prefabricated by CONTRACTOR or manufacturer prior to placement in the forms, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated waterstop joint assemblies shall be installed in the forms and the ends of the 24-inch strips shall be butt welded to the straight run portions of waterstop in place in the forms.
5. Where a centerbulb waterstop intersects and is jointed with a non-centerbulb waterstop, care shall be taken to seal the end of the centerbulb, using additional TPV material, if required.
6. The symmetrical halves of the waterstops shall be equally divided between the concrete placements at the joints and centered within the joint width, unless shown otherwise. Centerbulb waterstops shall be placed in expansion joints so that the centerbulb is centered on the joint filler material.

7. When any waterstop is installed in the forms or is embedded in the first concrete placement and the waterstop remains exposed to the atmosphere for more than four days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.
8. Waterstop placed in joints intended for future concrete placement shall be protected from direct rays of the sun by temporary means until a permanent cover is installed so that the waterstop is not exposed to the direct rays of the sun for more than a total of four days.

3.7 BONDING AGENT

- A. Use epoxy bonding agent for bonding of fresh concrete to concrete that has been in place for at least 60 days or to existing concrete.
- B. Use epoxy-cement bonding agent for the following:
 1. Bonding toppings and concrete fill to concrete that has been in place for at least 60 days or to existing concrete.
 2. For all locations where bonding agent is required and the concrete can be placed at that location within the open time period of epoxy bonding agent.
 3. Bonding of horizontal construction joints where these are required by the Drawings or approved by ENGINEER.
- C. Use a cement-water slurry as a bonding agent for toppings and concrete fill to new concrete. The cement water slurry shall be worked into the surface with a stiff bristle broom and concrete shall be placed before the cement-water slurry dries.
- D. Handle and store bonding agent in compliance with the manufacturer's printed instructions, including safety precautions.
- E. Mix the bonding agent in complete accordance with the instructions of the manufacturer.
- F. Before placing fresh concrete, thoroughly roughen to a CSP 6 and clean hardened concrete surfaces and coat with bonding agent not less than 1/16-inch thick. Place fresh concrete while the bonding agent is still tacky (within its open time), without removing the in-place bonding agent coat, and as directed by the manufacturer.

3.8 SEALANT INSTALLATION

- A. Sealants shall be installed according to the manufacturer's recommendations for sealant which is to be subjected to continuous submerged conditions and the following requirements. Prior to sealant installation, arrange to have a representative of the sealant manufacturer instruct the crew doing the Work as to the proper methods of surface preparation, mixing, and application of the sealant.

- B. Surfaces to receive sealant shall be cleaned of all materials which could interfere with proper bonding. Concrete surfaces shall have all fins or other defects removed or repaired and shall receive a light abrasive blasting and cleaning prior to priming and sealant application. All surfaces to receive sealant shall be completely dry.
- C. Spaces to receive sealant shall be filled with joint filler as shown. Where not shown, the space shall be filled with joint filler or a backer rod so that the depth of sealant does not exceed the width of the space. Where the bottom of the space to receive sealant is formed by a material other than backer rod, a bond breaker tape shall be placed. The maximum sealant depth, at middle of the joint width, shall be 1/2-inch.
- D. The cleaner, primer and sealant used shall be supplied by the same manufacturer. No sealant shall be placed without the use of both a cleaner and primer.
- E. Self-leveling sealants shall only be used in joints with a slope less than 0.5 percent and where maximum and minimum sealant depths can be maintained. Non-sag sealant shall be used at all other locations and may be used instead of self-leveling sealant. All non-sag sealant shall be tooled to a uniform concave surface before skinning and curing begins. Use traffic grade sealants where foot traffic or vehicular traffic occurs.
- F. Sealant material shall be conditioned to be within the optimum temperature range recommended by the manufacturer for installation for a minimum of 16 hours prior to installation. Installation shall proceed only when the substrate is at a temperature recommended by the manufacturer. Sealant shall not be placed if there is a threat of imminent rainfall or dust storm. Submit a letter certifying that the applied sealants were installed in accordance with the manufacturer's recommendations, including temperature, relative humidity, etc.
- G. All joints to receive sealant shall be inspected by the ENGINEER prior to sealant placement.
- H. All sealant shall achieve final cure at least seven days before the structure is filled with water or foot and vehicular traffic is allowed on the surface.
- I. Any sealant which, after the manufacturer's recommended curing time for the job conditions, fails to fully and properly cure shall be completely removed. The surfaces to receive sealant shall be completely cleaned of all traces of the improperly cured sealant and primer. The specified sealant shall then be reinstalled. All costs of such removal, surface treatment, and reinstallation shall be at the expense of CONTRACTOR.

++ END OF SECTION ++

SECTION 03252

ANCHORAGE IN CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified, and required to furnish and install anchor bolts, concrete anchors (adhesive and expansion anchors), and concrete inserts.
- B. Coordination: This Section includes all bolts, anchors and inserts required for the Work but not specified under other Sections.
- C. The types of work using anchor bolts and anchors drilled into concrete or masonry includes, but is not limited to, the following:
1. Structural members and accessories.
 2. Metal, wood, and plastic fabrications.
 3. Equipment.
 4. Piping.
 5. Grating and floor plate.
 6. Electrical.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown and specified.
1. ASTM A 36, Specification for Structural Steel.
 2. ASTM A 123, Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
 3. ASTM A 153, Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 4. ASTM A 193, Grade B7, Alloy-Steel and Stainless Steel Bolting Materials for high Temperature or High Pressure Service and Other Special Purpose Applications.
 5. ASTM A 276, Specification for Stainless Steel Bars and Shapes.
 6. ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
 7. ASTM A 484/A 484M, Specification for General Requirements for Stainless and Heat-Resisting Steel Bars, Billets and Forgings.
 8. ASTM A 525, Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
 9. ASTM A 536, Specification for Ductile Iron Castings.

10. ASTM A 570/A 570M, Specification for Structural Steel, Sheet and Strip, Carbon, Hot-Rolled.
11. ASTM B 633, Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
12. ASTM F 593, Specification for Stainless Steel Bolts; Hex Cap Screws, and Studs.
13. Federal Specification, FF-S-325 for Concrete Expansion Anchors.
14. Federal Specifications, WW-H-171E for Malleable Iron.

- B. Adhesive, screw type anchors and inserts shall have an ICC-ES Report or other Building Code Approval Agency Report, UL, or FM approved reports.

1.3 SUBMITTALS

- A. Samples: Submit for approval the following:
1. Representative samples of bolts, anchors and inserts as may be requested by ENGINEER. Review will be for type and finish only. Compliance with all other requirements is exclusive responsibility of CONTRACTOR.
- B. Shop Drawings: Submit for approval the following:
1. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
 2. Setting drawings and templates for location and installation of anchorage devices.
 3. Copies of manufacturer's specifications, load tables, dimension diagrams and installation instructions for the anchorage devices.
 4. Copies of Building Code Approval Agency's Evaluation Report, UL, or FM reports certifying design values for load carrying capacities along with installation requirements for the anchorage devices.
 5. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
 6. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- A. When the size, length or load carrying capacity of an anchor bolt, concrete anchor, or concrete insert is not shown on the Drawings, provide the following:
1. For anchor bolts (cast-in-place), provide the size, length and capacity required to carry the design load based on the values and requirements given in 2.1.B.4 section.
 2. For concrete anchors (adhesive, screw types) and concrete inserts, provide the size, length, type, and capacity required to carry the design load based on the design values and requirements given in 2.1.B.4 section. CONTRACTOR to submit ICC Evaluation Service Evaluation Report, or similar certifications by UL or FM, for the anchor to be used. Alternately the capacity may be based on independent testing lab capacities for tension and shear strength using a minimum safety factor of four. Consideration of reduced capacity due to spacing and edge distance shall be made.
- B. Determine design loads as follows:
1. For equipment anchors, use the design load recommended by the equipment manufacturer and approved by ENGINEER.
 2. For pipe hangers and supports, use one half of the total weight of: pipe, fittings, and water contained in pipe, plus the full weight of valves and accessories located between the hanger or support in question.
 3. Allowances for vibration are included in the safety factor specified above.
 4. Concrete anchors shall develop ultimate shear and pull-out loads of not less than the following values in 4000 psi concrete:

Bolt diameter (Inches)	Min Shear (Pounds)	Min Pull-Out Load (Pounds)
1/2	5,000	7,600
5/8	8,000	12,000
3/4	11,500	17,000
7/8	15,700	20,400
1	20,500	28,400

2.2 APPLICATION

- A. Where a concrete anchor is shown on the Drawings, either an adhesive anchor or anchor bolt shall be used. In masonry, where a concrete anchor is indicated, only anchor bolts and adhesive anchors shall be used.
- B. Anchor Bolts (Cast-in-Place):
1. Shall be used where indicated and may be used where concrete anchors are indicated.

2. Where an anchor bolt is indicated, only a cast-in-place anchor bolt shall be used, unless another anchor type is accepted by the ENGINEER.
 3. Provide anchor bolts as shown on the Drawings or as required to secure structural steel to concrete or masonry.
- C. Adhesive Anchors:
1. Use wherever concrete anchors are shown on the Drawings.
 2. Use where subject to vibration or where buried or submerged.
 3. Use for pipe supports.
 4. Use in concrete and masonry.
 5. Shall not be used in ceilings.
 6. Shall not be used for pipe hangers.
- D. Concrete Inserts:
1. Use only where indicated.
 2. Use for pipe hangers and supports for the pipe size and loading recommended by the insert manufacturer.

2.3 MATERIALS

- A. Anchor Bolts:
1. In aboveground applications, provide carbon steel bolts complying with ASTM A 307, headed or non-headed type, unless otherwise indicated.
 2. In buried, or wash-down areas or submerged locations, provide stainless steel bolts complete with washers complying with ASTM F 593, AISI Type 316 and with nitronic 60 stainless steel nuts and locknuts. Other AISI types may be used subject to ENGINEER'S approval.
 3. For equipment, provide anchor bolts, which meet the equipment manufacturer's recommendations for size, material, and strength.
 4. Provide anchor bolts as shown on the Drawings or as required to secure structural steel to concrete or masonry.
 5. Locate and accurately set the anchor bolts using templates or other devices as required.
 6. Protect threads and shank from damage during installation of equipment and structural steel.
 7. Comply with manufacturer's required embedment length and necessary anchor bolt projection.
- B. Adhesive Anchors:
1. Do not use Adhesive Anchor Systems to resist gravity loads in fire rated construction or in direct tension load applications.
 2. Provide stainless steel adhesive anchors complying with ASTM F 593, AISI Type 316 with nitronic 60 stainless steel nuts and locknuts.

3. In buried or submerged locations, provide stainless steel adhesive anchors complying with ASTM F 593, AISI Type 316 with nitronic 60 stainless steel nuts and locknuts.
 4. Anchors shall be of the size required for the concrete strength specified.
 5. Adhesive anchors shall consist of threaded rods or bolts anchored with an approved adhesive system for hardened concrete or grout-filled masonry. The adhesive system shall use a two-component adhesive mix and shall be injected with a static mixing nozzle following manufacturer's instructions. The embedment depth of the rod/bolt shall provide a minimum allowable bond strength that is equal to the allowable tensile capacity of the rod/bolt, unless noted otherwise on the Drawings.
 6. Product and Manufacturer for anchors in Concrete: Provide one of the following:
 - a. HIT-RE 500 V3 Epoxy Adhesive Anchor System, by Hilti Inc.
 - b. SET-XP Structural Epoxy-Tie Anchor System, by Simpson Strong-Tie.
 - c. Or equal.
 7. Product and Manufacturer for anchors into Grout Filled Masonry: Provide one of the following:
 - a. HIT HY-70 Adhesive Anchor System, as manufactured by Hilti Inc.
 - b. SET-XP Adhesive Anchor System, as manufactured by Simpson Strong-Tie.
 - c. Or equal.
- C. Concrete Inserts:
1. For piping, grating, floor plate and masonry lintels, provide malleable iron inserts. Comply with Federal Specification WW-H-171E (Type 18). Provide those recommended by the manufacturer for the required loading.
 2. Finish shall be black.
 3. Product and Manufacturer: Provide one of the following:
 - a. Figure 282, as manufactured by ITT Grinnell.
 - b. No. 380, as manufactured by Hohmann and Barnard, Incorporated.
 - c. Or equal.
- D. Powder actuated fasteners and other types of bolts and fasteners not specified herein shall not be used unless approved by ENGINEER.
- E. Expansion anchors will not be allowed unless approved by ENGINEER.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which anchor bolts, expansion anchors and concrete insert Work is to be installed, and notify ENGINEER, in writing, of conditions detrimental to proper and timely completion of Work. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Assure that embedded items are protected from damage and are not filled in with concrete.
- B. Use concrete inserts for pipe hangers and supports for the pipe size and loading recommended by the insert manufacturer.
- C. For the adhesive anchors and adhesive material, comply with the manufacturer's installation instructions on the hole diameter and depth required to fully develop the tensile strength of the anchor or reinforcing bar. Properly clean out the hole per manufacturer's requirements utilizing a non-metallic fiber bristle brush and compressed air to remove all loose material from the hole, prior to installing adhesive material.
- D. Adhesive anchor manufacturer's representative shall observe and demonstrate the proper installation procedures for the adhesive anchors and adhesive material at no additional expense to OWNER. Each installer shall be certified in writing by the manufacturer to be qualified to install the adhesive anchors.

3.3 CLEANING

- A. After embedding concrete is placed, remove protection and clean bolts and inserts.

3.4 FIELD QUALITY CONTROL

- A. Employ a testing laboratory to perform field quality testing of installed anchors. Field engineer is to determine the level of testing which is required for the various types of adhesive anchors and anchor bolts. A minimum of ten percent of the adhesive anchors and adhesive reinforcing bars are to be tested to 50 percent of the ultimate tensile capacity of the adhesive anchor or reinforcing bar.
- B. If failure of any of the adhesive anchors or reinforcing bars occurs, testing the remaining 90 percent will be required and the costs involved belong to the CONTRACTOR. Responsibility belongs to CONTRACTOR to correct improper workmanship, remove and replace, or correct as directed by the ENGINEER, all adhesive anchors or bars found unacceptable or deficient, at no additional cost to the OWNER.
- C. The independent testing and inspection agency shall complete a report on each area of the Work where concrete anchors are installed. The report shall summarize the observations made by the inspector and be submitted to ENGINEER.
- D. Provide access for the testing agency to places where work is being produced so that required inspection and testing can be accomplished.

++ END OF SECTION ++

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install cast-in-place concrete.
2. The Work includes providing concrete consisting of portland cement, fine and coarse aggregate, water, and approved admixtures; combined, mixed, transported, placed, finished and cured. The Work also includes:
 - a. Providing openings in concrete to accommodate the Work under this and other Sections and building into the concrete all items such as sleeves, frames, anchor bolts, inserts and all other items to be embedded.

B. Coordination:

1. Review installation procedures under other Sections and coordinate the installation of items that must be installed in the concrete.

C. Classifications of Concrete:

1. Type "1" concrete shall be steel reinforced and includes the following:
 - a. All concrete, unless indicated otherwise.
2. Type "2" concrete shall be placed without forms or with simple forms, with little or no reinforcing, and includes the following:
 - a. Concrete fill within structures greater than or equal to 4-inches thick. Where less than 4-inches thick, provide Grout Fill topping grout in conformance with Section 03600 Grout.
 - b. Duct banks.
 - c. Unreinforced encasements.
 - d. Curbs and gutters.
 - e. Sidewalks.
 - f. Thrust blocks.
3. Type "3" and "5" concrete shall be steel reinforced and provided where shown on the Drawings.
4. Type "4" concrete shall be unreinforced and used where required as concrete fill under foundations as shown on the Drawings and per the general structural notes, specifically sheet S.1.1, and wherever "lean" concrete is required on the Drawings. This concrete shall be one-sack Controlled Low Strength Material (CLSM) per contract drawing S-1.1.

1.2 QUALITY ASSURANCE

- A. Standard Specifications and Details:
1. Conform to all applicable requirements of Section Nos. 505, 725, 726 and 728 of the Uniform Standard Specifications for Public Works Construction by the Maricopa Association of Governments (MAG) as supplemented by the City of Phoenix. Where there is a conflict between MAG Standard Specifications as supplemented by the City of Phoenix and this Specification, provisions of this Specification shall govern.
- B. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. ACI 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
 2. ACI 214, Recommended Practice for Evaluation of Strength Test Results of Concrete.
 3. ACI 301, Specifications for Structural Concrete (includes ASTM Standards referred to herein).
 4. ACI 304, Guide for Measuring, Mixing, Transporting and Placing Concrete.
 5. ACI 305, Hot Weather Concreting.
 6. ACI 306, Cold Weather Concreting.
 7. ACI 308, Guide for Curing Concrete.
 8. ACI 309, Guide for Consolidation of Concrete.
 9. ACI 311, Guide for Concrete Inspection.
 10. ACI 350, Code Requirements for Environmental Engineering Concrete Structures.
 11. ANSI/NSF 61, Drinking Water System Components-Health Effects.
 12. AASHTO M 182, Burlap Cloth Made From Jute or Kenaf.
 13. AASHTO TP 23, Proposed Standard Method of Test for Water Content of Freshly Mixed Concrete Using Microwave Oven Drying.
 14. ASTM C 31, Practice for Making and Curing Concrete Test Specimens in the Field.
 15. ASTM C 33, Specification for Concrete Aggregates.
 16. ASTM C 39, Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 17. ASTM C 42, Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete
 18. ASTM C 94, Specification for Ready-Mixed Concrete.
 19. ASTM C109, Test Method for Compressive Strength of Hydraulic Cement Mortars.
 20. ASTM C 138, Test Method for Density (Unit Weight, Yield and Air Content (Gravimetric) of Concrete.
 21. ASTM C 143, Test Method for Slump of Hydraulic- Cement Concrete.
 22. ASTM C 150, Specification for Portland Cement.
 23. ASTM C 157, Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
 24. ASTM C 171, Specification for Sheet Materials for Curing Concrete.
 25. ASTM C 172, Practice for Sampling Freshly Mixed Concrete.

26. ASTM C 231, Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
 27. ASTM C 260, Specification for Air-Entraining Admixtures for Concrete.
 28. ASTM C 309, Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
 29. ASTM C 330, Specification for Lightweight Aggregates for Structural Concrete.
 30. ASTM C 494, Specification for Chemical Admixtures for Concrete.
 31. ASTM C 618, Specification for Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Portland Cement Concrete.
 32. ASTM C 882, Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
 33. ASTM C 1240, Specification for Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout.
 34. ASTM C 1602 Specification for Mixing Water Used in the Production of Hydraulic Cement Concrete.
 35. ASTM E 154, Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
 36. ASTM E 329, Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used for Construction.
 37. ASTM E 1745, Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
- C. Concrete Testing Service:
1. Field testing and inspection services for concrete will be provided by OWNER. Coordinate with OWNER's testing agency.
 - a. Testing agency shall meet the requirements of ASTM E 329.
 - b. Selection of a testing laboratory is subject to ENGINEER'S approval.
 - c. Submit a written description of the proposed concrete testing laboratory giving qualifications of personnel, laboratory facilities and equipment, and other information that may be requested by ENGINEER.
 2. Materials and installed Work may require testing and retesting, as directed by ENGINEER, at any time during the progress of the Work. Allow free access to material stockpiles and facilities at all times. Tests not specifically indicated to be done at OWNER'S expense, including the retesting of rejected materials and installed Work, shall be done at CONTRACTOR'S expense.
- D. Qualifications of Water-Reducing Admixture Manufacturer:
1. Water-reducing admixtures shall be manufactured under strict quality control in facilities operated under a quality assurance program. Furnish copy of manufacturer's quality assurance handbook to document the existence of the program. Manufacturer shall maintain a concrete testing laboratory that has been approved by the Cement and Concrete Reference Laboratory at the Bureau of Standards, Washington, D.C.
 2. Provide a qualified concrete technician employed by the admixture manufacturer to assist in proportioning the concrete for optimum use of the admixture. The concrete

technician shall advise on proper addition of the admixture to the concrete and on adjustment of the concrete mix proportions to meet changing jobsite conditions.

E. Laboratory Trial Batch:

1. Each concrete mix design specified shall be verified by a laboratory trial batch, unless indicated otherwise.
2. Each trial batch shall include the following testing:
 - a. Aggregate gradation for fine and coarse aggregates.
 - b. Fly ash testing to verify meeting specified properties, unless the fly ash supplier provides certification by an independent testing laboratory.
 - c. Slump.
 - d. Air content.
 - e. Compressive strength based on three cylinders each tested at seven days and at 28 days.
 - f. Shrinkage test as specified herein for Type “1” concrete mix designs.
3. Each trial batch shall provide the following information:
 - a. Project identification name and number.
 - b. Date of report.
 - c. Complete identification of aggregate source of supply.
 - d. Tests of aggregates for compliance with specified requirements.
 - e. Scale weight of each aggregate.
 - f. Absorbed water in each aggregate.
 - g. Brand, type and composition of cement.
 - h. Brand, type and amount of each admixture.
 - i. Amounts of water used in trial mixes.
 - j. Proportions of each material per cubic yard.
 - k. Gross weight and yield per cubic yard of trial mixtures.
 - l. Measured slump.
 - m. Measured air content.
 - n. Compressive strength developed at seven days and 28 days, from not less than three test cylinders cast for each seven day and 28 day test, and for each design mix.
 - o. Shrinkage test results where required and as specified herein.
4. The requirement for a trial batch may be waived if the required test information has been provided in a previous laboratory trial batch run on the identical mix design within the previous two years. The same brand, type, and source of all materials must have been used.

F. Shrinkage Test:

1. Drying shrinkage tests will be made for the trial batch as specified herein.
2. Drying shrinkage specimens shall be 4-inch by 4-inch by 11-inch prisms with an effective gage length of 10-inches, fabricated, cured, dried and measured in accordance with the requirements of ASTM C 157 modified as follows: specimens shall be removed from molds at an age of 23 ±1 hours after trial batching, shall be placed immediately in water at 70°F ±3°F for at least 30 minutes, and shall be

measured within 30 minutes thereafter to determine original length and then submerged in saturated lime water at 73°F ±3°F. Measurement to determine expansion expressed as a percentage of original length shall be made at age seven days. This length at age seven days shall be the base length for drying shrinkage calculations ("0" days drying age). Specimens then shall be stored immediately in a humidity control room maintained at 73°F ±3°F and 50 percent ±4 percent relative humidity for the remainder of the test. Measurements to determine shrinkage expressed as percentage of base length shall be made and reported separately for 7, 14, 21, and 28 days of drying after seven days of moist curing.

3. The drying shrinkage deformation of each specimen shall be computed as the difference between the base length (at "0" days drying age) and the length after drying at each test age. The average drying shrinkage deformation of the specimens shall be computed to the nearest 0.0001-inch at each test age. If the drying shrinkage of any specimen departs from the average of that test age by more than 0.0004-inch, the results obtained from that specimen shall be disregarded. Results of the shrinkage test shall be reported to the nearest 0.001 percent of shrinkage. Compression test specimens shall be taken in each case from the same concrete used for preparing drying shrinkage specimens. These tests shall be considered a part of the normal compression tests for the project. Allowable shrinkage limitations shall be as specified in Part 2, herein.
- G. Certification of Concrete Mix:
1. The need for a trial batch may be waived if the following requirements are met. The compressive strength of each specified mix shall be verified by data from a series of a minimum of 30 consecutive tests that have been made within the previous 12 months. A test is defined as the average strength of all specimens of the same age fabricated from a sample taken from a single batch of concrete. All tests shall have been made on concrete which is identical in mix design to the submitted proposed mix design, including sources of aggregate and manufacturers of cementitious materials and admixtures. The tests must average above the specified strength with no individual test falling more than 500 psi below specified strength and no three consecutive tests averaging below specified strength. In addition, the standard deviation for the series of tests shall not exceed 640 psi as defined by ACI 214.
- H. Sample Panels:
1. Provide sample panels of wall finishes, 12-inches by 12-inches by 3-inches thick. Perform revisions and corrective work required to produce finished concrete and surfaces as required by ENGINEER.
 - a. Construct additional sample panels as may be required if original results are not satisfactory.
 2. The continuity of color and texture for exposed concrete surfaces is of prime importance. Maintain such controls and procedures, in addition to those specified, as is necessary to provide continuous match of concrete Work with accepted samples.

1.3 SUBMITTALS

- A. Samples: Submit samples of materials as specified and as otherwise may be requested by ENGINEER, including names, sources and descriptions.
- B. Shop Drawings: Submit for approval the following:
1. Manufacturer's specifications with application and installation instructions for proprietary materials and items, including admixtures and bonding agents.
 2. List of concrete materials and concrete mix designs proposed for use. Include the results of all tests performed to qualify the materials and to establish the mix designs.
 3. The following information, if ready-mixed concrete is used.
 - a. Physical capacity of mixing plant.
 - b. Trucking facilities available.
 - c. Estimated average amount that can be produced and delivered to the site during a normal eight hour day, excluding the output to other customers.
 - d. Each Shop Drawing Submittal shall include a hard copy of the relevant Specification Section and shall be clearly marked to indicate whether the requirements for equipment and/or services in the Specification Section are met by writing "accept" or "deviate" next to each Paragraph. If clarifications are needed to any of the Paragraphs in the Specification Sections due to deviations, they shall be addressed next to the Paragraph as such and explained further with any additional information necessary. If any exceptions and/or deviations are proposed to any of the Specifications, they shall be clearly noted as such in the Submittal, and an explanation of any deviation and/or exception shall be provided. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected.
 4. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
 5. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
 6. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested

deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

- C. Laboratory Test Reports: Submit copies of laboratory test reports for concrete cylinders, materials and mix design tests. ENGINEER'S review will be for general information only. Production of concrete to comply with specified requirements is the responsibility of CONTRACTOR.
- D. Submit notarized certification of conformance to referenced standards when requested by ENGINEER.
- E. Delivery Tickets: Furnish to ENGINEER copies of all delivery tickets for each load of concrete delivered to the site. Provide items of information as specified in ASTM C 94, Section 16.1.
 - 1. Provide batch tickets for each batch of job-site mixed concrete, as specified.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. All materials used for concrete must be kept clean and free from all foreign matter during transportation and handling and kept separate until measured and placed in the mixer. Bins or platforms having hard clean surfaces shall be provided for storage. Suitable means shall be taken during hauling, piling and handling to ensure that segregation of the coarse and fine aggregate particles does not occur and the grading is not affected.

1.5 CONCRETE COORDINATION MEETING

- A. A Concrete Coordination Meeting shall be held to review the detailed requirements of CONTRACTOR'S proposed concrete design mixes, to determine the procedures for producing proper concrete construction, and to clarify the roles of the parties involved shall be held no later than 14 days after the Notice to Proceed.
- B. All parties involved in the concrete Work shall attend the conference, including but not limited to the following:
 - 1. CONTRACTOR'S representative.
 - 2. Testing laboratory representative.
 - 3. Concrete subcontractor.
 - 4. Reinforcing steel subcontractor and detailer.
 - 5. Concrete supplier.
 - 6. Admixture manufacturer's representative.
 - 7. ENGINEER.
- C. The Concrete Coordination Meeting shall be held at a mutually agreed upon time and place. The ENGINEER shall be notified no less than five days prior to the date of the Concrete Coordination Meeting.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All admixtures, curing compounds, etc. used in concrete or the curing and repair of concrete, which can contact potable water, shall be certified as conforming to the requirements of ANSI/NSF 61 for contact with potable water when in the finished concrete.

2.2 CEMENTITIOUS MATERIALS

A. Cement:

1. Portland cement, ASTM C 150, Type II.
2. Use Portland cement made by a well-known acceptable manufacturer and produced by not more than one plant. Alternate cement sources may be used provided that a mix design has been accepted and a trial batch verifying performance has been made.
3. Do not use cement which has deteriorated because of improper storage or handling.

B. Fly Ash Mineral Admixture:

1. Mineral admixtures, when used, shall meet the requirements of ASTM C 618 Class F, except as follows:
 - a. The loss on ignition shall be a maximum of 4 percent.
 - b. The maximum percent of sulfur trioxide (SO₃) shall be 4.0.
2. Fly ash shall be considered to be a cementitious material.
3. Laboratory trial batches shall be tested to determine compliance with strength requirements, times of setting, slump, slump loss, and shrinkage characteristics.
4. A substitution by weight, of the portland cement by fly ash, so that the total tricalcium aluminate content of the resulting cement plus fly ash is not greater than eight percent, will be considered. However, the fly ash shall not exceed 20 percent by weight of the cement plus fly ash.

C. Silica Fume Mineral Admixture:

1. Silica fume mineral admixture shall be the dry compacted or slurry form and shall meet the requirements of ASTM C 1240. Silica Fume shall be considered to be a cementitious material. Application rate shall be seven percent by weight of cement, unless indicated otherwise.
2. Product and Manufacturer: Provide one of the following:
 - a. MasterLife SF100, as manufactured by Master Builders, Inc.
 - b. Force 10,000 D, as manufactured by GCP.
 - c. Sikacrete 950 DP, as manufactured by Sika Corporation.
 - d. Eucon MSA, as manufactured by the Euclid Chemical Company.
 - e. Or equal.

2.3 AGGREGATES

A. General:

1. Aggregates shall conform to the requirements of ASTM C 33 and as herein specified.
 2. Do not use aggregates containing soluble salts or other substances such as iron sulfides, pyrite, marcasite, ochre, or other materials that can cause stains on exposed concrete surfaces.
- B. Fine Aggregate: Clean, sharp, natural sand free from loam, clay, lumps or other deleterious substances.
1. Dune sand, bank run sand and manufactured sand are not acceptable.
- C. Coarse Aggregate: Clean, uncoated, processed aggregate containing no clay, mud, loam, or foreign matter, as follows:
1. Crushed stone, processed from natural rock or stone.
 2. Washed gravel, either natural or crushed. Use of slag and pit or bank run gravel is not permitted.
 3. Lightweight Aggregate: ASTM C 330.

2.4 WATER

- A. Water used in the production and curing of concrete shall be clean and free from injurious amounts of oils, acids, alkalis, organic materials or other substances that may be deleterious to concrete or steel (ASTM C 1602).

2.5 CONCRETE ADMIXTURES

- A. Provide admixtures produced by established reputable manufacturers, and use in compliance with the manufacturer's printed instructions. All admixtures shall be compatible and by a single manufacturer capable of providing qualified field service representation. Admixtures shall not contain thiocyanates nor more than 0.05 percent chloride ion, and shall be non-toxic in the concrete mix after 30 days. Do not use admixtures that have not been incorporated and tested in the accepted mixes, unless otherwise authorized in writing by ENGINEER.
- B. Air-Entraining Admixtures: Provide air entraining admixtures complying with ASTM C 260, and that are vinsol resin or vinsol resin based.
1. Product and Manufacturer: Provide one of the following:
 - a. SIKA AER or SIKA AEA-15, as manufactured by Sika Corporation.
 - b. MB-VR, as manufactured by BASF.
 - c. Daravair 1000, as manufactured by Grace Construction Products.
 - d. Or equal.
- C. Water-Reducing Admixture: ASTM C 494, Type A.
1. Proportion all Type "1" "2" "3" and "5" concrete with non-air entraining, normal setting, water-reducing, aqueous solution of a modification of the salt of polyhydroxylated organic acids. The admixture shall not contain any lignin, nitrates or chlorides added during manufacture.

2. Product and Manufacturer: Provide one of the following:
 - a. Eucon WR-75, as manufactured by Euclid Chemical Company.
 - b. Pozzolith series, as manufactured by Master Builders, Inc.
 - c. WRDA-15, as manufactured by GCP.
 - d. Plastocrete 161 or Plastiment NS, as manufactured by Sika Corporation.
 - e. Or equal.

- D. High Range Water-Reducing Admixture (HRWR): ASTM C 494, Type F/G.
 1. High range water-reducer shall be used in classifications of concrete, where specified, and shall be permitted, at CONTRACTOR'S option, in all other classifications of concrete. It shall be added to concrete in compliance with the manufacturer's printed instructions. The specific admixture formulation shall be as recommended by the manufacturer for the project conditions. Provide one of the following:
 - a. Sikament series, as manufactured by Sika Corporation.
 - b. MasterLife series, as manufactured by Master Builders, Inc.
 - c. Daracem-100, as manufactured by GCP.
 - d. Eucon 37 or Eucon 537, as manufactured by the Euclid Chemical Company.
 - e. Or equal.

- E. Set-Control Admixtures: ASTM C 494, as follows:
 1. Type B, Retarding.
 2. Type C, Accelerating.
 3. Type D, Water-reducing and Retarding.
 4. Type E, Water-reducing and Accelerating.
 5. Type F, Water-reducing, high range admixtures.
 6. Type G, Water-reducing, high range, and retarding admixtures.

- F. Calcium Chloride: Calcium chloride shall not be used.

- G. Shrinkage Reducing Admixture:
 1. A shrinkage reducing admixture is not required unless otherwise requested by the ENGINEER or specified in the design drawings.
 2. A shrinkage reducing admixture shall be permitted to be used in the mix design only when acceptable to the ENGINEER where necessary to meet specified shrinkage limitations provided that specified strength requirements are met and there is no reduction in sulfate resistance and no increase in permeability.
 3. Shrinkage reducing admixtures shall be one of the following:
 - a. Eclipse, as manufactured by Grace Construction Products.
 - b. Tetraguard AS20, as manufactured by Master Builders, Inc.
 - c. Or equal.

- H. If super plasticizers are used in mix designs, the mix shall be slumped at jobsite prior to addition of plasticizer.

2.6 PROPORTIONING AND DESIGN OF MIXES

A. Prepare concrete design mixes subject to the following limitations:

Classification	Coarse Size A	Aggregate ¹ Size B	Minimum Cementitious (lbs/cu yd)	Maximum W/C	Slump ²	Air (%)	Min. Comp. Strength ³ (psi)
Type "1"	#57	#8	564	0.45	4"	4 1/2	4000
Type "2"	#467 or #67		517	0.50	6"	1 1/2	3000
Type "3"	#57 or #67		564	0.40	4"	4 1/2	5000
Type "4"	Any ASTM C 33		<-----no requirements----->				150
Type "5"	#57	#8	564	0.40	4"	4 1/2	6000

1. Coarse aggregate size numbers refer to ASTM C 33. Where a size A and B are listed, it is intended that the smaller size B aggregate is to be added, replacing a portion of the coarse and /or fine aggregate, in the minimum amount necessary to make a workable and pumpable mix with a sand content not exceeding 41 percent of total aggregate.
2. The slumps listed are prior to the addition of high range water reducer (super plasticizer)
3. Mix designs shall be made for all but Type "4", which does not require a trial batch, so that the compressive strength achieved for the laboratory trial batches will be no less than 125 percent of the specified design strength. This is to assure meeting the design strength for all concrete batched during the project.
4. The quantity of water to be used in the determination of the water-cementitious materials ratio shall include free water on aggregates in excess of SSD and the water portion of admixtures.
5. Allowable tolerance for air content at the point of delivery is +/- 1.5 percent.

B. Use an independent testing facility acceptable to ENGINEER for preparing and reporting proposed mix designs.

1. The testing facility shall not be the same as used for field quality control testing.

C. Submit written reports of laboratory trial batch test results for proposed mixes of concrete to ENGINEER at least 15 days prior to start of Work. Do not begin concrete production until mixes have been approved by ENGINEER.

D. Adjustment to Concrete Mixes: Mix design adjustments may be requested by CONTRACTOR when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to the OWNER and as accepted by

ENGINEER. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by ENGINEER before using the revised mixes.

E. Admixtures:

1. Use air-entraining admixture in all concrete, unless otherwise shown or specified. Add air-entraining admixture at the manufacturer's prescribed rate to result in concrete at the point of placement having air content within the prescribed limits.
2. Use amounts of admixtures as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities and types of admixtures as required to maintain quality control.

F. Slump Limits with High Range Water Reducer:

1. Slump shall not exceed 4-inches prior to adding high range water-reducer and shall not exceed 8 inches, measured at point of placement, after adding high range water reducer.

G. Shrinkage Limitation:

1. The maximum concrete shrinkage for specimens cast in the laboratory from the trial batch, as measured at 21-day drying age or at 28-day drying age shall be 0.039 percent or 0.045 percent, respectively. Only use a mix design for construction that has first met the trial batch shrinkage requirements. Shrinkage limitations apply only to Types "1" "3" & "5" concretes.
2. If the trial batch results fail to meet the shrinkage limitation, the mix shall be redesigned to reduce shrinkage. Alternately, CONTRACTOR may use a higher shrinkage mix when acceptable to the ENGINEER provided that the amount of shrinkage reinforcement in the structures is increased as determined by the ENGINEER to resist the higher levels of shrinkage stresses. The additional reinforcing shall be provided at CONTRACTOR'S expense.
3. The use of shrinkage reducing admixture to meet the shrinkage limitations shall not be used unless approved, specified in the design drawings, or requested by the ENGINEER.

H. Color: Provide colored concrete where shown on the Drawings and specified. Incorporate pigments into the concrete mix according to manufacturer's written instructions. Match sample color approved by ENGINEER.

2.7 BONDING AGENT

- A. Provide epoxy and epoxy-cement bonding agents as specified in Section 03251, Concrete Joints.

2.8 CONCRETE CURING MATERIALS

- A. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 10 ounces per square yard and complying with AASHTO M 182, Class 3.

- B. Curing Mats: Curing mats shall be heavy carpets or cotton mats, quilted at 4-inches on center. Curing mats shall weigh a minimum of 12 ounces per square yard when dry.
- C. Moisture Retaining Cover: One of the following, complying with ASTM C 171.
 - 1. Waterproof paper.
 - 2. Polyethylene film.
 - 3. White burlap-polyethylene sheet.
- D. Curing Compound: ASTM C 309 Type 1-D (water retention requirements):
 - 1. Product and Manufacturer: Provide one of the following:
 - a. Super Aqua Cure VOX, as manufactured by The Euclid Chemical Company.
 - b. 1100 Clear, as manufactured by W.R. Meadows, Incorporated.
 - c. Atlas Res-Cure, as manufactured by Atlas Tech Products.
 - d. Or equal.
 - 2. Provide fugitive dye.
 - 3. Curing compound must be applied by roller or power sprayer.

2.9 FINISHING AIDS

- A. Evaporation Retardant:
 - 1. Product and Manufacturer: Provide one of the following:
 - a. Confilm, as manufactured by BASF.
 - b. Eucobar, as manufactured by Euclid Chemical Company.
 - c. SikaFilm by Sika Corporation.
 - d. Or equal.

2.10 CONCRETE REPAIR MATERIALS

- A. Concrete repair mortar shall be a prepackaged polymer-modified cementitious repair mortar with the following minimum properties:
 - 1. Compressive strength at one day: 2000 psi (ASTM C 109).
 - 2. Compressive strength at 28 days: 7000 psi (ASTM C 109).
 - 3. Bond strength at 28 days: 1800 psi (ASTM C 882 modified).
- B. Concrete repair mortar shall be:
 - 1. Five Star Structural Concrete, manufactured by Five Star Products, Inc. The formulation recommended by the manufacturer for the specific application conditions shall be used.
 - 2. SikaTop 122 Plus, SikaTop 123 Plus, SikaTop 111 Plus, or Sikacem 133, manufactured by the Sika Corporation. The formulation, among those listed, recommended by the manufacturer for the specific application conditions shall be used.
 - 3. Emaco S88-CA or S66-CR, manufactured by Master Builders Inc. The formulation, among those listed, recommended by the manufacturer for the specific application conditions shall be used.

4. Verticoat, Verticoat Supreme, or Euco SR-VO, manufactured by the Euclid Chemical Company. The formulation, among those listed, recommended by the manufacturer for the specific application conditions shall be used.
 5. Or equal.
- C. Cement Mortar: Cement mortar shall consist of a mix of one part cement to 1 1/2 parts sand with sufficient water to form a trowelable consistency. Minimum compressive strength at 28 days shall be 4000 psi. Where required to match the color of adjacent concrete surfaces, white portland cement shall be blended with standard portland cement so that, when dry, the patching mortar shall match the color of the surrounding concrete.

2.11 CRACK INJECTION MATERIALS

- A. Epoxy:
1. Epoxy for injection shall be a low viscosity, high modulus moisture insensitive type.
 2. Products and Manufacturers: Provide one of the following:
 - a. Sikadur 35, Hi-Mod L.V. and Sikadur 31, Hi-Mod Gel, as manufactured by Sika Corporation.
 - b. Eucopoly Injection Resin, as manufactured by The Euclid Chemical Company.
 - c. Or equal.
- B. Hydrophilic Resin
1. Hydrophilic resin shall be an acrylic-ester based resin with a maximum viscosity of 50 cps. It shall cure into a flexible rubber-like material that has the potential for unrestrained increase in volume in excess of 100 percent in the presence of water.
 2. Products and Manufacturers: Provide one of the following:
 - a. Duroseal Inject, as manufactured by BBZ USA, Inc.
 - b. Sika Injection 29, by Sika Corporation.
 - c. Or equal.

2.12 CONCRETE REPAIR MATERIALS

- A. Concrete repair mortar shall be a prepackaged polymer-modified cementitious repair mortar with the following minimum properties:
1. Compressive strength at one day: 2000 psi (ASTM C 109).
 2. Compressive strength at 28 days: 6000 psi (ASTM C 109).
 3. Bond strength at 28 days: 1800 psi (ASTM C 882 modified).
- B. Concrete repair mortar shall be:
1. Five Star Structural Concrete, manufactured by Five Star Products, Inc. The formulation recommended by the manufacturer for the specific application conditions shall be used.
 2. SikaTop 122 Plus, SikaTop 123 Plus, SikaTop 111 Plus, or Sikacem 133, manufactured by the Sika Corporation. The formulation, among those listed,

recommended by the manufacturer for the specific application conditions shall be used.

3. Emaco S88-CA or S66-CR, manufactured by Master Builders Inc. The formulation, among those listed, recommended by the manufacturer for the specific application conditions shall be used.
 4. Verticoat, Verticoat Supreme, or Euco SR-VO, manufactured by the Euclid Chemical Company. The formulation, among those listed, recommended by the manufacturer for the specific application conditions shall be used.
 5. Or equal.
- C. Cement Mortar: Cement mortar shall consist of a mix of one part cement to 1 1/2 parts sand with sufficient water to form a trowelable consistency. Minimum compressive strength at 28 days shall be 4000 psi. Where required to match the color of adjacent concrete surfaces, white portland cement shall be blended with standard portland cement so that, when dry, the patching mortar shall match the color of the surrounding concrete.

2.13 CHEMICAL HARDENER

- A. Provide a clear chemical hardener of the fluosilicate family.
- B. Product and Manufacturer: Provide one of the following:
 1. Lapidolith, as manufactured by Sonneborn ChemRex Inc.
 2. Hornolith, as manufactured by Tamms Industries, Inc.
 3. Or equal.

2.14 SHAKE-ON METALLIC HARDENER

- A. Provide a metallic hardener formulated, processed and packaged under stringent quality control at the manufacturer's owned and controlled factory. The hardener shall be a mixture of specially processed and graded aggregate, selected portland cement and plasticizing agents.
- B. Product and Manufacturer: Provide one of the following:
 1. Euco-Plate H.D., as manufactured by the Euclid Chemical Company.
 2. Masterplate 200, as manufactured by Master Builders, Inc.
 3. Or equal.

2.15 MOISTURE BARRIER

- A. Moisture Barrier: ASTM E 154:
 1. Provide moisture barrier cover over prepared base material where shown on the Drawings. Use polyethylene membrane not less than 8 mils thick, lapping at least 9-inches at joints.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the substrate and the conditions under which Work is to be performed and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 CONCRETE MIXING

A. General:

1. Concrete may be produced at batch plants or it may be produced by the ready-mixed process. Batch plants shall comply with the recommendations of ACI 304, and shall have sufficient capacity to produce concrete of the qualities specified, in quantities required to meet the construction schedule. All plant facilities are subject to testing laboratory inspection and acceptance of ENGINEER.

B. Ready-Mix Concrete:

1. Comply with the requirements of ASTM C 94, and as herein specified. Proposed changes in mixing procedures, other than herein specified, must be accepted by ENGINEER before implementation.
- a. Plant equipment and facilities: Conform to National Ready-Mix Concrete Association "Plant and Delivery Equipment Specification".
 - b. Mix concrete in revolving type truck mixers that are in good condition and which produce thoroughly mixed concrete of the specified consistency and strength.
 - c. Do not exceed the proper capacity of the mixer.
 - d. Mix concrete for a minimum of two minutes after arrival at the job site, or as recommended by the mixer manufacturer.
 - e. Do not allow the drum to mix while in transit.
 - f. Mix at proper speed until concrete is discharged.
 - g. Maintain adequate facilities at the job site for continuous delivery of concrete at the required rates.
 - h. Provide access to the mixing plant for ENGINEER at all times.
2. When silica fume is used in the dry compacted form, the following mix requirements shall be followed to ensure full dispersion.
- a. For all types of mixing equipment, mix times shall be increased by 40 percent over the minimum mix time required to achieve mix uniformity as defined by ASTM C 94.
 - b. For truck-mixed and central mixed concrete, maximum allowable batch size shall be 80 percent of the maximum in accordance with ASTM C 94.

- C. Maintain equipment in proper operating condition, with drums cleaned before charging each batch. Schedule rates of delivery in order to prevent delay of placing the concrete

after mixing, or holding dry-mixed materials too long in the mixer before the addition of water and admixtures.

3.3 TRANSPORTING CONCRETE

- A. Transport and place concrete not more than 90 minutes after water has been added to the dry ingredients.
- B. Take care to avoid spilling and separation of the mixture during transportation.
- C. Do not place concrete in which the ingredients have been separated.
- D. Do not retemper partially set concrete.
- E. Use suitable and approved equipment for transporting concrete from mixer to forms.

3.4 PREPARATION FOR CONCRETING

- A. All reinforcement, installation of waterstop and positioning of embedded items shall be inspected and approved by the ENGINEER a minimum of four hours prior to concrete placement.
- B. Subgrade surfaces shall be thoroughly wetted by sprinkling, prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.
- C. All reinforcing steel and embedded items shall be completely cleaned of mortar, loose rust, form release compounds, dirt, or any other substance which would interfere with proper bonding with concrete. Protective coatings on embedded aluminum items shall continuously cover the surface to be in contact with concrete. Any defects in the coating shall be repaired.
- D. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. No concrete shall be deposited underwater nor shall CONTRACTOR allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, will be subject to the review of the ENGINEER.
- E. Joint surfaces shall be prepared as required by Section 03251, Concrete Joints.

3.5 CONCRETE PLACEMENT

- A. General: Place concrete continuously so that no concrete will be placed on concrete that has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as specified in Section 03251, Concrete Joints. Deposit concrete as nearly as practical in its final location to avoid segregation due to rehandling or flowing. Do not subject concrete to any procedure which will cause segregation.
1. Screed concrete that is to receive other construction to the proper level to avoid excessive skimming or grouting.
 2. Do not use concrete which becomes non-plastic and unworkable, or does not meet the required quality control limits, or which has been contaminated by foreign materials. Do not use retempered concrete. Remove rejected concrete from the job site and dispose of it in an acceptable location.
 3. Do not place concrete until all forms, bracing, reinforcement, and embedded items are in final and secure position.
 4. Unless otherwise approved, place concrete only when ENGINEER is present.
 5. Allow a minimum of three days before placing concrete against a slab or wall already in place.
- B. Bonding for Next Concrete Pour:
1. Prepare for bonding of fresh concrete to new concrete that has set but is not fully cured, as follows:
 - a. Thoroughly wet the surface, but allow no free standing water.
 - b. For horizontal surfaces place a 2-inch layer of mortar, one part sand and one part cement with water added to a flowable consistency, or a 6-inch layer of Construction Joint Grout, as specified in Section 03600, Grout, over the hardened concrete surface.
 - c. Place fresh concrete before the mortar/grout has attained its initial set.
 - d. If a high range water reducer is used to increase the concrete slump to at least 6-inches, the mortar/grout layer may be omitted.
 2. Bonding of fresh concrete to fully-cured hardened existing concrete shall be accomplished by using a bonding agent as specified in Section 03251, Concrete Joints.
- C. Concrete Conveying:
1. Handle concrete from the point of delivery and transfer to the concrete conveying equipment and to the locations of final deposit as rapidly as practical by methods that will prevent segregation and loss of concrete mix materials.
 2. Provide mechanical equipment for conveying concrete to ensure a continuous flow of concrete at the delivery end. Provide runways for wheeled concrete conveying equipment from the concrete delivery point to the locations of final deposit. Keep interior surfaces of conveying equipment, including chutes, free of hardened concrete, debris, water, ice and other deleterious materials.

3. Do not use chutes for distributing concrete, unless approved in writing by ENGINEER.
 - a. Provide sketches showing methods by which chutes will be employed when requesting such approval.
 - b. Design chutes, if permitted, with proper slopes and supports to permit efficient handling of the concrete.
 4. Pumping concrete is permitted, however do not use aluminum pipe for conveying.
- D. Placing Concrete into Forms:
1. Deposit concrete in forms in horizontal layers not deeper than 18-inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place concrete at such a rate that concrete that is being integrated with fresh concrete is still plastic.
 2. Do not permit concrete to free fall within the form from a distance exceeding four feet. Where high range water reducer is used to extend slump to at least 6- inches, the maximum free fall of concrete may be increased to six feet. If a 12-inch thick layer of construction joint grout, as specified in Section 03251, Concrete Joints, is placed on the horizontal joint, concrete with slump extended by a high range water reducer may free fall up to eight feet in walls that are 24-inches and thicker. Use "elephant trunks" to prevent free fall and excessive splashing on forms and reinforcement. Free falls in excess of four feet shall be discontinued if there is any evidence of segregation.
 3. Remove temporary spreaders in forms when concrete placing has reached the elevation of such spreaders.
 4. Consolidate concrete placed in forms by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with the applicable recommended practices of ACI 309. Vibration of forms and reinforcing will not be permitted, unless otherwise accepted by ENGINEER.
 5. Where height of concrete placement in walls exceeds 14 feet, temporary windows shall be installed in the formwork to facilitate vibration. The windows shall be properly closed when the height of concrete approaches the windows. Location, size, and spacing of the windows shall be determined by CONTRACTOR to suit equipment used.
 6. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the layer of concrete and at least 6-inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.
 7. Do not place concrete in beam and slab forms until the concrete previously placed in columns and walls is no longer plastic.

8. Force concrete under pipes, sleeves, openings and inserts from one side until visible from the other side to prevent voids.
- E. Placing Concrete Slabs:
1. Deposit and consolidate concrete slabs in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.
 2. Consolidate concrete during placing operations using mechanical vibrating equipment, so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 3. Consolidate concrete placed in beams and girders of supported slabs, and against bulkheads of slabs on ground, as specified for formed concrete structures.
 4. Bring slab surfaces to the correct level. Smooth the surface, leaving it free of humps or hollows. Do not sprinkle water on the plastic surface. Do not disturb the slab surfaces prior to beginning finishing operations.
 5. Where slabs are placed in conditions of high temperature or wind that could lead to formation of plastic shrinkage cracks, an evaporation retardant shall be applied in accordance with the manufacturer's recommendations, when required by the ENGINEER.
- F. Quality of Concrete Work:
1. Make all concrete solid, compact and smooth, and free of laitance, cracks and cold joints.
 2. All concrete for liquid retaining structures, and all concrete in contact with earth, water, or exposed directly to the elements shall be watertight.
 3. Cut out and properly replace to the extent directed by ENGINEER, or repair to the satisfaction of ENGINEER, surfaces which contain cracks or voids, are unduly rough, or are in any way defective. Thin patches or plastering shall not be acceptable.
 4. All leaks through concrete that exhibit any flowing water, and cracks, holes or other defective concrete in areas of potential leakage, shall be repaired and made watertight by CONTRACTOR.
 5. Repair, removal, and replacement of defective concrete as directed by ENGINEER shall be at no additional cost to the OWNER.
- G. Cold Weather Placing:
1. Protect all concrete Work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures, in compliance with the requirements of ACI 306 and as herein specified.
 2. When the air temperature has fallen to or may be expected to fall below 40°F, provide adequate means to maintain the temperature, in the area where concrete is being placed, at between 50°F and 70°F for at least seven days after placing. Provide temporary housings or coverings including tarpaulins or plastic film. Maintain the heat and protection, if necessary, to ensure that the ambient temperature does not fall more than 30°F in the 24 hours following the seven-day period. Avoid rapid

dry-out of concrete due to overheating, and avoid thermal shock due to sudden cooling or heating.

3. When air temperature has fallen to or is expected to fall below 40°F, uniformly heat all water and aggregates before mixing as required to obtain a concrete mixture temperature of not less than 55°F and not more than 85°F at point of placement.
4. Do not use salt and other materials containing antifreeze agents or chemical accelerators, or set-control admixtures, unless approved by ENGINEER, in mix designs.

H. Hot Weather Placing:

1. When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI 305 and as herein specified.
2. When ambient air temperature is at or above 90°F, cool ingredients before mixing to maintain concrete temperature at time of placement below 80°F when the air temperature is rising and below 85°F when the air temperature is falling. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated in the total amount of mixing water. In addition, the reduction in time from addition of mix water to placement or the use of a set retarding admixture may be required.
3. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.
4. Wet forms thoroughly before placing concrete.
5. Do not place concrete at a temperature so as to cause difficulty from loss of slump, flash set, or cold joints.
6. Do not use set-control admixtures, unless approved by ENGINEER in mix designs.
7. Obtain ENGINEER'S approval of other methods and materials proposed for use.

3.6 FINISH OF FORMED SURFACES

A. Standard Form Finish:

1. Standard form finish shall be basically smooth and even but shall be permitted to have texture imparted by the form material used. Defects shall be repaired as specified herein.
2. Use standard form finish for the following:
 - a. Exterior vertical surfaces from the foundation up to one foot below grade.
 - b. Vertical surfaces not exposed to view.
 - c. Other areas shown.

B. Smooth Form Finish:

1. Produce smooth form finish by selecting form materials that will impart a smooth, hard, uniform texture. Arrange panels in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas as specified herein.
2. Use smooth form finish for the following:

- a. Exterior surfaces that are exposed to view.
 - b. Surfaces that are to be covered with a coating material. The material may be applied directly to the concrete or may be a covering bonded to the concrete such as waterproofing, damp proofing, painting or other similar system.
 - c. Interior vertical surfaces of liquid containers.
 - d. Interior and exterior exposed beams and undersides of slabs.
 - e. Surfaces to receive an abrasive blasted finish.
 - f. Surfaces to receive a smooth rubbed or grout cleaned finish.
 - g. Other areas shown.
- C. Smooth Rubbed Finish:
1. Provide smooth, Class A, rubbed finish to concrete surfaces, which have received smooth form finish and where all defects have been repaired, as follows:
 - a. Rubbing of concrete surfaces not later than the day after form removal.
 - b. Moistening of concrete surfaces and rubbing with carborundum brick or other abrasive until a uniform color and texture is produced. Do not apply cement grout other than that created by the rubbing process.
 2. Except where surfaces have been previously covered as specified above, use smooth, Class A, rubbed finish for the following:
 - a. Interior exposed walls and other vertical surfaces.
 - b. Exterior exposed walls and other vertical surfaces down to one foot below grade.
 - c. Interior and exterior horizontal surfaces, except exterior exposed slabs and steps.
 - d. Interior exposed vertical surfaces of liquid containers down to one foot below liquid level.
 - e. Other areas shown on the Drawings.
- D. Grout Cleaned Finish:
1. Provide grout cleaned finish to concrete surfaces, which have received smooth form finish and where all defects have been repaired, as follows:
 - a. Combine one part portland cement to 1-1/2 parts fine sand by volume, and mix with water to the consistency of thick paint. Blend standard portland cement and white portland cement, amounts determined by trial patches, so that the final color of dry grout will closely match adjacent concrete surfaces.
 - b. Thoroughly wet the concrete surface and apply grout uniformly by brushing or spraying immediately to the wetted surfaces. Scrub surface with cork float or stone to coat surface and fill surface holes. Remove excess grout by scraping, followed by rubbing with clean burlap to remove any visible grout film. Keep grout damp during the setting period by means of fog spray at least 36 hours after final rubbing. Complete any area in the same day it is started, with the limits of any area being natural breaks in the finished surface.
 2. Except where surfaces have been previously covered as specified above, use grout cleaned finish for the following:
 - a. Interior exposed walls and other vertical surfaces.

- b. Exterior exposed walls and other vertical surfaces down to one foot below grade.
- c. Interior and exterior horizontal surfaces, except exterior exposed slabs and steps.
- d. Interior exposed vertical surfaces of liquid containers down to one foot below liquid level.
- e. Other areas shown on the Drawings.

E. Abrasive Blasted Finish:

1. Provide abrasive blasted finish where shown.
2. Where abrasive blasted finish is indicated, it shall be applied to a smooth formed finish after the end of the curing period, with all defects repaired, to match the approved finish provided on the mock-up panel.
3. Heavy Abrasive Blasted Finish: Abrasive blast to uniformly expose coarse aggregate.
4. Light Abrasive Blasted Finish: Abrasive blast to uniformly expose fine aggregate.

F. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces occurring adjacent to formed surfaces, strike off smooth and finish with a texture matching the adjacent formed surfaces. Continue the final surface treatment of formed surfaces uniformly across the adjacent unformed surfaces, unless otherwise shown.

3.7 SLAB FINISHES

A. Float Finish:

1. After placing concrete slabs, do not work the surface further until ready for floating. Begin floating when the surface water has disappeared or when the concrete has stiffened sufficiently. Check and level the surface plane to a tolerance not exceeding 1/4-inch in ten feet when tested with a ten foot straightedge placed on the surface at not less than two different angles. Cut down high spots and fill all low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat the surface to a uniform, smooth, granular texture.
2. Use float finish for the following:
 - a. Interior exposed horizontal surfaces of liquid containers, except those to receive grout topping.
 - b. Exterior below grade horizontal surfaces.
 - c. Surfaces to receive additional finishes, except as shown or specified.

B. Trowel Finish:

1. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when the surface produces a ringing sound as the trowel is moved over the surface.
2. Consolidate the concrete surface by the final hand troweling operation. Finish shall be free of trowel marks, uniform in texture and appearance, and with a surface plane

tolerance not exceeding 1/8-inch in ten feet when tested with a ten foot straight edge. Grind smooth surface defects that would telegraph through applied floor covering system.

3. Use trowel finish for the following:
 - a. Interior exposed slabs, unless otherwise shown or specified.
 - b. Slabs to receive resilient floor finishes.

- C. Non-Slip Broom Finish:
 1. Immediately after float finishing, slightly roughen the concrete surface by brooming in the direction perpendicular to the main traffic route. Use fine fiber-bristle broom, unless otherwise directed by the ENGINEER. Coordinate the required final finish with ENGINEER before application.
 2. Use Non-Slip Broom Finish for the following:
 - a. Exterior exposed horizontal surfaces subject to light foot traffic.
 - b. Interior and exterior concrete steps and ramps.
 - c. Horizontal surfaces which will receive a grout topping or a concrete equipment base slab.

3.8 CONCRETE CURING AND PROTECTION

A. General:

1. Protect freshly placed concrete from premature drying and excessive cold or hot temperature, and maintain without drying at a relatively constant temperature for the period of time necessary for hydration of the cement and proper hardening of the concrete.
2. Start initial curing after placing and finishing concrete as soon as free moisture has disappeared from the concrete surface. Keep continuously moist for not less than 72 hours.
3. Begin final curing procedures immediately following initial curing and before the concrete has dried. Continue final curing for at least seven days and in accordance with ACI 301 procedures for a total curing period, initial plus final, of at least ten days. For concrete sections over 30-inches thick, continue final curing for an additional seven days, minimum. Avoid rapid drying at the end of the final curing period.

B. Curing Methods:

1. Water retaining and below grade structures shall be moist cured by the addition of water to maintain the surface in a continually wet condition. Other concrete shall be cured by moist curing, by moisture retaining cover curing, or by the use of curing compound. Use curing compound at water retaining and below grade structures only in cold weather and only when permitted by ENGINEER.
 - a. For curing, use water that is free of impurities that could etch or discolor exposed, natural concrete surfaces.
2. Provide moisture curing by any of the following methods:
 - a. Keeping the surface of the concrete continuously wet by covering with water.

- b. Continuous water-fog spray.
 - c. Covering the concrete surface with curing mats, thoroughly saturating the mats with water, and keeping the mats continuously wet with sprinklers or porous hoses. Place curing mats so as to provide coverage of the concrete surfaces and edges, with a 4-inch lap over adjacent mats. If necessary, the curing cover shall be weighted to maintain contact with the concrete surface.
 - d. At the end of the curing period apply one coat of curing compound, unless concrete surface is to receive a topping or coating or application is waived by the ENGINEER.
 3. Provide moisture retaining cover curing as follows:
 - a. Cover the concrete surfaces with the specified moisture retaining cover for curing concrete, placed in the widest practical width with sides and ends lapped at least 3-inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during the curing period using cover material and waterproof tape.
 4. Provide liquid curing compound as follows:
 - a. Apply the specified curing compound to all concrete surfaces when permitted by ENGINEER. Slabs to receive terrazzo floors, chemical resistant heavy duty concrete topping or ceramic tile, shall not be cured with liquid curing compound, but shall be moisture cured. The compounds shall be applied immediately after final finishing in a continuous operation by power spray equipment in accordance with the manufacturer's directions. Recoat areas that are subjected to heavy rainfall within three hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire curing period. For concrete surfaces that will be in contact with potable water, the manufacturer shall certify that the curing compound meets the requirements of ANSI/NSF 61.
 - b. When curing compound is authorized for application to water retaining or below grade members, it shall be applied at the manufacturer's recommended coverage rate and then applied again at the same rate to provide twice the recommended coverage.
 - c. At the end of the curing period, curing compound shall be removed where required by the ENGINEER.
- C. Curing Formed Surfaces:
 1. Cure formed concrete surfaces; including the undersides of girders, beams, supported slabs and other similar surfaces by moist curing with the forms in place unloosened for the full curing period or until forms are removed. Where wood forms are kept in place, water shall be added to keep the forms wet. If forms are removed, continue curing by methods specified above, as applicable.
- D. Curing Unformed Surfaces:
 1. Initially cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by using the appropriate method specified above.

2. Final cure unformed surfaces, unless otherwise specified, by utilizing methods specified above, as applicable.
- E. Temperature of Concrete During Curing:
1. When the atmospheric temperature is 40°F and below, maintain the concrete temperature between 50°F and 70°F continuously throughout the curing period. When necessary, make arrangement before concrete placing for heating, covering, insulation or housing as required to maintain the specified temperature and moisture conditions continuously for the concrete curing period. Provide cold weather protection complying with the requirements of ACI 306.
 2. When the atmospheric temperature is 80°F and above, or during other climatic conditions which will cause too rapid drying of the concrete, make arrangements before the start of concrete placing for the installation of wind breaks or shading, and for fog spraying, wet sprinkling, or moisture retaining covering. Protect the concrete continuously for the concrete curing period. Provide hot weather protection complying with the requirements of ACI 305, unless otherwise specified.
 3. Maintain concrete temperature as uniformly as possible, and protect from rapid atmospheric temperature changes. Avoid temperature changes in concrete which exceed 5°F in any one hour and 50°F in any 24 hour period.
- F. Protection from Mechanical Injury:
1. During the curing period, protect concrete from damaging mechanical disturbances including load stresses, heavy shock, excessive vibration, and from damage caused by rain or flowing water. Protect all finished concrete surfaces from damage by subsequent construction operations.

3.9 FIELD QUALITY CONTROL

- A. The OWNER shall employ a testing laboratory to perform field quality control testing. ENGINEER will direct the number of tests and cylinders required. Make standard compression test cylinders and entrained air tests as specified below, under the direct inspection by ENGINEER. Also, provide all labor, material and equipment required including, scale, glass tray, cones, rods, molds, air tester, thermometer, curing in a heated storage box, and all other incidentals required. Above will be subject to approval by ENGINEER. Furnish all necessary storage and curing, as specified in Section 01450, On-Site Facilities for Testing Laboratory, and transportation required by the testing.
- B. Quality Control Testing During Construction:
1. Perform sampling and testing for field quality control during the placement of concrete, as follows:
 - a. Sampling Fresh Concrete: ASTM C 172.
 - b. Slump: ASTM C 143; one test for each concrete load at point of discharge; and one for each set of compressive strength test specimens.
 - c. Air Content: ASTM C 231; one for every other concrete load at point of discharge, or when required by an indication of change.

- d. Compressive Strength Tests: ASTM C 39; one set of compression cylinders for each 50 cubic yards or fraction thereof, of each mix design placed in any one day; one specimen tested at seven days, and three specimens tested at 28 days.
 - 1) Adjust mix if test results are unsatisfactory and resubmit for ENGINEER'S approval.
 - 2) Concrete that does not meet the strength requirements is subject to rejection and removal from the Work, or to other such corrective measures as directed by ENGINEER, at the expense of CONTRACTOR.
 - e. Compression Test Specimens: ASTM C 31; make one set of four standard cylinders for each compressive strength test, unless otherwise directed.
 - 1) Cast, store and cure specimens as specified in ASTM C 31.
 - f. Water Cementitious Materials Ratio: Perform one test from each sample from which compression test specimens are taken in accordance with AASHTO TP 23.
 - g. Concrete Temperature: Test hourly when air temperature is 40°F and below, and when 80°F and above; and each time a set of compression test specimens is made.
2. The testing laboratory shall submit certified copies of test results directly to ENGINEER and CONTRACTOR within 24 hours after tests are made.
- C. Evaluation of Quality Control Tests:
1. Do not use concrete delivered to the final point of placement, which has slump or total air content outside the specified values.
 2. When water content testing indicates water-cementitious materials ratio to exceed specified requirements by more than 0.02, remaining batches needed to complete the concrete placement shall have water content decreased in the mix and water reducing admixture dosage increased as needed to bring the subsequently batched concrete within the specified water-cementitious materials ratio. Additional testing shall be done to verify compliance with the specified water-cementitious materials ratio. Concrete production for further concrete placements shall not resume until CONTRACTOR has identified the cause of the excess water in the mix and revised batching procedures and/or adjustments to mix design needed to bring water-cementitious materials ratio into conformance with specified requirements have been accepted by ENGINEER.
 3. Compressive strength tests for laboratory-cured cylinders will be considered satisfactory if the averages of all sets of three consecutive compressive strength tests results equal or exceed the 28 day design compressive strength of the type or class of concrete; and, no individual strength test falls below the required compressive strength by more than 500 psi.
 - a. Where questionable field conditions may exist during placing concrete or immediately thereafter, strength tests of specimens cured under field conditions will be required by ENGINEER to check the adequacy of curing and protecting of the concrete placed. Specimens shall be molded at the same time and from the same samples as the laboratory cured specimens.

- 1) Provide improved means and procedures for protecting concrete when the 28 day compressive strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders.
 - 2) When laboratory-cured cylinder strengths are appreciably higher than the minimum required compressive strength, field-cured cylinder strengths need not exceed the minimum required compressive strength by more than 500 psi even though the 85 percent criterion is not met.
 - 3) If individual tests of laboratory-cured specimens produce strengths more than 500 psi below the required minimum compressive strength, or if tests of field-cured cylinders indicate deficiencies in protection and curing, provide additional measures to assure that the load-bearing capacity of the structure is not jeopardized. If the likelihood of low-strength concrete is confirmed and computations indicate the load-bearing capacity may have been significantly reduced, tests of cores drilled from the area in question will be required at CONTRACTOR'S expense.
- b. If the compressive strength tests fail to meet the minimum requirements specified, the concrete represented by such tests will be considered deficient in strength and subject to replacement, reconstruction or to other action approved by ENGINEER.

D. Testing Concrete Structure for Strength:

1. When there is evidence that the strength of the in-place concrete does not meet specification requirements, employ at CONTRACTOR'S expense the services of a concrete testing service to take cores drilled from hardened concrete for compressive strength determination. Tests shall comply with the requirements of ASTM C 42 and the following:
 - a. Take at least three representative cores from each member or suspect area at locations directed by ENGINEER.
 - b. Strength of concrete for each series of cores will be considered satisfactory if their average compressive strength is at least 85 percent and no single core is less than 75 percent of the 28 day required compressive strength.
 - c. Report test results to ENGINEER, in writing, on the same day that tests are made. Include in test reports, the Project identification name and number, date, name of CONTRACTOR, name of concrete testing service, location of test core in the structure, type or class of concrete represented by core sample, nominal maximum size aggregate, design compressive strength, compression breaking strength and type of break (corrected for length-diameter ratio), direction of applied load to core with respect to horizontal plane of the concrete as placed, and the moisture condition of the core at time of testing.
2. Fill core holes solid with non-shrink, high strength grout, and finish to match adjacent concrete surfaces.
3. Conduct static load test and evaluations complying with the requirements of ACI 318 if the results of the core tests are unsatisfactory, or if core tests are impractical to obtain, as directed by ENGINEER.

3.10 MISCELLANEOUS CONCRETE ITEMS

A. Temporary Openings

1. Openings in concrete walls and/or slabs required for passage of Work or installation of equipment and not shown on the Drawings shall be provided, but only with approval of the ENGINEER.
2. All temporary openings made in concrete shall be provided with waterstop in below grade or water retaining members. Continuity of required reinforcement shall be provided in a manner acceptable to the ENGINEER.
3. Temporary openings left in concrete structures shall be filled with concrete after the Work causing the need for the opening is in place, unless otherwise shown or directed. Mix, place and cure concrete as specified herein, to blend with in-place construction. Provide all other miscellaneous concrete filling shown or required to complete the Work.

B. Equipment Bases:

1. Unless specifically shown otherwise, provide concrete bases for all pumps and other equipment. Coordinate and construct bases to the dimensions shown, or as required to meet manufacturers' requirements and Drawing elevations. Where no specific elevations are shown, bases shall be 6-inches thick and extend 3-inches outside the metal equipment base or supports. Bases shall have smooth trowel finish, unless a special finish such as terrazzo, ceramic tile or heavy duty concrete topping is required. In those cases, provide appropriate concrete finish.
2. Include all concrete equipment base work not specifically included under other Sections.
3. In general, place bases up to 1-inch below the metal base. Properly shim equipment to grade and fill 1-inch void with non-shrink grout as specified in Section 03600, Grout.

C. Curbs:

1. Provide monolithic finish to interior curbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
2. Exterior curbs shall have rubbed finish for vertical surfaces and a broomed finish for top surfaces.

3.11 CONCRETE REPAIRS

A. Repair of Formed Surfaces:

1. The following defects shall be repaired in all types of formed finishes:
 - a. Spalls, air bubbles, rock pockets, form depressions, and other defects that are more than 1/4-inch in depth.
 - b. Holes from tie rods and other form tie systems.
 - c. Fins, offsets and other projections that extend more than 1/4-inch beyond the designated member surface.

- d. Structural cracks, as defined by the ENGINEER.
 - e. Non-structural cracks, as defined by the ENGINEER, which are greater than 0.010-inch wide. In water retaining members, elevated slabs subject to rainfall and washdown, and below grade members, any crack that shows any amount of leakage. Where it is not possible to verify that a crack is not leaking, it shall be repaired.
2. The following defects shall be repaired in smooth finish surfaces, in addition to those listed above:
 - a. Spalls, air bubbles, rock pockets, form depressions, and other defects which extend to more than 1/2-inch in width in any direction, no matter how deep.
 - b. Spalls, air bubbles, rock pockets, form depressions, and other defects of any size that exceed three in number in a 12-inch square or 12 in number in a three foot square.
 - c. Fins, offsets and other projections shall be completely removed and smoothed.
 - d. Scratches and gouges in the surface.
 - e. Texture and color irregularities. At water retaining surfaces, texture and color irregularities need not be repaired when greater than 12-inches below the minimum normal operating water surface, except where such defects are indicative of reduced durability.
 3. Where a smooth rubbed or grout cleaned finish is specified, minor surface defects repairable by the finishing process need not be repaired prior to the finish application, when approved by the ENGINEER.
- B. Method of Repair of Formed Surfaces:
1. Repair and patch defective areas with cement mortar or concrete repair mortar immediately after removal of forms and as directed by ENGINEER. Repairs made to water bearing and buried surfaces shall be made with repair mortar only. Repairs of form tie holes on water bearing or buried surfaces shall be made with non-shrink grout as specified in Section 03600, Grout.
 2. Cut out honeycomb, rock pockets, voids, and holes left by tie rods and bolts, down to solid concrete but, in no case, to a depth of less than 1-inch for cement mortar and 1/2-inch for repair mortar. Make edges of cuts perpendicular to the concrete surface. Before placing the cement mortar, thoroughly clean and brush-coat the area to be patched with the specified bonding agent. Where concrete repair mortar is used, bonding agent shall be optional and the surface prepared and mortar placed per manufacturers recommendations.
 - a. Repairs at exposed-to-view surfaces shall match the color of surrounding concrete, except color matching is not required for the interior surfaces of liquid containers up to one foot below liquid level. Impart texture to repaired surfaces to match texture of existing adjacent surfaces. Provide test areas at inconspicuous locations to verify mixture, texture and color match before proceeding with the patching. Compact mortar in place and strike off slightly higher than the surrounding surface.

3. Structural cracks shall be pressure grouted using an injectable epoxy using a pumped pressure system. Apply in accordance with the manufacturer's directions and recommendations.
 4. Non-structural cracks shall be pressure grouted using hydrophilic resin. Apply in accordance with the manufacturer's directions and recommendations.
 5. Determination of the crack type shall be made by the ENGINEER.
 6. Fill holes extending through concrete by means of a plunger- type gun or other suitable device from the least exposed face, using a flush stop held at the exposed face to ensure completely filling. At below grade and water retaining members, fill holes with concrete repair mortar except use a color matched cement mortar for the outer 2-inches at exposed to view surfaces.
 7. Where power washing and/or scrubbing is not adequate, abrasive blast exposed-to-view surfaces that require removal of stains, grout accumulations, sealing compounds, and other substances marring the surfaces. Use sand finer than No. 30 and air pressure from 15 to 25 psi.
- C. Repair of Unformed Surfaces:
1. Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to the tolerances specified for each surface and finish. Correct low and high areas as herein specified.
 2. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having the required slope. Correct high and low areas as herein specified.
 3. Repair finish of unformed surfaces that contain defects that adversely affect the durability of the concrete. Surface defects include crazing, cracks in excess of 0.01-inch wide, spalling, popouts, honeycomb, rock pockets, and other objectionable conditions.
 4. Repair structural cracks in all structures and non-structural cracks in water-holding structures. In water-holding structures, where the dry face of the concrete member can be observed, cracks that show any rate of water flow shall be repaired. Where the dry face of the member cannot be observed, all cracks shall be repaired.
- D. Methods of Repair of Unformed Surfaces:
1. Correct high areas in unformed surfaces by grinding, after the concrete has cured sufficiently so that repairs can be made without damage to adjacent areas.
 2. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out the low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Where the concrete has already set and repairs are required, sawcut around the perimeter of the area to be repaired to a 1/2-inch depth and remove concrete so that the minimum thickness of the repair is 1/2-inch. Apply specified concrete repair mortar in accordance with the manufacturer's directions and recommendations.
 3. Repair defective areas, except random cracks and single holes not exceeding 1-inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete with clean, square cuts, and expose reinforcing steel with at least

3/4-inch clearance all around. The minimum thickness of the repair shall be 1.5-inches. Dampen all concrete surfaces in contact with patching concrete and brush with the specified bonding agent. Place patching concrete while the bonding agent is still tacky. Mix patching concrete of the same materials and proportions to provide concrete of the same classification as the original adjacent concrete. Place, compact and finish as required to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

4. Repair isolated random non-structural cracks (in members which are not below grade or water retaining), and single holes not over 1-inch diameter, by the dry-pack method. Groove the top of cracks and cut out holes to sound concrete and clean of dust, dirt and loose particles. Dampen all cleaned concrete surfaces and brush with the specified bonding agent. Place dry-pack before the cement grout takes its initial set. Mix dry-pack, consisting of 1 part portland cement to 2-1/2 parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.
 5. Structural cracks shall be pressure grouted using an injectable epoxy. Apply in accordance with the manufacturer's directions and recommendations.
 6. Non-structural cracks in below grade and water retaining structures shall be pressure grouted using hydrophilic resin. Apply in accordance with the manufacturer's directions and recommendations.
 7. Determination of the crack type shall be made by the ENGINEER.
 8. Assure that surface is acceptable for flooring material to be installed in accordance with manufacturer's recommendations.
- E. Other Methods of Repair:
1. Repair methods not specified above may be used if approved by ENGINEER.
 2. For concrete repair and rehabilitation to existing structures see Specification Section 03930.

++ END OF SECTION ++

SECTION 03600

GROUT

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. Provide all labor, materials, equipment, and incidentals as shown, specified and required to furnish and install grout.
 2. Section includes:
 - a. Requirements for the grouts, except masonry grouts, referenced on the Contract Drawings and in other Specification Sections.
- B. Types of grouts and their applications. Unless indicated otherwise, provide grouts as listed in this Section whether called for on the Drawings or not.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
1. ACI 211.1, Practice for Selecting Proportions for Normal, Heavy-Weight and Mass Concrete.
 2. ACI 301, Specification for Structural Concrete (Includes ASTM Standards referred to herein).
 3. ASTM C 33, Specification for Concrete Aggregates.
 4. ASTM C 109, Test Method for Compressive Strength of Hydraulic Cement Mortars (using 2-in. or 50 mm. Cube Specimens).
 5. ASTM C 150, Specification for Portland Cement.
 6. ASTM C 230, Specification for Flow Table for use in Tests of Hydraulic Cement.
 7. ASTM C 531, Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical- Resistant Mortars, Grouts, and Monolithic Surfacing.
 8. ASTM C 579, Test Method for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing and Polymer Concretes.
 9. ASTM C 827, Test Method for Early Volume Change of Cementitious Mixtures.
 10. ASTM C 882, Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete.
 11. ASTM C 937, Specification for Grout Fluidifier for Preplaced-Aggregate Concrete.

12. ASTM C 939, Test Method for Flow of Grout for Preplaced-Aggregate Concrete (Flow Cone Method).
13. ASTM C 942, Standard Test Method for Compressive Strength of Grouts for Preplaced-Aggregate Concrete in the Laboratory.
14. ASTM C 1107, Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
15. ASTM C 1181, Test Method for Compressive Creep of Chemical-Resistant Polymer Machinery Grouts.
16. ASTM D 696, Test Method for Coefficient of Linear Thermal Expansion of Plastics.

B. Field Tests:

1. Compression test specimens will be taken during construction from the first placement of each type of grout, and at intervals thereafter as selected by the ENGINEER to ensure continued compliance with these specifications. The specimens will be made by the ENGINEER or its representative.
2. Compression tests and fabrication of specimens for non-shrink grout will be performed as specified in ASTM C 109 at intervals during construction as selected by the ENGINEER. A set of three specimens will be made for testing at seven days, 28 days, and each additional time period as appropriate.
3. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C 579, Method B, at intervals during construction as selected by the ENGINEER. A set of three specimens will be made for testing at seven days, and each earlier time period as appropriate.
4. The cost of all laboratory tests on grout will be borne by the OWNER, but CONTRACTOR provide assistance to the ENGINEER in obtaining specimens for testing. However, the cost of any additional tests and investigation on work performed which does not conform to the requirements of the specifications belongs to CONTRACTOR. Supply all materials necessary for fabricating the test specimens.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
2. For Grout Fill and Construction Joint Grout, copies of grout design mix and laboratory test reports for grout strength tests.
3. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
4. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked

to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

- B. Reports and Certificates, submit for approval the following:
1. For proprietary materials, submit copies of manufacturer's certification of compliance with the specified properties for Class I, II, and III grouts.
 2. Submit certified testing lab reports for ASTM C 1107, Grade B and Grade C (as revised herein) requirements for Class I and II grouts tested at a fluid consistency for temperatures of 45, 73.4, 90°F with a pot life of 30 minutes at fluid consistency.
 3. Submit certification that materials meet specification requirements for nonproprietary materials.
 4. Submit certifications that all grouts used on the project are free of chlorides or other chemicals causing corrosion.
 5. Manufacturer's specifications and installation instructions for all proprietary materials.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Delivery of Materials: Prepackage grout materials from manufacturers shall be delivered in unopened containers or packages and shall bear intact manufacturer's labels and mixing instructions. For Concrete Grout materials see Section 03300 Cast-In-Place Concrete.
- B. Storage and Handling of Prepackage Materials:
1. Prepackage grout materials shall be stored in a dry shelter and shall be protected from moisture.
 2. Store and precondition all prepackage grout and grout materials per grout manufacturer requirements. Provide air-conditioned storage facility as may be required.
 3. Store prepackage grout materials in undamaged condition with seals and labels intact as packaged by the manufacturer. Do not use open prepackage materials

that have not been opened the same day or that may have been either in contact with moisture or is no longer pre-conditioned as required by the manufacturer.

PART 2 - PRODUCTS

2.1 CEMENT BASED NON-SHRINK GROUTS

A. General:

1. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each type of non-shrink grout specified herein shall be that recommended by the manufacturer for the particular application.
2. Provide grout that meets the performance requirements of ASTM C 1107.
3. Use hydraulic cement complying with ASTM C 150, Type I for exposures not in contact with sewage or soils, and Type II (sulfate resistant) for exposures in contact with sewage or soils.
4. Do not add other materials to the grout with the exception of aggregate only as recommended by the manufacturer.
5. The non-shrink property must not be based on a chemically generated gas or gypsum expansion.
6. The grout when tested shall not bleed at maximum allowed water.
7. Volume change:
 - a. The length change from placement to time of final set shall not have a shrinkage greater than the amount of expansion measured at 3 or 14 days. The expansion at 3 or 14 days shall not exceed the 28-day expansion.
 - b. Range: 0.0 to 0.3 percent when tested in accordance with ASTM C1090.
8. Provide Non-Shrink Non-Metallic Grout wherever "non-shrink grout" is referenced on the Drawings, unless noted otherwise.

B. Non-Shrink Non-Metallic Precision Grout:

1. Application: Use for precision grouting where positive expansion for optimum bearing, high strength, and fluid consistency are required. Example applications are as follows.
 - a. Machinery and equipment.
 - b. Bearing plates.
 - c. Structural steel or precast concrete bearing.
 - d. Anchor bolts and dowels.
 - e. Storage tanks and vessels.
2. Aggregate: Provide mineral, non-metallic aggregate.
3. Compressive Strength: Tested per ASTM C 109 or ASTM C 942.
 - a. Flowable Consistency at 28 days: 9000 psi.
 - b. Fluid Consistency at 28 days: 7000 psi.

4. Consistency: Shall meet the requirements of ASTM C 1107 Grade C and B (as modified below) when tested using the amount of water required to achieve the following properties:
 - a. Fluid consistency (20 to 30 seconds) in accordance with ASTM C 939.
 - b. At temperatures of 45, 73.4, and 95°F.
 5. Acceptable Product and Manufacturer:
 - a. Masterflow 928, as manufactured by BASF Construction Chemicals, LLC.
 - b. NS Grout, as manufactured by the Euclid Chemical Company.
 - c. Five Star High Strength Grout, as manufactured by Five Star Products, Inc.
 - d. Or equal.
- C. Non-Shrink Non-Metallic Grout:
1. Application: Use for general construction grouting where non-shrink, high strength, and flowable to damp pack consistency are required. Example applications are as follows.
 - a. Bedding grout for precast panels.
 - b. Base plates.
 - c. Low-rise Structural steel or precast concrete bearing.
 - d. Anchor bolts and dowels.
 - e. Damp pack applications.
 - f. Filling blocked out spaces for embedded items such as railing posts, gate guide frames, etc.
 2. Aggregate: Provide mineral, non-metallic aggregate.
 3. Compressive Strength: Tested per ASTM C 109 or ASTM C 942.
 - a. Flowable Consistency at 28 days: 7000 psi.
 - b. Damp Pack at 28 days: 8000 psi.
 4. Consistency: Shall meet the requirements of ASTM C 1107 Grade C and B (as modified below) when tested using the amount of water required to achieve the following properties:
 - a. Flowable consistency (125 to 145 percent flow on flow table, ASTM C 230, five drops in 30 seconds.)
 - b. Flowable for at least 30 minutes.
 5. Product and Manufacturer: Provide one of the following:
 - a. Construction Grout, as manufactured by BASF Construction Chemicals, LLC.
 - b. Five Star Grout, as manufactured by Five Star Products, Inc.
 - c. Dry Pack Grout, as manufactured by the Euclid Chemical Company.
 - d. Or equal.

2.2 EPOXY GROUTS

- A. Non-Shrink Epoxy Grout:

1. Application: Use for high performance grouting under conditions of heavy impact, dynamic, and vibratory loading. Example applications are as follows.
 - a. High performance machinery grouting.
 - b. Reciprocating engines.
 - c. Crane rail grouting.
 - d. Precision seating and alignment generators, pumps, and electric motors.
 - e. Grouted anchors, bars and dowels.
2. Epoxy grout shall be a pourable, non-shrink, 100 percent solids system. The epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all premeasured and prepackaged. The resin component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted, unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged. The following properties shall be attained with the minimum quantity of aggregate allowed by the manufacturer.
3. The vertical volume change at all times before hardening shall be between 0.0 percent shrinkage and 4.0 percent expansion when measured according to ASTM C 827 (modified for epoxy grouts by using an indicator ball with a specific gravity between 0.9 and 1.1). Alternately, epoxy grouts which maintain an effective bearing area of not less than 95 percent are acceptable.
4. The length change after hardening shall be negligible (less than 0.0006 in/in) and the coefficient of thermal expansion shall be less than 0.00003 in/in/F when tested in accordance to the requirements of ASTM C 531.
5. The compressive creep at one year shall be negligible (less than .001 in/in) when tested under a 400 psi constant load at 140°F in accordance to the requirements of ASTM C 1181.
6. The seven day compressive strength shall be a minimum of 14,000 psi when tested in accordance to the requirements of ASTM C 579.
7. The grout shall be capable of maintaining at least a flowable consistency for a minimum of 30 minutes at 70°F.
8. The shear bond strength to Portland Cement concrete shall be greater than the shear strength of the concrete when tested in accordance to the requirements of ASTM C 882.
9. The effective bearing area shall be a minimum of 95 percent.
10. Product and Manufacturer: Provide one of the following:
 - a. E3-HP, High Performance Epoxy Grout System, as manufactured by The Euclid Chemical Company.
 - b. Sikadur 42 Grout Pak, as manufactured by Sika Corporation.
 - c. Five Star Epoxy Grout, as manufactured by Five Star Products, Incorporated.
 - d. Masterflow 648 CP, as manufactured by BASF Construction Chemicals, LLC.
 - e. Or equal.

2.3 CONCRETE GROUTS

A. Grout Fill, Topping Grout:

1. Grout for topping of slabs and grout fill for built-up surfaces of tank, channel, and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed as specified herein. All materials and procedures specified for normal concrete in Section 03300, Cast-In-Place Concrete, shall apply except as noted otherwise herein.
2. Topping grout and grout fill shall contain a minimum of 564 pounds of cement per cubic yard with a maximum water cement ratio of 0.45. Where grout fill is thicker than 4-inches, Type “1” concrete, as specified in Section 03300, Cast-In-Place Concrete, may be used when accepted by the ENGINEER.
3. Coarse aggregate shall be graded as follows:

<u>U.S. STANDARD SIEVE SIZE</u>	<u>PERCENT BY WEIGHT PASSING</u>
1/2-inch	100
3/8-inch	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 30	0

4. Final mix design shall be as determined by trial mix design under supervision of the approved testing laboratory.
5. Strength: Minimum compressive strength of Grout Fill and Topping Grout at the end of 28 days shall be 4000 psi.

B. Construction Joint Grout:

1. Construction Joint Grout approximates Type “1” concrete, as specified in Section 03300, Cast-In-Place Concrete, with aggregate coarser than 1/2-inch removed. The mix is to be designed as flowable with a high mortar content. It is intended to be placed over construction joints and mixed with Type “1” concrete as specified in Section 03300, Cast-In-Place Concrete. All materials and procedures specified for normal concrete in Section 03300, Cast-In-Place Concrete, shall apply except as noted otherwise herein. The mix requirements for Construction Joint Grout are as follows:
 - a. Compressive Strength: 4,500 psi minimum at 28-days.
 - b. Maximum Water-Cement Ratio: 0.45 by weight.
 - c. Coarse Aggregate: ASTM C33, No. 8 size.
 - d. Fine Aggregate: ASTM C33, approximately 60 percent by weight of total aggregate.
 - e. Air Content: 8±1 percent.
 - f. Minimum Cement Content: 752 pounds per cubic yard.

- C. Requirements for Grout Fill Topping, Grout and Construction Joint Grout:
1. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the Project for grout required. Comply with ACI 211.1 and report to ENGINEER the following data:
 2. Complete identification of aggregate source of supply.
 3. Tests of aggregates for compliance with specified requirements.
 4. Scale weight of each aggregate.
 5. Absorbed water in each aggregate.
 6. Brand, type and composition of cement.
 7. Brand, type and amount of each admixture.
 8. Amounts of water used in trial mixes.
 9. Proportions of each material per cubic yard.
 10. Gross weight and yield per cubic yard of trial mixtures.
 11. Measured slump.
 12. Measured air content.
 13. Compressive strength developed at seven days and 28 days, from not less than three test specimens cast for each seven day and 28-day test, and for each design mix.
 14. Submit written reports to ENGINEER of proposed mix of grout at least 30 days prior to start of Work. Do not begin grout production until mixes have been approved by ENGINEER.
 15. Laboratory Trial Batches: When laboratory trial batches are used to select grout proportions, prepare test specimens and conduct strength tests as specified in ACI 301, Section 4 - Proportioning. However, mixes need not be designed for greater than 125 percent of the specified strength, regardless of the standard deviation of the production facility.
 16. Field Experience Method: When field experience methods are used to select grout proportions, establish proportions as specified in ACI 301, Section 4.
 17. Admixtures: Use air-entraining admixture in all grout. Use amounts of admixtures as recommended by the manufacturer for climatic conditions prevailing at the time of placing. Adjust quantities and types of admixtures as required to maintain quality control. Do not use admixtures which have not been incorporated and tested in the accepted design mix, unless otherwise authorized in writing by ENGINEER.

2.4 CURING MATERIALS

- A. Curing materials shall be as specified in Section 03300, Cast-in-Place Concrete, and as recommended by the manufacturer of prepackaged grouts.

2.5 CONSISTENCY

- A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the

Contract Documents, it shall mean a grout of that consistency; the type of grout to be used shall be as specified herein for the particular application.

- B. The slump for Topping Grout and Grout Fill shall be adjusted to match placement and finishing conditions, but shall not exceed 4-inches.
- C. The slump for Construction Joint Grout shall be 7 ± 1 -inches.

2.6 MATERIALS

- A. Aggregate:
 - 1. Provide aggregate that conforms to the material requirements of Section 03300 Cast-In-Place Concrete, and the prepackaged grout manufacturer's requirements.
 - 2. Store and precondition aggregate per the prepackaged grout manufacturer's requirements.
- B. Water:
 - 1. Potable quality water that is free from deleterious amounts of acids, alkalis, and organic substances.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine the substrate and conditions under which grout is to be placed and notify ENGINEER, in writing, of unsatisfactory conditions. Do not proceed with the Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. General:
 - 1. Place grout as shown and in accordance with manufacturer's instructions. If manufacturer's instructions conflict with the Specifications do not proceed until ENGINEER provides clarification.
 - 2. Manufacturers of proprietary prepackaged products shall make available upon 72 hours notification the services of a qualified, full time employee to aid in assuring proper use of the product under job conditions.
 - 3. Placing grout shall conform to either the temperature and weather limitations in Section 03300, Cast-In-Place Concrete or per the prepackaged manufacturer's requirements.
 - 4. Grout shall be cured following manufacturer's instructions for prepackaged grout and the requirements in Section 03300, Cast-In-Place Concrete, for grout fill and topping grout.

B. Columns, Beams and Equipment Bases:

1. Epoxy grout: After shimming equipment to proper grade, securely tighten anchor bolts. Properly form around the base plates, allowing sufficient room around the edges for placing the grout. Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with the epoxy grout.
2. Non-shrink, non-metallic grout: After shimming columns, beams and equipment to proper grade, securely tighten anchor bolts. Properly form around the base plates allowing sufficient room around the edges for placing the grout. Adequate depth between the bottom of the base plate and the top of concrete base must be provided to assure that the void is completely filled with the non-shrink, non-metallic grout.

C. Handrails and Railings:

1. After posts have been properly inserted into the holes or sleeves, fill the annular space between posts and sleeve with the non-shrink, non-metallic grout. Bevel grout at juncture with post so that moisture flows away from post.

D. Construction Joints:

1. Place a 6-inch minimum thick layer of Construction Joint Grout over the contact surface of the old concrete at the interface of horizontal construction joints as specified in Section 03251, Concrete Joints, and Section 03300, Cast-In-Place Concrete.

E. Topping Grout:

1. All mechanical, electrical, and finish work shall be completed prior to placement of topping grout. The base slab shall be given a roughened textured surface (CSP-6 or greater) by sandblasting or hydroblasting exposing the aggregates to ensure bonding to the base slab.
2. The minimum thickness of grout topping shall be 1-inch.
3. The base slab shall be thoroughly cleaned and wetted prior to placing topping and fill. No topping concrete shall be placed until the slab is complete free from standing pools or ponds of water. A thin coat of neat Type II cement slurry shall be broomed into the surface of the slab and topping or fill concrete shall be placed while the slurry is still wet. The topping and fill shall be compacted by rolling or tamping, brought to established grade, and floated. Grouted fill for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the revolving mechanism of the equipment in accordance with the procedures outlined by the equipment manufacturer after the grout is brought to the established grade.
4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.
5. The surface shall be tested with a straight edge to detect high and low spots which shall be immediately eliminated. When the topping has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes

and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand-troweling. During finishing, no water, dry cement or mixture of dry cement and sand shall be applied to the surface.

6. Cure and protect the grout topping as specified in Section 03300, Cast-In-Place Concrete.

F. Grout Fill:

1. All mechanical, electrical, and finish work shall be completed prior to placement of grout fill. Grout fill shall be mixed, placed, and finished as required in Section 03300, Cast-In-Place Concrete.
2. The minimum thickness of grout fill shall be 1-inch. Where the finished surface of grout fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2-inches wide by 1-1/2-inches deep.
3. The surface shall be tested with a straight edge to verify that the surface slopes uniformly to drain and to detect high and low spots which shall be immediately eliminated. When the grout fill has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. During finishing, no water, dry cement or mixture of dry cement and sand shall be applied to the surface.

++ END OF SECTION ++

SECTION 05051

ANCHOR BOLTS AND ADHESIVE ANCHORS

PART 1 - GENERAL

1.1 DESCRIPTION

- A. Scope:
1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified, and required to furnish and install anchor bolts (cast-in place) and adhesive anchors.
- B. Coordination:
1. Review installation procedures under this and other Sections and coordinate installation of items that must be installed with or before the anchor bolts and adhesive anchor work.
- C. This Section includes all anchor bolts (cast-in-place) and adhesive anchors required for the Work, but not specified under other Sections.
- D. The types of Work using anchor bolts (cast-in-place) and adhesive anchors include, but are not limited to the following:
1. Hangers and brackets.
 2. Equipment.
 3. Piping.
 4. Grating and floor plate.
 5. Electrical.
 6. Metal, wood, and plastic fabrications.
 7. Structural members and accessories.

1.2 QUALITY ASSURANCE

- A. Reference Standards: Comply with the applicable provisions and recommendations of the following, except as shown on the Drawings or specified otherwise.
1. ASTM F 593, Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
 2. ASTM F 594, Specification for Stainless Steel Nuts.
 3. Phoenix Building Code.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
1. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
 2. Setting drawings and templates for location and installation of anchorage devices.

3. Copies of manufacturer's specifications, load tables, dimension diagrams, and installation instructions for the devices.
 4. Copies of ICC, IAPMO, UL, or FM Reports certifying load carrying capacities and installation requirements for the anchorage devices.
 5. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
 6. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
- B. Samples: Representative samples of anchor bolts (cast-in-place) and adhesive anchors as may be requested by ENGINEER. Review will be for type and finish only. Compliance with all other requirements is exclusive responsibility of CONTRACTOR.

PART 2 - PRODUCTS

2.1 DESIGN CRITERIA

- A. When the size, length or load carrying capacity of an anchor bolt or adhesive anchor, is not shown on the Drawings, provide the following:
 1. For anchor bolts (cast-in-place), provide the size, length and capacity required to carry the design load based on the values and requirements for concrete given in the Phoenix Building Code.
 2. For adhesive anchors, provide the size, length, type, and capacity required to carry the design load based on the values and requirements given in the ICC or IAPMO Evaluation Report, or similar certifications by UL or FM, for the anchor to be used. Alternately, the capacity may be based on independent testing lab capacities for

tension and shear strength using a minimum safety factor of four. Consideration of reduced capacity due to spacing and edge distance shall be made.

- B. Determine design loads as follows:
1. For equipment anchors, use the design load recommended by the equipment manufacturer and approved by ENGINEER.
 2. For pipe hangers and supports, use one half of the total weight of: pipe, fittings, and water contained in pipe, plus the full weight of valves and accessories located between the hanger or support in question, and the next adjacent pipe hanger or support, in both directions along the pipe.
 3. Allowances for vibration are included in the safety factor specified above.
 4. Anchor bolts (cast-in-place) and adhesive anchors in concrete shall develop ultimate shear and pull-out loads of not less than the following values in 4,000- psi concrete:

Bolt Diameter (Inches)	Min. Shear (Pounds)	Min. Pull-Out Load (Pounds)
1/2	5,000	7,600
5/8	8,000	12,000
3/4	11,500	17,000
7/8	15,700	20,400
1	20,500	28,400

2.2 APPLICATION

- A. Where a concrete anchor is shown on the Drawings, either install an adhesive anchor or anchor bolt (cast-in-place).
- B. Anchor Bolts (Cast-in-Place):
1. Use in concrete or grout filled masonry.
 2. Where an anchor bolt is indicated, only a cast-in-place anchor bolt shall be used, unless another anchor type is accepted by the ENGINEER.
 3. Provide anchor bolts as shown on the Drawings or as required to secure structural steel to concrete or masonry.
- C. Adhesive Anchors:
1. Use in concrete or masonry.
 2. Use where subject to vibration or where buried or submerged.
 3. Use for pipe supports.
 4. Shall not be used for vertical overhead installations.

2.3 MATERIALS

- A. Anchor Bolts:

1. Unless otherwise indicated, provide stainless steel bolts complete with washers and nuts, complying with ASTM F 593 and ASTM F 594, AISI Type 316.
 2. For equipment, provide anchor bolts which meet the equipment manufacturer's requirements for size, material, strength, embedment length, and projection.
 3. Locate and accurately set the anchor bolts using templates or other devices as required.
- B. Adhesive Anchors in Concrete or Grout Filled Masonry:
1. Provide stainless steel adhesive anchors complete with washers and nuts, complying with ASTM F 593 and ASTM F 594, AISI Type 316.
 2. Adhesive anchors shall consist of threaded rods anchored with an adhesive system into hardened concrete or grout-filled masonry. The adhesive system shall use a two-component adhesive mix. Adhesive shall be injected with a static mixing nozzle following manufacturer's instructions. The embedment depth of the threaded rod shall provide a minimum allowable bond strength that is equal to the allowable steel tensile capacity of the threaded rod, unless noted otherwise on the Drawings.
 3. Adhesive Anchors 5/8-inch Diameter or Greater, in Concrete:
 - a. Product and Manufacturer: Provide one of the following:
 - 1) HIT-RE 500 V3 Epoxy Adhesive Anchoring System, by Hilti, Inc.
 - 2) SET-XP Epoxy Adhesive Anchor System, by Simpson Strong-Tie Company, Inc.
 - 3) Or equal.
 4. Adhesive Anchors Less than 5/8-inch Diameter, in Concrete:
 - a. Product and Manufacturer: Provide one of the following:
 - 1) HIT-HY 200 Adhesive Anchoring System, by Hilti, Inc.
 - 2) HIT-RE 500 V3 Epoxy Adhesive Anchoring System, by Hilti, Inc.
 - 3) Red Head Epcon G5 Adhesive anchor System by ITW Red Head.
 - 4) SET-XP Epoxy Adhesive Anchor System, by Simpson Strong-Tie Company, Inc.
 - 5) Or equal.
- C. Powder activated fasteners and other types of bolts and fasteners not specified herein shall not be used, unless approved by ENGINEER.
- D. Expansion anchors will not be allowed.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Examine areas and conditions under which anchor bolt (cast-in-place) and adhesive anchor Work is to be installed, and notify ENGINEER, in writing, of conditions

detrimental to proper and timely completion of Work. Do not proceed with Work until unsatisfactory conditions have been corrected in a manner acceptable to ENGINEER.

3.2 INSTALLATION

- A. Protect anchor bolt (cast-in-place) and adhesive anchor threads and shank from damage during installation of equipment and structural steel.
- B. Adhesive Anchors in Concrete or Grout Filled Masonry:
 - 1. Holes shall be drilled in hardened concrete or grout to the adhesive anchor system manufacturer's recommended diameter and depth to develop the required pullout resistance but shall not be greater in diameter than 1/4-inch more than the anchor diameter nor less than 12 times the anchor diameter in depth.
 - 2. Holes shall be drilled by methods which do not interfere with the proper bonding of the adhesive. Only masonry type drill bits shall be used.
 - 3. Existing reinforcing steel in the vicinity of proposed holes shall be located prior to drilling. The location of holes to be drilled shall be adjusted to avoid drilling through or nicking any existing reinforcing bars. Holes in adjusted locations may be drilled only after approval by the ENGINEER.
 - 4. Holes shall be brushed and blown clean with clean, dry compressed air to remove all dust and loose particles. Conform to the adhesive system manufacturer's written instructions.
 - 5. Adhesive shall be injected into the hole through the injection system-mixing nozzle (and any necessary extension tubes) placed to the bottom of the hole. The discharge end shall be withdrawn as resin is placed but kept immersed to prevent formation of air pockets. The hole shall be filled to a depth that ensures that excess material is expelled from the hole during dowel placement.
 - 6. Anchor rods shall be twisted during insertion into the partially filled hole so as to guarantee full wetting of the bar surface with adhesive. Anchor rods shall be inserted slowly to avoid developing air pockets.
 - 7. Adhesive anchor manufacturer's representative shall observe and demonstrate the proper installation procedures for the adhesive anchors and adhesive material at no additional expense to OWNER. Each installer shall be certified in writing by the manufacturer to be qualified to install the adhesive anchors.

3.3 CLEANING

- A. After embedding concrete is placed, remove protection and clean anchor bolts.

3.4 FIELD QUALITY CONTROL

- A. Testing of Adhesive Anchors:
 - 1. Employ the services of an independent testing laboratory to perform field quality testing of adhesive anchors. A minimum of 10 percent (but no less than 15 anchors) shall be chosen at random by the testing laboratory and confirmed by the

ENGINEER. Unless otherwise directed by the ENGINEER, adhesive anchors shall be tensioned to 60 percent of the specified yield strength. Where adhesive anchors are located less than eight dowel diameters from the edge of concrete the ENGINEER will determine the tensile load required for the test.

2. Provide access for the testing agency to places where Work is being produced so that required inspection and testing can be accomplished.
3. CONTRACTOR shall be responsible for the failure of any adhesive anchor. If any anchor fails, the testing shall be increased to 20 percent (but no less than 30 anchors), and may be increased further after review by the ENGINEER.
4. Correct improper workmanship, remove and replace, or correct as directed by the ENGINEER, all adhesive anchors found unacceptable or deficient, at no additional cost to the OWNER.
5. Pay for all corrections and subsequent tests required to confirm the integrity of the adhesive anchors.
6. The independent testing and inspection agency shall complete a report for each area. The report shall summarize the observations made by the Inspector and be submitted to the ENGINEER.

++ END OF SECTION ++

SECTION 09910

SPECIAL FINISHES

PART 1 - GENERAL

1.1 SUMMARY

- A. CONTRACTOR shall provide all labor, materials, equipment, services, and incidentals required to furnish and install corrosion resistant coatings for the sanitary sewer manholes and sanitary sewer junction structures as specified herein.

1.2 SECTION INCLUDES

- A. Corrosion resistant coating.

1.3 SUBMITTALS

- A. Submit the following for approval:
1. Letters of Certification of Compliance on materials, equipment, etc.
 2. Identify product name and number, manufacturer and local distributor name, address, and telephone number.
 3. Samples.
 4. Operating and/or service manuals, and all other data pertinent to operating or servicing the complete apparatus. Include detailed procedures for light repairs such as dents and scratches.
 5. Manufacturer's installation methods:
 - a. Safety data sheets (SDS)
 - b. Maximum storage life and storage requirements
 - c. Mixing and proportioning requirements
 - d. Environmental requirements for application and worker safety, including ventilation, humidity, and temperature ranges
 - e. Application film thickness PM coat of primer and finish coat
 - f. Curing time required
 6. Identify manufacturer's recommended, published spreading rate and dry film thickness of each coating material proposed for use.
 7. Mixing instructions, shelf life, method of application, recommended number of coats, and drying time.
 8. General bulletins and catalog cuts describing complete coating system, including all principles and fundamentals.
 9. Materials of construction of all components.
 10. Material gradation, design mix, job mix formula, and/or material analysis.
 11. Copies of the CONTRACTOR'S proposed protection procedures in each area of Work.

12. Sample of finished product showing final color: Coating shall be light in color.
13. A written certification of the applicator's qualifications to the ENGINEER for approval. Applicator shall be an Arizona licensed contractor. Each of the applicator's employees applying coatings and underlayment's shall be certified by the manufacturer as having sufficient training and knowledge to properly apply their products
14. Quality Assurance and Testing Reports.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. All surface coating materials shall be delivered to the job site in original sealed containers and shall be used directly from these sealed containers.
- B. All containers shall have the following labels naming title of material, manufacturer's name and stock number, contents by volume, color name and number, and application instructions.
- C. All surface coating materials shall be stored in an area according to manufacturer's recommendations.
- D. The storage area shall be kept neat and clean. Floors and other surfaces shall be adequately protected. Any damage caused by the CONTRACTOR to surfaces in the storage area shall be thoroughly cleaned and repaired.
- E. All oily rags, waste, etc., shall be placed in a covered material container and removed by the CONTRACTOR at the end of each shift.

1.5 QUALITY ASSURANCE

- A. Corrosion resistant coating manufacturer and applicator shall have at least five years experience in production and coating applications, respectively.
- B. Provide the services of a qualified manufacturer's representative at the Project site for a minimum of two trips and two, eight hour work days at the commencement of Work to advise on materials, installation, and finishing techniques.
- C. Certify long-term compatibility of all coatings with all substrates.
- D. Provide the services of a qualified manufacturer's representative at the Project site for a minimum of two trips and four, eight hour work days during Work and completion of the Work for inspection. Within seven calendar days after inspection by the manufacturer, the CONTRACTOR shall provide a written report from the manufacturer certifying the coatings have been applied properly and in accordance with the manufacturer's recommendations and requirements. Deficiencies in the coating system, if any, noted by the manufacturer during final inspection shall be defined in the

manufacturer's report including corrective measures to be implemented by the CONTRACTOR at the CONTRACTOR'S expense. Following corrective measures by the CONTRACTOR, the manufacturer shall re-inspect the Work. Within seven days after re-inspection, provide a written report from the manufacturer certifying the coatings have been applied properly and in accordance with the manufacturer's recommendations and requirements.

E. Pre-Application Meeting:

1. A pre-application meeting MUST take place at the job-site or mutually agreed upon site a minimum 3 (three) weeks before the application of any coating or lining work proceeding. Attendance is required of all principal decision making parties directly affecting work of this section, including OWNER, ENGINEER, CONTRACTOR, COATING MANUFACTURER'S REPRESENTATIVE and COATING INSPECTOR etc. Record the discussions of the conference and the decisions and agreements (or disagreements) and furnish a copy of the record to each party attending. Review foreseeable methods and procedures relating to the painting Work, including but not necessarily limited to, the following:
 - a. Review Project Coating Specification, Project requirements, including Contract Documents, Project Schedule, approved Shop Drawings, pending and approved Change Orders and requests for information.
 - b. Field quality control: Contractors responsibilities, i.e. providing written daily reports and review required samples and submittals, both completed and yet to be completed.
 - c. Review status of surfaces including drying, surface preparations and similar considerations.
 - d. Review availability of materials, tradesman, equipment and facilities needed to make progress, avoid delays and protect the Work from damaging conditions.
 - e. Coating Inspector's authority and responsibilities, required inspections, testing services, certifications and quality control procedures.
 - f. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions. Supplemental heating sources, as may be required to continue the Work under low temperature conditions, shall be in operating order and acceptable to coating applicator.
 - g. Review methods for complying with regulations of governing authorities having jurisdiction, such as compliance with environmental protection, health, safety, fire and similar regulations.
 - h. Material storage requirements
 - i. Protection of surfaces not scheduled to be coated
 - j. Application requirements and procedures
 - k. Protection of coating systems
2. Provide meeting minutes to all parties for review and possible clarification. Should any correction to the meeting minutes be required, the minutes should be corrected and resubmitted to all parties.

3. Reconvene the meeting at the earliest opportunity if additional information must be developed in order to conclude the subjects under consideration.
 4. Record any revisions or changes agreed upon, reasons therefore, and parties agreeing or disagreeing with them.
- G. Maintain a Coating Application Log. The Paint Application Log shall be maintained on a daily basis for all areas where the Work is being performed. The Paint Application Log shall be turned over to the ENGINEER by 9:00 a.m. the following day that the work was performed. The log shall include the following:
1. Date.
 2. Time.
 3. Weather condition (at work location).
 4. Air temperature (at work location).
 5. Surface temperature (at work location).
 6. Dew point (at work location).
 7. Humidity (at work location).
 8. Material temperature (Before (Separately) and Mixed (Combined))
 9. Location/area square footage.
 10. Description of Work performed.
 11. Materials used, colors and batch numbers, quantity of materials used (not including waste).
 12. Application/surface preparation equipment and personnel.
 13. WFT/surface profile measurements.
 14. Comments, quality control procedures.
 15. Signature/title.

1.6 WARRANTY

- A. The corrosion resistant coating manufacturers shall warrant the products being supplied to the OWNER against defects for a period of five years under normal use. The warranty shall be in printed form.
- B. Warranty Period Inspection:
 1. OWNER may conduct inspection at any time prior to five (5) years following completion of new coating work and /or repaired coating work. CONTRACTOR and representative of coating manufacturer shall be notified of any apparent coating failures. Defective work or coating failures shall be repaired in accordance with this specification and to the satisfaction of OWNER.
 2. If warranty inspections are not held, CONTRACTOR is not relieved of responsibilities under Contract Documents.

PART 2 - PRODUCTS

2.1 PRODUCTS FOR COATINGS

- A. Manholes and Junction Structures, including all concrete surfaces such as walls, floors, and openings:
 - 1. Sauereisen Sewergard 210TN Troweled Industrial coating
 - 2. No approved equal.

2.2 MATERIALS

- A. Manholes and Junction Structures:
 - 1. Troweled product shall be applied in one layer to a minimum of 125 mils dry film thickness after the concrete filler/sealer has been applied (or as required by the coating manufacturer and approved by the ENGINEER) to the concrete surfaces. In floor coatings, CONTRACTOR shall incorporate silica sand or other approved natural or synthetic grit to provide a slip-resistant surface. The additive shall be mixed in the coating compound prior to application.

PART 3 - EXECUTION

3.1 SAFETY

- A. The CONTRACTOR shall perform all surface preparation and application of the coatings as described below. All surface preparation and coating application shall be in compliance with all applicable Federal, State, and local occupational safety, health, and air pollution control regulations. All safety precautions recommended by the manufacturer in printed instructions or special bulletins, and as required by applicable regulations. The CONTRACTOR shall provide forced ventilation in all areas where inadequate ventilation exists.

3.2 SURFACE PREPARATION

- A. New concrete shall cure as required for an acceptable surface to apply coating system as determined by the coating manufacturer. Testing the new concrete to determine whether it is acceptable for a coating system includes capillary moisture in accordance with ASTM D4263 and further testing in accordance with ASTM F1869 if moisture is detected and ground water intrusion is suspected. Test for moisture content of concrete surfaces before commencement of painting Work. There are many tests for moisture in concrete such as ASTM D 4263, ASTM F 1869 or ASTM F 2170. Provide from the submitted coating manufacturer in writing as to which standard they want used and what results must be obtained for satisfactory compliance. Report results to ENGINEER before starting Work.

- B. The concrete shall be prepared in accordance with SSPC/NACE Preparation of Concrete. The concrete surface shall be abrasive blast cleaned in accordance with ASTM D4259 to a uniform texture of 50-60 grit sandpaper and a surface profile of 4-6 mils. When sandblasting a surface to be coated, the CONTRACTOR shall protect all surrounding surfaces from sustaining any damage. All surfaces to be sound, clean, dry, and free of all contaminants prior to application of the coating system. Patch all holes as recommended by the coating manufacturer.
- C. Test for moisture content of concrete surfaces before commencement of painting Work. There are many tests for moisture in concrete such as ASTM D 4263, ASTM F 1869 or ASTM F 2170. Provide from the submitted coating manufacturer in writing as to which standard they want used and what results must be obtained for satisfactory compliance. Report results to ENGINEER before starting Work.
- D. Verify that the pH levels, of the cleaned concrete surfaces to be coated, are 10 to 12 or within the coating manufacturers' current written acceptable range. The pH of the concrete substrate will be measured using pH indicating papers. The pH testing is to be performed once every 50 square feet (5 square meters). Acceptable pH values can be measured using color indicating pH paper with readable color calibrations and a scale at whole numbers (minimum). Use Hydrion Insta-Check Jumbo 1-12, or equal. The paper shall be touched to the surface once using moderate gloved finger pressure. The surface shall not be wiped or moved laterally to disturb the surface during pH testing. Following the one touch, lift the paper vertically to not "wipe" the surface. Compare the color indicated with the scale provided and record the pH. Spot check any areas that may be questionable with phenolphthalein solution. Where paint system is used to provide chemical containment barrier protection, repair cracks and expansion joints in concrete and provide 2-inch radius cove base fillets at all equipment pads and containment walls as part of the complete chemical containment paint system Work. Use materials and techniques recommended by the specified Manufacturer.
- E. Remove all cast-in-place concrete fins, projections, tie wire, nails and other surface irregularities, which would protrude above the level of finished intermediate fillers and surfacers by chipping and scarification by mechanical abrasion.
- F. Using specified filler and surfacer, patch all cast-in-place concrete and precast concrete surfaces as required to completely fill surface air holes and honeycombing. Level all protrusions and grind filler and surfacing compounds smooth and level with adjacent surfaces.
- G. Where concrete masonry unit block filler is specified, spot patch holes and cracks with a putty knife using specified block filler to provide smooth finish for large surfaces coating materials can be applied by airless spray and backroll uniformly using a roller with a synthetic nap cover. While the coating material; is still wet a rubber squeegee can be used to provide a smooth finish.

3.3 INSTALLATION

- A. The corrosion resistant coating shall be applied by a coating applicator specialist qualified to apply the coating in accordance with the manufacturer's specification.
- B. Do not open containers or mix components until necessary preparatory work has been completed and application work will start immediately.
- C. Handling of materials before, during, and after application in such a manner as to prevent inclusion of foreign materials.
- D. All interior spaces of the manholes and Junction Structures shall be coated. This includes the floor, walls, openings and ceiling. The joint between the sewer pipe penetrations and the coating system shall be made at the recommendation of the respective manufacturers.
- E. Prior to Coating Installation, CONTRACTOR shall perform adhesion testing of the concrete per ASTM C 1583.
- F. Use only application methods approved by the manufacturer.

3.4 TESTING

- A. Contractor shall give ENGINEER a minimum of three days advance notice before the start of any surface preparation, underlayment application work, coating application work or testing.
- B. All testing shall be performed in presence of ENGINEER.
- C. Acceptance for holiday testing, adhesion testing and dry film thickness testing shall be witnessed by an independent Testing Agency or Laboratory approved by the OWNER. Costs of this inspection and Testing shall be the responsibility of the CONTRACTOR. At OWNER's option, OWNER may waive requirement of CONTRACTOR provided testing agency or laboratory and have ENGINEER witness this testing.
- D. Additional illumination, scaffolding, and permit required confined space entry equipment and support shall be provided by CONTRACTOR as necessary to facilitate inspection by ENGINEER and/or Testing Agency when requested.
- E. Holiday testing equipment and procedures shall be in strict accordance with the latest edition of NACE "Standard Recommended Practice-Discontinuity (Holiday) Testing of Protective Coatings." and ASTM D4787-13. Areas containing holidays shall be marked repaired or recoated and re-tested in accordance with coating manufacturer's printed instructions.

1. Holiday detectors shall be high voltage plus-type detectors as manufactured by Tinker & Razor or D.E.Sterns Co. Unit Shall be adjusted to operate at voltage required to cause sparks jump across air gap equal to twice specified coating thickness. Minimum applied voltage for 125 Mil coating shall be 17,000 volts.
- F. Dry film thickness measurements shall be provided by report submitted by CONTRACTOR to ENGINEER. The report shall be presented after completion of underlayment, top coating operations and shall state number of manufacturer's product units used and total square footage of surfaced area covered. ENGINEER shall have option of requiring CONTRACTOR to document number of units (coating materials) on hand before and after coating operations to verify actual minimum dry film thickness applied
1. All film thickness not meeting required minimum will be recoated per manufacturer's recommendations to required minimum 125 mil thickness.
- G. CONTRACTOR shall perform adhesion test on 15% of coated surface areas. Adhesion tests shall conform to ASTM D7234, minimum pull off strength of 200 psi concrete. A minimum pull off strength of 150 psi on concrete will be acceptable if substrate is adhered to coating and dolly on more than ½ the area of the dolly. 50mm dollies shall be used for adhesion testing. In the event of a failure, ENGINEER and CONTRACTOR shall determine limits of failure through additional investigation, sounding and pull tests. Failed areas shall be removed and repaired in accordance with these specification and manufacturer's recommendations. Repaired area shall undergo testing as specified herein.

3.5 CLEAN-UP

- A. During progress of the Work, remove from the site all discarded materials, rubbish, cans or buckets, and rags at the end of each Work day.
- B. Upon completion of the Work, clean all coating-spattered surfaces. Remove spattered coating by proper methods of washing and scraping, using care not to scratch or otherwise damage surfaces.
- C. At the completion of Work of other trades, touch-up and restore all damaged or defaced coated surfaces as determined by the ENGINEER.
- D. Ensure that all Federal, State, and Municipal laws and regulations are met during the disposal of coating material or any other hazardous material associated with the coating process.

++ END OF SECTION ++

SECTION 15050

PIPING SYSTEMS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. This Section specifies systems of process piping and general requirements for piping systems. Detailed Specifications for the components listed on the Piping System Specification Sheets are found in the applicable Sections of Division 15, Mechanical. This Section shall be used in conjunction with those Sections.
2. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish, install and test all piping, fittings and specials. The Work includes, but is not limited to, the following:
 - a. All types and sizes of piping, except those specified under other Sections.
 - b. Piping beneath, embedded or within structures.
 - c. Supports, restraints and thrust blocks.
 - d. Pipe encasements.
 - e. Work on or affecting existing piping.
 - f. Testing.
 - g. Cleaning and disinfecting.
 - h. Installation of all jointing and gasket materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods and all other Work required to complete the piping installation.
 - 1) Gasket materials shall comply with National Sanitation Foundation (NSF-61) and Arizona Administration Code requirements as stated in Specification Section 01420 – References.
 - i. Incorporation of valves, meters and special items shown on the Drawings or specified into the piping systems as required and as specified in the applicable Section in Division 15, Mechanical.
 - j. Unless otherwise specifically shown on the Drawings, specified, or included under other Sections, all buried piping Work required begins at the outside face of structures or structure foundations and extending away from structure.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate with the Work that is related to this Section.

C. Definitions:

1. Pressure terms used in this Section and elsewhere in Division 15, Mechanical, are defined as follows:
 - a. Maximum: The greatest continuous pressure at which piping system operates.

- b. Test: The hydrostatic pressure used to determine system acceptance.

1.2 QUALITY ASSURANCE

- A. Conform to all applicable requirements of Parts 600 and 700 of the Uniform Standard specifications for Public Work Construction by the Maricopa Association of Governments (MAG). If there is a conflict between MAG Standard specifications and these Specifications, the Provisions of these Specifications shall govern.
- B. Requirements of Regulatory Agencies:
1. Comply with requirements of NFPA Standard No. 24 for "Outside Protection" where applicable to water pipe systems used for fire protection.
 2. Comply with applicable requirements of NFPA Standard No. 14 for "Standpipe and Hose Systems" used for fire protection.
 3. Comply with requirements of UL, FM and other jurisdictional authorities, where applicable.
 4. Refer to the General and Supplementary Conditions regarding permit requirements for this Work.
 5. Comply with requirements of the City of Phoenix Building Construction Code.
- C. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown on the Drawings or specified.
1. AASHTO M36/M36M, Metallic (Zinc or Aluminum) Coated Corrugated Steel Culverts and Underdrains.
 2. ANSI A13.1, Scheme for the Identification of Piping Systems.
 3. ANSI B1.20.1, Pipe Threads, General Purpose (Inch).
 4. ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings Class 25, 125, 250, and 800.
 5. ANSI B16.3, Malleable Iron Threaded Fittings Class 150 and 300.
 6. ANSI B16.5, Pipe Flanges and Flanged Fittings.
 7. ANSI B16.9, Factory-Made Wrought Steel Buttwelding Fittings.
 8. ANSI B16.11, Forged Steel Fittings, Socket Welding and Threaded.
 9. ANSI B16.12, Cast Iron Threaded Drainage Fittings.
 10. ANSI B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
 11. ANSI B16.26, Cast Copper Alloy Fittings for Flared Copper Tubes.
 12. ANSI B31.1, Power Piping.
 13. ANSI B31.3, Chemical Plant and Petroleum Refinery Piping.
 14. ASME SECTION IX, Boiler and Pressure Vessel Code; Welding and Brazing Qualifications.
 15. ASTM A 47/A 47M, Specification for Ferritic Malleable Iron Castings.
 16. ASTM A 53/A 53M, Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated Welded and Seamless.
 17. ASTM A 74, Specification for Cast Iron Soil Pipe and Fittings.
 18. ASTM A 105/A 105M, Specification for Carbon Steel Forgings for Piping Components.

19. ASTM A 106/A 106M, Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
20. ASTM A 126, Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
21. ASTM A 197/A 197M, Specification for Cupola Malleable Iron.
22. ASTM A 234/A 234M, Specification for Pipe Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and Elevated Temperatures.
23. ASTM A 312/A 312M, Specification for Seamless and Welded Austenitic Stainless Steel Pipe.
24. ASTM A 403/A 403M, Specification for Wrought Austenitic Stainless Steel Piping Fittings.
25. ASTM A 536, Specification for Ductile Iron Castings.
26. ASTM A 570/A 570M, Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.
27. ASTM B 88, Specification for Seamless Copper Water Tube.
28. ASTM C 76, Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe.
29. ASTM C 296, Specification for Asbestos-Cement Pressure Pipe.
30. ASTM C 443-REV A, Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets.
31. ASTM C 564, Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
32. ASTM D 1248, Specification for Polyethylene Plastics Molding and Extrusion Materials.
33. ASTM D 1784, Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
34. ASTM D 2241, Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe (SDR-PR).
35. ASTM D 2513, Specification for Thermoplastic Gas Pressure Pipe, Tubing, and Fittings.
36. ASTM D 2665, Specification for Poly (Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings.
37. ASTM D 2996, Specification for Filament-Wound Reinforced Thermosetting Resin Pipe.
38. ASTM D 3034, Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
39. ASTM D 3261, Specification for Butt Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing.
40. ASTM D 3262, Specification for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Sewer Pipe.
41. ASTM D 4174, Practice for Cleaning, Flushing, and Purification of Petroleum Fluid Hydraulic Systems.
42. ASTM D 4101, Specification for Propylene Plastic Injection and Extrusion Materials.
43. ASTM F 441, Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.

44. AWWA C105, Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.
45. AWWA C110, Ductile-Iron and Gray-Iron Fittings, 3 Inch Through 48 Inch, for Water and Other Liquids.
46. AWWA C111, Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
47. AWWA C115, Flanged Ductile-Iron and Gray-Iron Pipe with Threaded Flanges.
48. AWWA C151, Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
49. AWWA C200, Steel Water Pipe 6 Inches and Larger.
50. AWWA C205, Cement-Mortar Protective Lining and Coating for Steel Water Pipe--4 In. and Larger--Shop Applied.
51. AWWA C206, Field Welding of Steel Water Pipe.
52. AWWA C207, Steel Pipe Flanges for Waterworks Services--Sizes 4 In. through 144 In.
53. AWWA C208, Dimensions for Fabricated Steel Water Pipe Fittings.
54. AWWA C209, Cold-Applied Tape Coating for special sections, Connections, and Fittings for Steel Water Pipelines.
55. AWWA C210, Liquid Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipe.
56. AWWA C214, Tape Coating Systems for the Exterior of Steel Water Pipelines.
57. AWWA C301, Prestressed Concrete Pressure Pipe, Steel Cylinder Type, for Water and Other Liquids.
58. AWWA C303, Reinforced Concrete Pressure Pipe--Steel Cylinder Type, Pretensioned, for Water and Other Liquids.
59. AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.
60. AWWA C651, Disinfecting Water Mains.
61. AWWA C900, Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inches Through 12 Inches, for Water.
62. AWWA M11, Steel Pipe--A Guide for Design and Installation.
63. CISPI 301, specification Data for Hubless Cast Iron Sanitary System with No-Hub Pipe and Fittings.
64. FEDSPEC L-C-530B(1), Coating, Pipe, Thermoplastic Resin or Thermosetting Epoxy.
65. MIL-H-13528B, Hydrochloric Acid, Inhibited, Rust Removing.
66. MIL-STD-810C, Environmental Test Methods.
67. SAE J1227, Assessing Cleanliness of Hydraulic Fluid Power Components and Systems.
68. Phoenix Plumbing Code.
69. Phoenix Construction Code.
70. National Sanitation Foundation (NSF-61) and Arizona Administration Code requirements as stated in Specification Section 01420 – References.

D. Fitting and Coupling Compatibility:

1. To assure uniformity and compatibility of piping components, fittings and couplings for grooved end piping systems shall be furnished by the same manufacturers.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 1. Comply with the requirements of Section 01332, Shop Drawing Procedures.
 2. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
 3. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 4. Contractor shall provide piping layout within chemical pipe trench prior to fabrication.
- B. Submit Certificate of Compliance with NSF/ANSI 61 Standard or with Arizona Administrative Code R18-4-213, in accordance with the requirements of Section 01600, General Equipment Provisions.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. General:
 1. Deliver materials to the site to ensure uninterrupted progress of the Work.
 2. Handle all pipe, fittings, specials and accessories carefully with approved handling devices. Do not drop or roll material off trucks. Do not otherwise drop, roll or skid piping.
 3. Store pipes and fittings on heavy wood blocking or platforms so they are not in contact with the ground.

4. Unload pipe, fittings and specials opposite to or as close to the place where they are to be installed as is practical to avoid unnecessary handling. Keep pipe interiors completely free from dirt and foreign matter.
5. Inspect delivered pipe for cracked, gouged, chipped, dented or other damaged material and immediately remove defective pipe from site.

PART 2 - PRODUCTS

2.1 PIPING MATERIALS

- A. Unless otherwise specified, piping materials, including pipe, gaskets, fittings, connection and joint assemblies, linings and coatings, shall be selected from those listed on the Piping System Specification Sheets. Piping materials shall conform to detailed Specifications for each type of pipe and piping appurtenances specified in the applicable Sections of Division 15, Mechanical.
- B. All piping materials or products, including but not limited to pipe, gaskets, fittings, linings, coatings, etc., which can contact drinking water or a water treatment chemical furnished and installed under this Section, shall require NSF/ANSI 61, Drinking Water System Components Health Effects approval or comply with Arizona Administrative Code R18-4-213, Standards for Additives, Materials, and Equipment.

2.2 PIPING IDENTIFICATION

- A. Marking Piping:
 1. Clearly mark each piece of pipe or fitting with a designation conforming to that shown on the approved Shop Drawings.
 2. Cast or paint material, type and pressure designation on each piece of pipe or fitting 4-inches in diameter and larger.
 3. Pipe and fittings smaller than 4-inches in diameter shall be clearly marked by manufacturer as to material, type and rating.
 4. Markers bearing the legends on the background colors specified in Section 09900, Painting, and shall be provided in the letter heights specified in Section 10400, Identification Signs.

Outside Pipe Diameter,^a (inches)	Letter Height, (inches)
Less than 1-1/2	1/2
1-1/2 through 3	1-1/8
Greater than 3	2-1/4

^a Outside pipe diameter shall include insulation and jacketing.

In addition, pipe markers shall include uni- and bi-directional arrows in the same sizes as the legend. Legends and arrows shall be white on blue or red backgrounds and black on other specified backgrounds.

- B. Plastic Tracer Tape: Tracer tape shall be 6-inches wide, colored the same as the background colors as specified in Section 09900, Painting, and made of inert plastic material suitable for direct burial. Tape shall be capable of stretching to twice its original length and shall be as manufactured by Allen Systems, Brady USA, Inc., Seton Name Plate Corporation, Marking Services Inc., or equal.
1. Two messages shall be printed on the tape. The first message shall read "CAUTION CAUTION CAUTION _____ PIPE BURIED BELOW" with bold letters approximately 2-inches high. The blank shall be filled with the particular system fluid such as chlorine, oxygen or sulfur dioxide. The second message shall read, "CALL _____" with letters approximately 3/4-inch high. The blank shall be filled in with the City's SCADA telephone number (602) 261-8820. Both messages shall be printed at maximum intervals of two feet.
- C. Magnetic Tracer Tape: Polyethylene magnetic tracer tape shall be acid and alkali-resistant, 3-inches wide, 0.005-inch thick, and have 1500-psi strength and 140 percent elongation value. The tape shall be colored the same as the background colors as specified in Section 09900, Painting, and shall be inscribed with the word "CAUTION – PIPE BURIED BELOW" and the name of the piping system, and shall be as manufactured by Allen Systems, Brady USA, Inc., Seton Name Plate Corporation, Marking Services, Inc., or equal.

2.3 VALVES

- A. Valves of the same size and service shall be provided by a single valve manufacturer. Packing shall be non-asbestos material. Actual length of valves shall be within 1/16-inch (plus or minus) of the manufacturer's specified length. Flanges shall meet the requirement of ANSI B16.5. Push-on and mechanical joints shall meet the requirements of AWWA C111 and conform to the requirements of Section 15051, Buried Piping Installation.

PART 3 - EXECUTION

3.1 INSTALLATION - GENERAL

- A. Location:
1. Piping shall be provided as specified, except for adjustments to avoid architectural and structural features and shall be coordinated with electrical construction.
- B. Piping Sizes:

1. Where the size of piping is not shown on the Drawings or specified, provide piping of the sizes required by 2012 Uniform Plumbing Code as amended by the City of Phoenix. Unless specified otherwise, small piping (less than 1-inch in diameter) required for services not described by UPC shall be 1/2-inch.
- C. Pipe Support, Anchorage and Seismic Bracing:
1. Piping shall be supported by anchor brackets, guides, saddles or hangers. Acceptable types of supports, guides, saddles, hangers and structure attachments for general pipe support, expansion/contraction and for seismic bracing, as well as anchorage details, are shown on the Drawings. Minimum spacing shall be as specified for supports and for seismic bracing. Where a specific type of support or anchorage is shown on the Drawings, then only that type shall be used there. Piping shall be vertically supported by anchor brackets, guides, saddles or hangers and shall be seismically braced where indicated to resist lateral load. Supports shall be provided on each run at each change of direction. Pipe supports, components and hardware shall be Type 304L stainless steel. Unless otherwise specified, existing pipes and supports shall not be used to support new piping.
 2. Pipe shall be supported, alignment and installed in such a way so as not to impose undue stress/forces to couplings, connections, supports, valves, equipment and instruments.
- D. Thrust Restraint:
1. General: All plugs, caps, tees and bends in buried pressure piping systems shall be anchored by means of reaction backing or restrained joints as specified.
 2. Restrained Pipe Joints: Pipe joints shall be restrained by means suitable to the type of pipe being installed.
 - a. Ductile-iron push on joints and mechanical joints shall be restrained utilizing a proprietary restrained joint system such as:
 - 1) American Loc-Ring or Flex-Ring,
 - 2) Clow Super-Lock Joint,
 - 3) EBBA Iron Sales Inc. Megalug,
 - 4) U.S. Pipe TR Flex Joint,
 - 5) or other system approved by ENGINEER.
 - b. Steel pipe shall have welded joints, flanged joints, or flexible or mechanical coupling connectors as specified in Section 15102, Steel Pipe. Tie rods connected to ears welded to the steel pipe shall be provided for restraint at all flexible coupling connectors.
 - c. Thermoplastic and copper piping shall generally be installed with soldered, solvent weld, threaded, flanged, or similar type joints. Where push-on type or other non-restrained joints are provided, provide tie rods or other suitable joint restraint system for these joints, subject to the approval of ENGINEER.
 - d. Harnessed lengths for pipe shall be determined by the pipe manufacturer in accordance with the formula in Section 15051, Buried Piping Installation, for determination of harnessed lengths.

- e. Restrain ductile iron pipe connected to flexible couplings or flanged coupling adapters by harnessing across the coupling or adapter using tie rods or extended bolts connecting between flanges.
3. Concrete Thrust Blocks and Anchor Blocks:
 - a. Thrust blocks and anchors shall be constructed of Class B concrete.
 - b. Blocks shall be placed against undisturbed soil and sized as shown on the Drawings or as directed by the ENGINEER. Concrete shall be placed so that pipe joints and fitting joints will be accessible for repair.
 - c. Thrust restraint using thrust blocks alone is not acceptable, thrust restraint per section 3.1.D.2 must be used in addition to thrust blocks and anchor blocks.
- E. Manufacturer's Installation Specialist:
 1. Provide the services of a competent installation specialist of the pipe manufacturer when pipe laying begins, if CONTRACTOR is not experienced in laying and jointing a particular type of pipe.
 2. Retain installation specialist at the site for a minimum of two days or until competency of the pipe laying crew has been satisfactorily demonstrated.
- F. Bedding and Backfill:
 1. Bedding and backfill for buried piping shall conform to the requirements of Section 15051, Buried Piping Installation.

3.2 PIPING IDENTIFICATION

- A. Pipe Coding:
 1. After application of the specified coating and insulation systems, exposed piping, interior and exterior, and piping in ceiling spaces, pipe trenches, pipe chases and valve boxes shall be identified with painted bonding and lettering as specified in Article 2.2, above. Legend markers and directional arrows shall be located at each side of walls, floors and ceilings, at one side of each piece of equipment, at piping intersections, and at approximately 25-foot centers.
- B. Plastic Tracer Tape:
 1. A single line of tape as specified in Paragraph 2.2.B., above, shall be provided 2.5 feet above the centerline of buried ferrous pipe. For pipelines buried eight feet or greater below finished grade, provide a second line of tape 12-inches below finished grade, above and parallel to each buried pipe. Tape shall be spread flat with message side up before backfilling.
- C. Magnetic Tracer Tape: Polyethylene magnetic tracer tape shall be buried 12 to 18-inches below finished grade and shall be above and parallel to buried non-ferrous, plastic and reinforced thermosetting resin pipe lines. For pipelines buried eight feet or greater below finished grade, provide a second line of tape 2.5 feet above and parallel to each buried pipe.

3.3 VALVE IDENTIFICATION

- A. Stainless steel tags bearing the specified valve number stamped in 1/4-inch high letters shall be installed on valve flanges in a position visible from floor level. Flangeless valves 8-inches in diameter and larger shall have tags attached to the valve body by self-tapping corrosion resistant metal screws. Flangeless valves 6-inches in diameter and smaller shall have tags attached to the valve stem by stainless steel wire. Wire shall be 0.063-inch minimum.
- B. Provide CMMS Tags for Valves as specified under Section 01630, Computerized Maintenance Management System Tags; and as shown on the Drawings.

3.4 WORK AFFECTING EXISTING PIPING

- A. Location of Existing Piping:
 - 1. Locations of existing piping shown on the Drawings should be considered approximate.
 - 2. Determine the true locations of existing piping to which connections are to be made, and locations of other facilities which could be disturbed during earthwork operations, or which may be affected by CONTRACTOR'S Work already installed.
 - 3. Conform to applicable requirements of Division 1, General Requirements, pertaining to cutting and patching and connections to existing facilities.
- B. Taking Existing Pipelines Out of Service:
 - 1. Do not take pipelines out of service, unless specifically listed below, or approved by ENGINEER.
 - a. Refer to Section 01143, Coordination with OWNER'S Operations.
 - 2. Notify ENGINEER at least 72 hours prior to taking pipeline out of service.
- C. Work on Existing Pipelines:
 - 1. Cut or tap pipes as shown on the Drawings or required, with machines specifically designed for this Work.
 - 2. Install temporary plugs to prevent entry of mud, dirt, water and debris.
 - 3. Provide all necessary adapters, fittings, pipe and appurtenances required to complete the Work.
 - 4. Existing pipelines which are cut and abandoned shall be adequately capped or filled with grout.

3.5 TESTING

- A. General:
 - 1. Upon completion of piping, but prior to application of insulation on exposed piping, test the piping systems. Pressures, media and test durations shall be as specified in Article 3.7, below. Equipment which may be damaged by the specified test conditions shall be isolated. Testing shall be performed using calibrated test gages and calibrated volumetric measuring equipment to determine leakage rates. Each

test gage shall be selected so that the specified test pressure falls within the upper half of the gage's range. Unless otherwise specified, notify the ENGINEER 24 hours prior to each test.

2. Unless otherwise specified, testing, as specified herein, shall include existing piping systems which connect with new piping systems. Existing pipe shall be tested to the nearest existing valve. Any piping which fails the test shall be repaired. Repair of existing piping will be considered and paid for as extra work.
3. Where testing existing chlorine and sulfur dioxide systems to the nearest isolation valve, provide a tee in the line adjacent to the valve. The branch outlet on the tee shall be valved and used for cleaning, pressure testing, draining, and drying the line. Unless otherwise indicated, the existing chlorine or sulfur dioxide system shall not be shut down during testing or connecting the tee and valve. Prior to placing the line in service, the valve on the branch outlet shall be plugged or sealed with a blind flange or threaded plug. Responsibility belongs to CONTRACTOR for all damage to the existing system as a result of this work.

B. Gas, Air, and Vapor Systems:

1. Test steam lines hydrostatically in accordance with the ASME procedure for testing pressure piping.
2. Testing medium and procedures for chlorine systems are specified in Paragraph 3.5.D., below.
3. Unless otherwise specified, the testing medium for other gas, air and vapor systems shall be as follows:

Pipeline size	Specified Test Pressure	Testing medium
2-inch and smaller	75 psi or less	Air or water
2-inch and smaller	Greater than 75 psi	Water
Greater than 2-inch	3 psi or less	Air or water
Greater than 2-inch	Greater than 3 psi	Water

4. Potable Water Systems Additional Requirements:
 - a. The CONTRACTOR shall provide all vents, piping, plugs, bulkheads, valves, bracing, blocking, pump, including measuring device and all other equipment necessary for making the tests, except pressure gages.
 - b. The pipe shall be tested between each valve or between a valve and the closed end of the pipe.
 - c. Pipe test section shall be limited to 1/2 linear mile, or less, unless otherwise approved in writing by the Engineer. Testing cannot be done against an existing valve. The new pipeline must be separated from any potable system in such a way to prevent any potential for cross-contamination between the existing potable water system and the new pipeline.
 - d. The test shall be made after the backfilling is completed or compacted, regardless of the compaction method.

- e. All connections, blow-offs, hydrants and valves shall be tested with the main, where practical.
- f. The test section shall be slowly filled with potable water and all air shall be vented from the line. The rate of filling shall be as approved by the Superintendent of Water Distribution, with at least 24-hour notice required before filling is scheduled.

C. Liquid Systems:

- 1. Leakage shall be zero at the specified test pressure throughout the specified duration for the following systems: Exposed piping, buried piping, and buried or exposed piping carrying liquid chemicals. Unless otherwise specified, leakage from other buried liquid piping systems shall be less than 0.02 gallon per hour per inch diameter per 100 feet of buried piping.

D. Drains:

- 1. Drain systems, other than pumped drain systems, shall be tested in accordance with Phoenix Plumbing Code.

3.6 CLEANING AND FLUSHING

A. General:

- 1. Piping systems shall be cleaned following completion of testing and prior to connection to operating, control, and regulating or instrumentation equipment. At CONTRACTOR’S option, may clean and test sections of the buried or exposed piping systems. Use of this procedure; however, will not waive the requirement for a full pressure test of the completed system. Unless specified otherwise, piping 24-inches in diameter and smaller shall first be cleaned by pulling a tightly fitting cleaning ball or swab through the system. Piping larger than 24-inches in diameter may be cleaned manually or with a cleaning ball or swab.

B. Temporary Screens:

- 1. Upon completion of the cleaning, connect the piping systems to related process equipment. Temporary screens, provided with locator tabs which remain visible from the outside when the screens are in place, shall be inserted in pipelines at the suction of pumps and compressors in accordance with the following table:

Equipment Suction Or Piping Size, (Inches)	Maximum Screen Opening, (Inches)
0 to 1	1/16
1-1/4 to 3	1/4
3-1/2 to 6	1/2
Over 6	1

2. Maintain the screens during testing, initial start-up, and initial operating phases of the commissioning process. In special cases, screens may be removed as required for performance tests. Remove the temporary screens and make the final piping connections after the screens have remained clean for at least 24 consecutive hours of operation. Systems handling solids are exempted.
- C. Gas and Air Systems:
1. Unless otherwise specified, gas and air system piping 6-inches in diameter and smaller shall be blown out, using air or the testing medium specified. Piping larger than 6-inches shall be cleaned by having a swab or "pig" drawn through the separate reaches of pipe. After connection to the equipment, it shall then be blown out using the equipment. Upon completion of cleaning, the piping shall be drained and dried with an airstream. Propane systems shall be purged with nitrogen and a nitrogen pad maintained at 10 psi until put in service. Sludge gas systems shall be purged with nitrogen and a nitrogen pad maintained at 3 psi until put in service.
- D. Liquid Systems:
1. After completion of cleaning, liquid systems, unless otherwise specified, shall be flushed with clean water. With temporary screens in place, the liquid shall be circulated through the piping system using connected equipment for a minimum period of 15 minutes and until no debris is collected on the screens.
- E. Potable Water Systems:
1. Potable water piping systems shall be flushed and disinfected in accordance with AWWA C651.

3.7 PIPING SPECIFICATION SHEET

- A. General:
1. Piping schedule is shown in Table D. Table D indicates the working pressure, fluid category, pipe material, interior lining, exterior coating, joint type, and additional information. The following abbreviations in Table A, B, and C are used in the Table D.

Table A - Material Abbreviations

Polyvinyl Chloride	PVC	Copper	COP
Ductile Iron	DIP	Steel	STL
Vitrified Clay	VCP	Reinforced Concrete	RCP
Acrylonitrile Butadiene Styrene	ABS	Galvanized Steel	GST
Chlorinated Polyvinyl Chloride	CPVC	Fiberglass Reinforced Plastic Resin	FRP
Stainless Steel	SST	Prestressed Concrete Cylinder	PCCP
High-Density Polyethylene	HDPE	Rubber Gasketed Reinforced Concrete	RGRCP
Galvanized Steel	GST	Corrugated Metal Pipe	CMP

Table B - Lining/Coating Abbreviations

Cement Mortar	CM	Polyethylene Wrap	PE
Bituminous Coating	BC	Glass Lined	GL
Galvanized	GALV	Paint per Section 09900	P
Petroleum Tape	PT	Polyurethane	PY
Polyvinyl Chloride	PVC		

Table C - Joint Abbreviations

Bell and Spigot	BS	Welded	W
Flanged	FLG	Mechanical Joint	MJ
Push On	PO	Grooved End Fitting	GEF
Solvent Welded	SW	Butt Wrapped	BW
Threaded	THD	Butt Fusion	BF
Soldered	SL		

CITY OF PHOENIX: Water Services Department
 PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
 PROJECT NUMBER: WS90500307 & WS90501004

Table D – Piping Schedule

BURRIED PIPE

SERVICE DESCRIPTION	PIPE SYMBOL	PIPE MATERIAL	SPECIFICATION	WORKING PRESSURE	CLASS/TYPE	INTERIOR LINING	EXTERIOR COATING	JOINT TYPE	TEST PRESSURE
GRAVITY SANITARY SEWER – 36-INCH	SAN	VCP	15064	N/A	SEE SPEC	NONE	NONE	BS	3.5PSI
GRAVITY SANITARY SEWER – 36-INCH	SAN	HDPE	15070	N/A	DR 21	NONE	NONE	BF	3.5PSI

++ END OF SECTION ++

SECTION 15051

BURIED PIPING INSTALLATION

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to perform all excavating, backfilling, filling, grading and disposing of earth materials and to furnish, install and test all buried piping, fittings, and specials. The Work includes, but is not limited to, the following:
 - a. Excavation and backfill.
 - b. All temporary means required to prevent discharge of sediment to water courses from dewatering systems or erosion.
 - c. All types and sizes of buried piping, except those specified under other Sections.
 - d. Piping beneath structures.
 - e. Restraints and thrust blocks.
 - f. Pipe encasements.
 - g. Work on or affecting existing piping.
 - h. Testing.
 - i. Cleaning and disinfecting.
 - j. Installation of all jointing and gasketing materials, specials, flexible couplings, mechanical couplings, harnessed and flanged adapters, sleeves, tie rods, and all other Work required to complete the buried piping installation.
 - k. Incorporation of valves, meters and special items shown on the Drawings or specified into the piping systems as required and as specified in the applicable Sections in Division 15, Mechanical.
 - l. Unless otherwise specifically shown on the Drawings, specified, or included under other Sections, all buried piping Work required, beginning at the outside face of structures or structure foundations and extending away from structure.
2. No classification of excavated materials will be made. Excavation includes all materials regardless of type, character, composition, moisture, or condition thereof.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before, the buried piping installation Work.
2. Section 15051, Buried Piping Installation, specifies the installation of all buried piping materials specified in Sections of Division 15, Mechanical. Coordinate with all applicable Sections.

1.2 QUALITY ASSURANCE

- A. Conform to all requirements of Section 601 of the Uniform Standard Specifications for Public Work Construction by the Maricopa Association of Governments (MAG), as supplemented by the City of Phoenix. If there is a conflict between MAG Standard Specifications and these Specifications, the Provisions of these Specifications shall govern.
- B. Testing Services:
1. General: Testing of materials, testing for moisture content during placement and compaction of fill materials, and of compaction requirements for compliance with technical requirements of the Specifications shall be performed by a testing laboratory as designated in 00700 General Requirements.
 2. OWNER'S Testing Agency Scope:
 - a. Test CONTRACTOR'S proposed materials in the laboratory and/or field for compliance with these Specifications.
 - b. Perform field moisture content and density tests to assure that the specified compaction of backfill materials has been obtained.
 - c. Report all test results to the ENGINEER and CONTRACTOR.
 3. Authority and Duties of OWNER'S Testing Agency: Technicians representing the testing laboratory shall inspect the materials in the field and perform tests and shall report their findings to the ENGINEER and CONTRACTOR. When the materials furnished or Work performed fails to fulfill Specification requirements, the technician will direct the attention of the ENGINEER and CONTRACTOR to such failure.
 - a. The technician shall not act as foreman or perform other duties for CONTRACTOR. Work will be checked as it progresses, but failure to detect any defective Work or materials shall not in any way prevent later rejection when such defect is discovered, nor shall it obligate the ENGINEER for final acceptance. Technicians are not authorized to revoke, alter, relax, enlarge, or release any requirements of the Contract Documents, nor to approve or accept any portion of the Work.
 4. Responsibilities and Duties of CONTRACTOR:
 - a. The use of testing services shall in no way relieve CONTRACTOR of the responsibility to furnish materials and construction in full compliance with the Contract Documents.
 - b. To facilitate testing services:
 - 1) Secure and deliver to the ENGINEER or to the testing agency, without cost, preliminary representative samples of the materials he proposes to use and which are required to be tested.
 - 2) Furnish such casual labor as is necessary to obtain and handle samples at the Work site or at other sources of material.
 - 3) Advise the OWNER'S testing agency sufficiently in advance of operations to allow for completion of quality tests and for the assignment of personnel.

- c. CONTRACTOR'S Testing Service shall inspect and approve subgrades and fill layers before further construction Work is performed thereon.
- d. Responsibility belongs to CONTRACTOR to accomplish the specified compaction for backfill and to control the operations by confirmation tests to verify and confirm compliance, and is complying at all times, with the requirements of these Specifications concerning compaction, control, and testing.
- e. The frequency of CONTRACTOR'S confirmation tests shall be not less than as follows; each test location for trenches shall include tests for each layer, type, or class of backfill from bedding to finish grade.
 - 1) Trenches for buried pipe:
 - a) In Open Fields: Four locations every 200 linear feet, each lift.
 - b) Along Dirt or Gravel Roads or Off Traveled Right-of-way: Four locations every 200 linear feet, each lift.
 - c) Crossing Paved Roads: Two locations along each crossing.
 - d) Under Pavement Cuts or Within Two Feet of Pavement Edges: Two locations every 200 linear feet, each lift.
 - e) Compaction test shall be taken at least every 1 foot of total lift and 75 feet lineally.
- f. Copies of the test reports shall be submitted promptly to the ENGINEER. CONTRACTOR'S tests shall be performed by a soils testing laboratory acceptable to the ENGINEER.
- g. Demonstrate the adequacy of compaction equipment and procedures before exceeding any of the following amounts of earthwork quantities:
 - 1) 200 linear feet of trench backfill.
- h. Until the specified degree of compaction on the previously specified amounts of earthwork is achieved, no additional earthwork of the same kind shall be performed.
- i. Periodic compliance tests will be made by the ENGINEER to verify that compaction is conforming to the requirements previously specified, at no cost to CONTRACTOR. Remove the overburden above the level at which the ENGINEER wishes to test and shall backfill and recompact the excavation after the test is complete.
- j. If compaction fails to conform to the specified requirements, remove and replace the backfill at proper density or shall bring the density up to specified level by other means acceptable to the ENGINEER. Subsequent tests required to confirm and verify that the reconstructed backfill has been brought up to specified density shall be paid by CONTRACTOR. CONTRACTOR'S confirmation tests shall be performed in a manner acceptable to the ENGINEER. Frequency of confirmation tests for remedial Work shall be double that amount specified for initial confirmation tests.

C. Requirements of Regulatory Agencies:

- 1. Comply with requirements of NFPA Standard No. 24 for “Outside Protection” where applicable to water pipe systems used for fire protection.

2. Comply with requirements of UL, FM and other jurisdictional authorities, where applicable.
 3. Refer to the General and Supplementary Conditions regarding permit requirements for this Project.
 4. Comply with requirements of the Phoenix Building Code.
 5. Obtain all necessary permits for Work in roads, rights-of-way, railroads, etc. Also, obtain permits as required by local, state and federal agencies for discharging water from excavations.
 6. Perform excavation Work in compliance with applicable requirements of governing authorities having jurisdiction.
- D. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown on the Drawings or specified.
1. Excavation and Backfill:
 - a. ASTM D 422, Standard Test Method for Particle-Size Analysis of Soils.
 - b. ASTM D 427, Test Method for Shrinkage Factors of Soils by the Mercury Method.
 - c. ASTM D 698, Standard Test Method for Laboratory Compaction Characteristics of Soil.
 - d. ASTM D 1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
 - e. ASTM D 2166, Standard Test Method for Unconfined Compression Strength of Cohesive Soil.
 - f. ASTM D 2922, Standard Test Methods for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
 - g. ASTM D 3017, Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).
 - h. ASTM D 4318, Method of Test for Liquid Limit of Soils.
 - i. AISC Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings.
 - j. OSHA Standard, Title 29, Code of Federal Regulations, Part 1926, Section .650 (Subpart P - Excavations).
 - k. AASHTO T-99, The Moisture-Density Relations of Soils Using a (2.5 kg) 5.5 lb Rammer and a (305 mm) 12 in. Drop {Proctor}.
 - l. ASSHTO-T-191, Density of Soil in Place by the Sand Cone Method.
 - m. Uniform Standard Specifications for Public Work Construction by the Maricopa Association of Governments (MAG), as supplemented by the City of Phoenix, Section 601.
 2. Piping Materials and Installation:
 - a. ASTM D 2321, Practice for Underground Installation of Flexible Thermoplastic Pipe.
 - b. ASTM D 2774, Practice for Underground Installation of Thermoplastic Pressure Piping.
 - c. AWWA C105, Polyethylene Encasement for Ductile-Iron Piping for Water and Other Liquids.

- d. AWWA C111, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
- e. AWWA C206, Field Welding of Steel Water Pipe.
- f. AWWA C600, Installation of Ductile-Iron Water Mains and Their Appurtenances.
- g. AWWA C606, Grooved and Shouldered Joints.
- h. AWWA C651, Disinfecting Water Mains.
- i. AWWA M9, Concrete Pressure Pipe.
- j. AWWA M11, Steel Pipe - A Guide for Design and Installation.
- k. AWWA M23, PVC - Design and Installation.
- l. ASCE MOP No. 37, Design and Construction of Sanitary and Storm Sewers.
- m. Concrete Pipe Handbook, American Concrete Pipe Association.
- n. NFPA 24, Private Fire Service Mains and Their Appurtenances.
- o. NFPA 54, National Fuel Gas Code.
- p. NSF/ANSI 61, Drinking Water System Components Health Effects.
- q. Arizona Administrative Code R18-4-213, Standards for Additives, Materials, and Equipment.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 - 1. Excavation and Backfill Submittals:
 - a. Excavation Plan: Prior to start of excavation operations, a written plan shall be submitted to demonstrate compliance with OSHA Standard 29 CFR Part 1926.650. As a minimum, excavation plan shall include:
 - 1) Name of competent person.
 - 2) Excavation method(s) or protective system(s) to be used.
 - 3) Copies of "manufacturer's data" or other tabulated data if protective system(s) are designed on the basis of such data.
 - b. Excavation and backfill requirements detailing sheeting and bracing, or other protective system(s), dewatering systems, cofferdams, and under-pinning.
 - c. Proposed Backfill Material and any On-site Batched Soils Intended for Use as Flowable Backfill:
 - 1) Submit material testing results of materials proposed for backfill.
 - 2) Submit on-site batched soils lean concrete flowable backfill mix design for approval, demonstrating compliance with these Specifications.
 - d. Shop Drawings shall be prepared by a Registered Professional Engineer, licensed in the State of Arizona, recognized as an expert in the specialty involved. Drawings shall be submitted to ENGINEER for record purposes only. Calculations shall not be submitted. Drawing submittals will not be checked and will not imply approval by ENGINEER of the Work involved. Responsibility belongs to CONTRACTOR for designing, installing, operating and maintaining whatever system is necessary to satisfactorily accomplish all necessary sheeting, bracing, protection, underpinning and dewatering.

- e. Samples of all materials, including flowable backfill, select backfill, general backfill, granular embedment, crushed stone and sand shall be submitted to the ENGINEER and the OWNER'S Testing Agency. Samples of the proposed material shall be submitted at least 14 days in advance of its anticipated use. Samples shall consist of 0.5 cubic feet of each type of material.
2. Piping Materials and Installation Submittals:
 - a. Laying schedules for all piping
 - b. Full details of piping, specials, manholes, joints, harnessing and thrust blocks, and connections to existing piping, structures, equipment and appurtenances.
 - c. Certificates of compliance with referenced Standards for proposed pipe material.
 - d. Descriptions of proposed pipe testing methods, procedures and apparatus. Prepare and submit a report for each test conducted.
 - e. Certificate of Compliance with NSF/ANSI 61 Standard or with Arizona Administrative Code R18-4-213, in accordance with the requirements of Section 01600, General Equipment Provisions.
3. Field Test Reports:
 - a. Testing laboratory shall submit copies of test reports for Field Density of Backfill directly to ENGINEER, with copy to CONTRACTOR.
4. Record Drawings:
 - a. During progress of the Work, keep an up-to-date set of Record Drawings showing field and Shop Drawing modifications.
 - b. Submit Record Drawings prior to the time of Substantial Completion.
5. Comply with the requirements of Section 01332, Shop Drawing Procedures.
6. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
7. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

1.4 JOB CONDITIONS

- A. Subsurface Information: Refer to Section 00700, General Conditions, and Section 00800, Supplementary Conditions, for available data on subsurface conditions. The data is not intended as a representation or warranty of continuity of conditions between soil borings nor of groundwater levels at dates and times other than date and time when measured. OWNER will not be responsible for interpretations or conclusions drawn there from by CONTRACTOR. Data is solely made available for the convenience of CONTRACTOR.
1. Additional test borings and other exploratory operations may be made by CONTRACTOR, at no additional cost to OWNER.
- B. Existing Structures: The Drawings show certain surface and underground structures adjacent to the Work. This information has been obtained from existing records. It is not guaranteed to be correct or complete and is shown on the Drawings for the convenience of CONTRACTOR. Explore ahead of the required excavation to determine the exact location of all existing structures. Structures shall be supported and protected from damage by CONTRACTOR. If they are broken or damaged, restore them immediately at no additional cost to the OWNER.
- C. Existing Utilities: Locate existing underground utilities in the areas of the Work. If utilities are to remain in place, provide adequate means of protection during all operations.
1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult piping or utility owner and ENGINEER immediately for directions as to procedure. Cooperate with OWNER and utility owner in keeping services and facilities in operation. Repair damaged utilities to satisfaction of utility owner. Comply with requirements of Section 01143, Coordination with OWNER'S Operations.
 2. In general, service lines to individual houses and businesses are not shown on the Drawings, however, assume that a service exists for each utility to each house or business.
 3. Do not interrupt existing utilities serving facilities occupied and used by OWNER or others, except when permitted in writing by ENGINEER and then only after acceptable temporary utility services have been provided.
 4. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies for shut-off of services if lines are active.
- D. Use of Explosives:
1. The use of explosives will not be permitted. Comply with requirements of Section 02220, Demolitions.

- E. Protection of Persons and Property: Barricade open excavations occurring as part of the Work and post with warning lights. Operate warning lights during hours from dusk to dawn each day and as otherwise required.
 - 1. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout and other hazards created by earthwork operations.
- F. Dust Control: Conduct all operations meeting the requirements specified in 00700 General Requirements pertaining to Earthmoving and Dust Control.
- G. Roadways and Walks: Unless otherwise approved by ENGINEER, excavated material and materials of construction shall be so deposited, and the Work shall be so conducted, as to leave open and free for pedestrian traffic all crosswalks, and for vehicular traffic a roadway not less than ten feet in width. All hydrants, valves, fire alarm boxes, letter boxes, and other facilities which may require access during construction shall be kept accessible for use. During the progress of the Work, maintain such crosswalks, sidewalks, and roadways in satisfactory condition and the Work shall at all times be so conducted as to cause a minimum of inconvenience to public travel, and to permit safe and convenient access to private and public property along the line of the Work.

1.5 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the site to ensure uninterrupted progress of the Work.
- B. Handle all pipe, fittings, specials and accessories carefully with approved handling devices. Do not drop or roll material off trucks. Do not otherwise drop, roll or skid piping.
- C. Store pipes and fittings on heavy wood blocking or platforms so they are not in contact with the ground.
- D. Unload pipe, fittings and specials opposite to or as close to the place where they are to be installed as is practical to avoid unnecessary handling. Keep pipe interiors completely free from dirt and foreign matter.
- E. Inspect delivered pipe for cracked, gouged, chipped, dented or otherwise damaged material and immediately remove from site.

PART 2 - PRODUCTS

2.1 EMBEDMENT AND BACKFILL MATERIALS

- A. On-site Batched Flowable Backfill:
 - 1. On-site soils shall be amended with cement and water to provide a flowable backfill as shown on the Drawings and per the general structural notes, specifically sheet S

-1.1. On-site batched flowable backfill shall conform to slump requirement of 1 Sack Controlled Low Strength Material (CLSM), as specified in Section 728 of the MAG Specifications and the contract drawing S 1.1. Minimum cement content for on-site batched flowable backfill material shall be per contract drawing S 1.1. Alternative on-site batched flowable backfill material, designed by a qualified Geotechnical Engineer and supported with test results, may be submitted for consideration to OWNER.

2. The extent of the on-site batched flowable backfill shown/noted on the Drawings is based on a probable line of excavation.
3. All buried steel pipe lines shall be backfilled with flowable backfill as described herein. The material shall be placed in the area from the bottom of the trench to one foot above the top of the pipe as shown per the Drawings.

B. Pipe Bedding/Granular Embedment:

1. All piping, except pipe systems as described in 2.1.A(3), 2.1.C(1) and pipes shown to be concrete encased on the contract drawings, shall be backfilled in pipe bedding/granular embedment as described herein.
2. Bedding is the material placed in the area from the bottom of the trench to one foot above the top of the pipe. Pipe bedding shall be Select Material Type B or Aggregate Base Course having the following gradation. Open graded rock will to be used without the written approval of the Engineer.

Sieve Sizes (Square Opening)	Percentage by Weight Passing Sieve	
	Select Material Type B	Aggregate Base Course
1-1/2-inch	100	
1-1/4-inch		100
No. 4	30 – 70	38 - 65
No. 8	20 – 60	25 – 60
No. 30	10 – 40	10 – 40
No. 200	0 - 12	3 - 12

3. Unless otherwise noted, the Plasticity Index as tested in accordance with AASHTO T-146, T-89 and T-90 shall not be more than five.

C. Sand:

1. Sand for use as embedment material around plastic pipes (CPVC, FRP Duct,) shall consist of natural or manufactured granular material.
2. No sand will be allowed for embedment material around centrifugally cast, fiberglass reinforced polymer mortar pipe.
3. Sand material shall contain no organic material. Sand shall be nonplastic, when tested in accordance with ASTM D 698, 100 percent shall pass a 1/2-inch screen and no more than 20 percent shall pass a No. 200 screen.

4. All material for sand must be tested and approved by the ENGINEER.
 5. No sand shall be placed without the approval of the ENGINEER.
- D. Encasement Material:
1. Pipe encasement material shall be Type 2 Portland cement concrete as specified in Section 03300, Cast-In-Place Concrete, unless otherwise shown on the Drawings.
- E. Backfill Material:
1. Materials acceptable for use as backfill above the pipe embedment shall be:
 - a. Stockpiled native sandy clay or granular soils obtained from on-site excavations and which are uniformly mixed, contain no organic matter, nor contain rocks or fragments greater than 3-inches in size, nor have greater than 40 percent passing the 200 sieve. The maximum expansion of on-site materials shall be 1.5 percent as performed on a sample remolded to approximately 95 percent of the maximum dry density as determined in accordance with ASTM D 698 at two percent below optimum moisture content under a 100 pound per square foot (psf) surcharge pressure.
 - b. Materials from off-site sources shall consist of silty or clayey sand soils which are uniformly mixed, contain no organic matter and which have a Plasticity Index less than ten. The maximum particle size of imported soils shall be 3-inches or less, if required to satisfy trenching, landscaping, or other requirements. The maximum expansion of off-site materials shall be 1.5 percent as performed on a sample remolded to approximately 95 percent of the maximum dry density as determined in accordance with ASTM D 698 at two percent below optimum moisture content under a 100 psf surcharge pressure.
 - c. All materials for use as backfill material shall be tested by the laboratory and approved by the ENGINEER.
 - d. If on-site material is unsuitable as determined by the ENGINEER, select backfill or approved off-site fill shall be used.

2.2 PIPING MATERIALS

- A. Unless otherwise specified, piping materials, including pipe, gaskets, fittings, connection and joint assemblies, linings and coatings, shall be selected from those listed in Section 15050, Piping Systems. Piping materials shall conform to detailed Specifications for each type of pipe and piping appurtenances specified in the applicable Sections of Division 15, Mechanical.
- B. All materials of products which can contact drinking water or a water treatment chemical furnished and installed under this Section, shall require NSF/ANSI 61, Drinking Water System Components Health Effects approval or comply with Arizona Administrative Code R18-4-213, Standards for Additives, Materials, and Equipment.

2.3 PIPING IDENTIFICATION

- A. Plastic Tracer Tape and Magnetic Tracer Tape Marking shall conform to the requirements specified in Section 15050, Piping Systems.

PART 3 - EXECUTION

3.1 EXCAVATION

- A. Provide ENGINEER with sufficient notice and with means to examine the areas and conditions under which excavation is to be performed. ENGINEER will notify CONTRACTOR if conditions are found that may be detrimental to the proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions have been corrected in an acceptable manner.
- B. Perform all excavation required to complete the Work as shown on the Drawings, specified and required. Excavations shall include earth, sand, clay, gravel, hardpan, boulders not requiring drilling and blasting for removal, decomposed rock, pavements, rubbish and all other materials within the excavation limits.
- C. Excavations for pipelines shall be open excavations. Provide excavation protection system(s) required by ordinances, codes, law and regulations to prevent injury to workmen and to prevent damage to new and existing structures or pipelines. Unless shown on the Drawings or specified otherwise, protection system(s) shall be utilized under the following conditions.
 - 1. Excavation Less Than Five Feet Deep: Excavations in stable rock or in soil conditions where there is no potential for a cave-in may be made with vertical sides. Under all other conditions, excavations shall be sloped and benched, shielded, or shored and braced.
 - 2. Excavations More Than Five Feet Deep: Excavations in stable rock where there is no potential for a cave-in may be made with vertical sides. Under all other conditions, excavations shall be sloped and benched, shielded or shored and braced.
 - 3. Excavation protection system(s) shall be installed and maintained in accordance with drawings submitted under Article 1.3, above.
- D. Where the pipeline is to be placed below the ground water table, well points, cofferdams or other acceptable methods shall be used to permit construction of said pipeline under dry conditions. Dry conditions shall prevail until the pipelines are properly jointed, tested and backfilled. Water level shall be maintained below top of backfill at all times.
- E. Pumping of water from excavations shall be done in such a manner to prevent the carrying away of unconsolidated concrete materials, and to prevent damage to the existing subgrade.

- F. Except where otherwise noted on the Drawings, or approved, in writing, by the Engineer, no more than 50 feet of trench may be opened in advance of pipe laying.
- G. Material Storage: Stockpile satisfactory excavated materials in approved areas, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.
 - 1. Locate and retain soil materials away from edge of excavations.
 - 2. Dispose of excess soil material and waste materials as specified hereinafter.
 - 3. Stockpiled excavated soils for use as subsequent fill shall be classified by laboratory as on-site granular or sandy clay soils. Use and placement of fill shall be performed as specified for each class.
 - 4. Excess soil from excavations shall be disposed of off-site. Disposal shall be in accordance with state and local regulatory requirements.
- H. Trench width shall be minimized to greatest extent practical but shall conform to the following:
 - 1. Sufficient to provide room for installing, jointing and inspecting piping. Trenches for other than cast-in-place concrete pipe shall conform to the dimensions listed below, unless otherwise shown on the Drawings, and/or approved by the Engineer.

Size of Pipe (I.D.) (Inches)	Maximum Width at Top of Pipe Greater than O.D. of Barrel	Minimum Width at Springline Each Side of Pipe
Less than 18	16-inches	6-inches
18 to 24 inclusive	19-inches	8-inches
27 to 39 inclusive	22-inches	9-inches
42 to 60 inclusive	1/2 of Pipe O.D.	12-inches
Over 60	36-inches	12-inches

- 2. The width of the trench shall not be greater than the maximum indicated above, at and below the level of the top of the pipe. If the maximum width as specified above is exceeded at the top of the pipe, provide, at no additional cost to the OWNER, the necessary loading bearing capacity by means of bedding, having a higher bedding factor than that specified, higher strength pipe a concrete cradle, cap or encasement, or by other means approved in writing by the Engineer.
- 3. The width of the trench above that level may be made as wide as necessary for shoring or other wall support measures necessary for a safe and proper installation. Trench walls may be sloped in-lieu of shoring, sheeting or other wall support measures. In all cases, responsibility belongs to CONTRACTOR for all costs incurred as a result of increased trench width.
- 4. Enlargements at pipe joints may be made if required and approved by ENGINEER.
- 5. Sufficient for shoring and bracing, or shielding and dewatering.
- 6. Sufficient to allow thorough compaction of embedment material adjacent to bottom half of pipe.

- I. Depth of trench shall be as required to install the piping at the elevations shown on the Drawings. For all pipe 12-inches or greater in diameter, except for pipe systems as described in accordance with Paragraph 2.1.A(3), excavate for and provide an initial granular bedding at least 4-inches thick or 1/2 the outside diameter of the pipe whichever is greater. The bedding material shall be placed at a uniform density with a minimum compaction density of 95 percent as determined by AASHTOT -99 and T-191 or ASTM D 2922 and D 3017. If required and approved by ENGINEER, depths may be revised. Remove all loose and unsuitable material from the trench bottom. For pipe systems as described in Paragraph 2.1.A(3), excavate for and provide a flowable backfill as shown on the Drawings.
- J. Subgrades for trench bottoms shall be firm, dense, and thoroughly compacted and consolidated; shall be free from mud, muck, and other soft or unsuitable materials; and shall remain firm and intact under all construction operations. Where ENGINEER considers the existing subgrades unsuitable, remove same and replace it with granular embedment material. Subgrades which are otherwise solid, but which become soft or mucky on top due to construction operations, shall be reinforced with granular embedment material. The finished elevation of stabilized subgrades shall not be above subgrade elevations required for the piping installation as herein specified. Proof roll all subgrades prior to placing of select fill and general fill material.
- K. Except at locations where excavation of rock from the bottom of the trench is required, care shall be taken not to excavate below the required depth. Unauthorized excavation below the specified grade line shall be refilled at Contractor's expense with aggregate base material compacted to a uniform density of not less than 95 percent of the maximum density as determined by AASHTO T-99 and T-191 or ASTM D 2922 and D 3017. When AASHTOT-99, Method A or B, and T-191 are used for density determination, MAG, Detail 190, will be used for rock correction.
- L. Whenever rock is encountered in the trench bottom, it shall be over excavated to a minimum depth of 6-inches below the O.D. of the pipe. This over excavation shall be filled with granular embedment material and compacted to a uniform density of not less than 95 percent of the maximum density as determined by AASHTOT-99 and T-191 or ASTM D 2922 and D 3017.
- M. Where pipe is laid in rock excavation, crushed stone as specified in Section 02318, Crushed Stone and Gravel, shall be carefully placed and tamped over the rock before the pipe is laid. Depth of crushed stone shall be at least 6-inches for pipe 16-inches and smaller and 9-inches for pipe 18-inches and larger. After laying pipe, the balance of the embedment and backfill shall be placed as described herein.

3.2 EXCAVATION DRAINAGE AND DEWATERING

- A. General:

1. Prevent surface and subsurface water from flowing into excavations and from flooding adjacent areas.
 2. Remove water from excavations as fast as it collects.
 3. Maintain the ground water level at approximately three feet below the bottom of the excavation to provide a stable surface for construction operations, a stable subgrade for permanent work and to prevent damage to Work during all stages of construction.
 4. Provide and maintain pumps, sumps, suction and discharge lines and other dewatering system components necessary to convey water away from excavations. Adequate operational standby equipment shall be maintained on the site.
 5. Provide approved sediment traps when water is conveyed into water courses.
 6. Obtain ENGINEER'S approval before shutting down dewatering system for any reason.
- B. Standby Requirements for Dewatering:
1. Provide standby equipment to ensure continuity of dewatering operations.
- C. Disposal of Water Removed by Dewatering System:
1. Dispose of all water removed from the excavation in such a manner as not to endanger public health, property, or any portion of the Work under construction or completed.
 2. Dispose of water in such a manner as to cause no inconvenience to OWNER, ENGINEER or others involved in work about the site.
 3. Convey water from the excavation in a closed conduit. Do not use trench excavations as temporary drainage ditches.

3.3 SHEETING, SHORING, AND BRACING FOR STRUCTURE EXCAVATIONS

- A. General:
1. Used material shall be in good condition, not damaged or excessively pitted. All steel or wood sheeting designated to remain in place shall be new. New or used sheeting may be used for temporary work.
 2. All timber used for breast boards (lagging) shall be new or used, meeting the requirements for Douglas Fir Dense Construction grade with a bending strength not less than 1,500 psi or Southern Pine No. 2 Dense.
 3. All steel work for sheeting, shoring, bracing, cofferdams, etc., shall be designed in accordance with the provisions of the "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" of the AISC, except that field welding will be permitted.
 4. Steel sheet piling shall be manufactured from steel conforming to ASTM A 328. Steel for soldier piles, wales, and braces shall be new or used and shall conform to ASTM A 36/ A 36M.
 5. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.

6. Unless otherwise shown on the Drawings, specified, or ordered, all materials used for temporary construction shall be removed when Work is completed. Such removal shall be made in a manner not injurious to the structure or its appearance or to adjacent Work.
 7. Provide permanent steel sheet piling or pressure creosoted timber sheet piling wherever subsequent removal of sheet piling might permit lateral movement of soil under adjacent structures. Cut off tops as required, but at least 3 feet below grade, and leave permanently in place.
 8. The clearances and types of the temporary structures, insofar as they affect the character of the finished Work and the design of sheeting to be left in place, will be subject to the approval of ENGINEER; but, responsibility for the adequacy of all sheeting, shoring, bracing, coffer-damming, etc., belongs to CONTRACTOR.
 9. Safe and satisfactory sheeting, shoring, and bracing shall be the entire responsibility of CONTRACTOR.
 10. All Municipal, County, State, and Federal ordinances, codes, regulations, and laws shall be observed.
- B. Removal of Sheeting and Bracing:
1. Remove sheeting and bracing from excavations, unless otherwise directed in writing by ENGINEER. Removal shall be done so as to not cause injury to the Work. Removal shall be equal on both sides of excavation to ensure no unequal loads on pipe or structure.
 2. Defer removal of sheeting and bracing, where removal may cause soil to come into contact with concrete, until the following conditions are satisfied:
 - a. Concrete has cured a minimum of seven days.
 - b. Wall and floor framing up to and including grade level floors are in place.

3.4 TRENCH SHIELDS

- A. Excavation of earth material below the bottom of a shield shall not exceed the limits established by ordinances, codes, laws, and regulations.
- B. When Using a Shield for Pipe Installation:
 1. Any portion of the shield that extends below the mid-diameter of an installed rigid pipe (e.g., RCP) shall be raised above this point prior to moving the shield ahead for the installation of the next length of pipe.
 2. The bottom of the shield shall not extend below the mid-diameter of installed flexible pipe (e.g., steel, DI, PVC, etc.) at any time.
- C. When using a shield for the installation of structures, the bottom of the shield shall not extend below the top of the bedding for the structures.
- D. When a shield is removed, extreme care shall be taken to prevent damage to the structures or the disturbance of the bedding for structures. Structures that are disturbed shall be removed and reinstalled as specified.

3.5 PIPE BEDDING/GRANULAR EMBEDMENT AND FLOWABLE BACKFILL

- A. Bedding/Granular Embedment shall be placed in the trench from the bottom of the trench to one foot above the top of the pipe for all piping, except for pipe systems as described in accordance with Paragraph 2.1.A(3). Flowable backfill shall be placed in the trench from the bottom of the trench to one foot above the top of the pipe for pipe systems as described in accordance with Paragraph 2.1.A(3) and as shown on the Drawings.
- B. Sand shall be placed as an envelope around CPVC pipes, PVC pipes, FRP ducts and all pipe 2-inches and smaller. Place and compact minimum 6-inches of sand all around pipes, in 6-inch lifts, to a level 12-inches above the top of pipe. The backfill shall be compacted to not less than 95 percent of laboratory maximum density as determined by AASHTOT-99 and T-191.
- C. Carefully place and thoroughly compact all pipe bedding with hand held pneumatic compactors as construction progresses.
- D. Granular embedment shall be spread in accordance with Paragraph 2.1.B., above, and the surface graded to provide a uniform and continuous support beneath the pipe at all points between bell holes or pipe joints. It will be permissible to slightly disturb the finished subgrade surface by withdrawal of pipe slings or other lifting tackle. After each pipe has been graded, aligned, placed in final position on the bedding material and shoved home, sufficient pipe embedment material shall be deposited and compacted under and around each side of the pipe and back of the bell or end thereof to hold the pipe in proper position and to maintain alignment during subsequent pipe jointing and embedment operations. Embedment material shall be deposited and compacted uniformly and simultaneously on each side of the pipe to prevent lateral displacement.

3.6 GENERAL REQUIREMENTS FOR BACKFILL AND COMPACTION

- A. Furnish, place, and compact all flowable backfill, select backfill, backfill, fill, and other materials required for pipelines as required to provide the finish grades as shown on the Drawings and as described herein.
- B. Fill containing organic materials or other unacceptable material shall be removed and replaced with approved fill material as specified.
- C. Placement Flowable Backfill, Select Backfill, Backfill, and Fill:
 - 1. Select backfill shall be placed to the grades shown on the Drawings. Bring backfill around piping up evenly on all sides.
 - 2. On-site batched flowable backfill shall be placed in accordance with MAG Standard Specification 604. Mechanical vibration in accordance with ACI requirements shall be used to consolidate all flowable backfill material.
 - 3. Keep excavations dry during backfilling operations. No backfill or fill material shall be placed when free water is standing on the surface of the area where the fill

is to be placed. No compaction of fill will be permitted with free water on any portion of the fill to be compacted. No fill shall be placed or compacted in a frozen condition or on top of frozen material. Any fill containing organic materials or other unacceptable material previously described shall be removed and replaced with approved fill material prior to compaction.

4. Compaction shall be performed with equipment suitable for the type of fill material being placed. CONTRACTOR shall select equipment that is capable of providing the minimum density required by these Specifications. Equipment shall be provided that is capable of compacting in restricted areas next to structures and around piping. The effectiveness of the equipment selected by CONTRACTOR shall be tested at the commencement of compacted fill work by construction of a small section of fill within the area where fill is to be placed. If tests on this section of fill show that the specified compaction is not obtained, CONTRACTOR shall increase the amount of coverages, decrease the lift thicknesses, or obtain a different type of compactor.
 5. The compaction requirements specified are predicated on the use of normal materials and compaction equipment. In order to establish criteria for the placement of a controlled fill so that it will have compressibility and strength characteristics compatible with the proposed structural loadings, a series of laboratory compaction and/or compressive strength tests shall be performed on the samples of materials submitted by CONTRACTOR. From the results of the laboratory tests, the final values of the required percent compaction, the acceptable compaction moisture content range, and the maximum permissible lift thickness will be established for the fill material and construction equipment proposed.
 6. If the specified densities are not obtained because of improper control of placement or compaction procedures, or because of inadequate or improperly functioning compaction equipment, CONTRACTOR shall perform whatever Work is required to provide the required densities. This Work shall include complete removal of unacceptable fill areas, and replacement and recompaction until acceptable fill is provided, at no additional cost to the OWNER.
 7. CONTRACTOR shall repair, at their own expense, any after-settlement that occurs. CONTRACTOR shall make all repairs and replacements required within 30 days after notice from ENGINEER or OWNER.
- D. Crushed Stone Placement:
1. Crushed stone shall be placed to the limits shown on the Drawings.
 2. Crushed stone shall be placed in hand tamped lifts not to exceed 6-inches.
- E. Sand Placement:
1. Sand shall be placed as an envelope around PVC and CPVC pipes, FRP ducts, and all pipe 2-inches and smaller. Place and compact a minimum of 6-inches of sand all around pipes, in 6-inch lifts, to level 6-inches above the top of pipe.
- F. Compaction Density Requirements: Refer to Article 3.9, below.

3.7 PIPE INSTALLATION

A. General:

1. All bedding shall be inspected by ENGINEER prior to laying pipe. Notify ENGINEER in advance of excavating, bedding and pipe laying operations.
2. The ENGINEER prior to installation shall inspect all piping. ENGINEER'S inspection will not relieve CONTRACTOR or manufacturer from responsibility for damaged products.
3. All piping shall be carefully examined for cracks, damage or other defects before installation. Any piping that is defective, including but not limited to, cracked, damaged, in poor condition, or with damaged linings or improper markings shall be rejected, unless the product can be repaired in a manner acceptable to the manufacturer and ENGINEER. Any piping found to be broken or defective after it has been installed shall be removed, replaced or repaired at CONTRACTOR'S expense.
4. Take field measurements, where required, prior to installation to ensure proper fitting of the Work. Uncover existing pipelines sufficiently in advance of the proposed Work in order that the type and location of the existing pipes and joints and other information required to fabricate the proposed piping can be determined. Responsibility to obtain whatever information is required to complete the connections of the proposed pipelines to the existing pipelines belongs to CONTRACTOR.
5. Present all conflicts between piping systems and equipment, structures or facilities to ENGINEER for determination of corrective measures before proceeding.
6. Request instructions from ENGINEER before proceeding if there is a conflict between the manufacturer's recommendations and the Contract Documents.
7. Installation of all pipe, fittings, valves, specials and appurtenances shall be subject to the review and approval of the ENGINEER.
8. Install piping as shown on the Drawings, specified and as recommended by the manufacturer and in conformance with referenced standards and approved Shop Drawings.
9. No pipe shall be brought into position until the preceding length has been bedded and secured in its final position.
10. Minimum earth cover over the piping shall be as shown on the Drawings, specified or directed by the ENGINEER, but in no case shall the earth cover be less than 3 feet-6 inches for all piping, except drains.
11. Interior of all piping and mating surfaces shall be inspected and all dirt, gravel, sand, debris or other foreign material shall be completely removed from the interior and mating surfaces before installation. Measures shall be taken to maintain the interior of all piping clean until acceptance of the completed Work. Care shall be taken to prevent foreign matter from entering joint space. Bell and spigot mating surfaces shall be wiped clean immediately before piping is laid. For ductile-iron pipe, the bell and spigot mating surfaces shall be thoroughly cleaned with a wire brush.

12. Install piping accurately to line and grade shown on the Drawings, specified or directed, unless otherwise approved by the ENGINEER. Accurate means of determining and checking the alignment and grade shall be used, which shall be subject to the approval of the ENGINEER. Any modifications to the Contract Documents to suit the pipe manufacturer's standard shall be approved by the ENGINEER. Remove and relay piping that is incorrectly installed, at CONTRACTOR'S expense.
13. Do not lay piping in water, unless otherwise specified in these Specifications or approved by the ENGINEER. Ensure that the water level in the trench is at least 6-inches below the bottom of piping. Maintain a dry trench until jointing and backfilling are complete, unless otherwise specified in these Specifications or approved by the ENGINEER.
14. Where unforeseen conditions will not permit the installation of piping as shown on the Drawings or specified, no piping shall be installed without approval of the ENGINEER. Do not modify structures or facilities without approval of the ENGINEER.
15. Start laying piping at lowest point and proceed toward the higher elevations, unless otherwise approved by the ENGINEER. Slope piping uniformly between elevations shown on the Drawings or as otherwise directed by the ENGINEER.
16. Place bell and spigot piping so that the bells face the direction of laying, unless otherwise approved by the ENGINEER.
17. Piping shall be installed so that the barrel of the piping, and not the joints, receives the bearing pressure from the trench bottom or other bedding condition.
18. No piping shall be brought into position until the preceding length, valve, fitting, or special has been bedded and secured in place.
19. Whenever pipe laying is not actively in progress, the open ends of the piping shall be closed by a temporary plug or cap to prevent soil, water and other foreign matter from entering the piping.
20. Field cutting of metallic piping, where required for inserting valves, fitting, specials, and closures, shall be made with a machine specially designed for cutting piping and in accordance with the manufacturer's instructions. Cuts shall be carefully done, without damage to piping, so as to leave a smooth end at right angles to the axis of the piping. Cut end shall be tapered and sharp edges filed off smooth. Flame cutting shall not be permitted. Any piping damaged by CONTRACTOR due to improper or careless methods of cutting shall be replaced or repaired at his expense.
21. Blocking under piping shall not be permitted, unless specifically approved by ENGINEER for special conditions.
22. Protective linings and coatings shall be touched up prior to installation, where required.
23. Except where bends, wyes or similar fittings are used, changes in alignment and grade of the piping shall be made by deflecting joints or with beveled pipe. Permissible joint deflection shall not exceed 75 percent of the amount allowed by the manufacturer.

24. All joints shall be made in the presence of the ENGINEER or his duly authorized representative, except as otherwise approved.
 25. Special care shall be taken to ensure that each section of piping abuts against the next in such a manner that there will be not shoulder or unevenness of any kind along the piping invert.
 26. Piping shall be rotated as required to place outlets in proper position.
 27. Blind flanges and cleanouts shall be provided at locations shown on the Drawings, specified or required. Cleanouts on buried piping shall include all pipe, fittings and appurtenances required to bring cleanout to finished grade and terminate in a flange and blind flange or suitably capped piping as shown on the Drawings. Cleanout piping shall be same as that specified for the main run.
 28. All gravity lines shall pitch uniformly at the grade shown on the Drawings or as specified or approved by the ENGINEER.
 29. Short pipe stubs, maximum 4-feet-0-inch in length, shall be used at all manholes and other wall faces, except as otherwise specified.
 30. Field painting shall be accomplished after joints are made.
 31. All piping shall be plugged watertight with a suitable cap or plug securely fastened to the end of the piping at all contact interfaces.
 32. On steep slopes, take measures acceptable to ENGINEER to prevent movement of the pipe during installation.
 33. Thrust Restraint: During the installation of the pipe, thrust blocks, tied joints, or proprietary restrained joint systems shall be provided wherever required for thrust restraint. Thrust restraint shall conform to the applicable requirements of Article 3.8, below.
 34. Exercise care to avoid flotation when installing pipe in cast-in-place concrete.
 35. For copper tubing and thermoplastic piping, snake piping in trench to compensate for thermal expansion.
- B. Manufacturer's Installation Specialist:
1. Provide the services of a competent installation specialist of the pipe manufacturer when pipe laying commences if CONTRACTOR is not experienced in laying and jointing a particular type of pipe for the following:
 - a. Concrete pipe.
 - b. FRP pipe.
 - c. Thermoplastic pipe.
 2. Retain installation specialist at the site for a minimum of two days or until competency of the pipe laying crew has been satisfactorily demonstrated.
- C. Separation of Sewers and Potable Water Pipe Lines:
1. Conform to requirements of MAG Specification Section 610.5.
- D. Plugs:
1. Temporarily plug installed pipe at the end of each day's Work or other interruption to the installation of any pipeline. Plugging shall prevent the entry of animals, liquids or persons into the pipe or the entrance or insertion of deleterious materials.

2. Install standard plugs into all bells at dead ends, tees or crosses. Cap all spigot ends.
 3. Fully secure and block all plugs and caps installed for pressure testing to withstand the specified test pressure.
 4. Where plugging is required for phasing of the Work or for subsequent connection of piping, install watertight, permanent type plugs.
- E. Laying Pipe:
1. Conform to manufacturer's instructions and requirements of the standards listed below, where applicable:
 - a. Ductile Iron Pipe: AWWA C600, AWWA C105.
 - b. Concrete Pipe: AWWA M9, Concrete Pipe Handbook.
 - c. Steel Pipe: AWWA M11, AWWA C206.
 - d. Thermoplastic Pipe: ASTM D 2774.
 - e. HDPE PIPE: AWWA M55, PE Pipe Design and Installation
 - f. Fiberglass Reinforced Polymer Mortar Pipe: AWWA C950.
 - g. ASCE Manual of Practice No. 37.
- F. Polyethylene Encasement:
1. Provide polyethylene encasement for ductile iron piping to prevent contact between the pipe and surrounding bedding material and backfill.
 2. Polyethylene may be supplied in tubes or in sheet material.
 3. Polyethylene encasement materials and installation shall be in accordance with the requirements of MAG Section 610.5.
- G. Jointing Pipe:
1. Ductile Iron Mechanical Joint Pipe:
 - a. Comply with requirements of Section 15101, Ductile Iron Pipe.
 - b. Wipe clean the socket, plain end and adjacent areas immediately before making joint. Make certain that cut ends are tapered and sharp edges are filed off smooth.
 - c. Lubricate the plain ends and gasket with soapy water or an approved pipe lubricant, in accordance with AWWA C111, just prior to slipping the gasket onto the plain end of the joint assembly.
 - d. Place the gland on the plain end with the lip extension toward the plain end, followed by the gasket with the narrow edge of the gasket toward the plain end.
 - e. Insert the pipe into the socket and press the gasket firmly and evenly into the gasket recess. Keep the joint straight during assembly.
 - f. Push gland toward socket and center it around pipe with the gland lip against the gasket.
 - g. Insert bolts and hand tighten nuts.
 - h. Make deflection after joint assembly, if required, but prior to tightening bolts. Alternately tighten bolts 180 degrees apart to seat the gasket evenly. The bolt torque shall be as follows:

Pipe Size (inches)	Bolt Size (inches)	Range of Torque (ft-lbs)
3	5/8	45 to 60
4 to 24	3/4	75 to 90
30 to 36	1	100 to 120
42 to 48	1-1/4	120 to 150

- i. All bolts and nuts shall be heavily coated with two 10-mil minimum coats of coal-tar epoxy coating as manufactured by Tnemec, or equal.
 - j. Restrained mechanical joints shall be in accordance with Section 15101, Ductile Iron Pipe.
2. Ductile Iron Push-On Joint Pipe:
- a. Comply with requirements of Section 15101, Ductile Iron Pipe.
 - b. Prior to assembling the joints, the last 8-inches of the exterior surface of the spigot and the interior surface of the bell shall be thoroughly cleaned with a wire brush, except where joints are lined or coated with a special protective lining or coating.
 - c. Rubber gaskets shall be wiped clean and flexed until resilient. Refer to manufacturer's instructions for procedures to ensure gasket resiliency when assembling joints in cold weather.
 - d. Insert gasket into joint recess and smooth out the entire circumference of the gasket to remove bulges and to prevent interference with the proper entry of the spigot of the entering pipe.
 - e. Immediately prior to joint assembly, apply a thin film of approved lubricant to the surface of the gasket which will come in contact with the entering spigot end of pipe. Option, apply a thin film of lubricant to the outside of the spigot of the entering pipe.
 - f. For assembly, center spigot in the pipe bell and push pipe forward until it just makes contact with the rubber gasket. After gasket is compressed and before pipe is pushed or pulled all the way home, carefully check the gasket for proper position around the full circumference of the joint. Final assembly shall be made by forcing the spigot end of the entering pipe past the rubber gasket until it makes contact with the base of the bell. When more than a reasonable amount of force is required to assemble the joint, the spigot end of the pipe shall be removed to verify the proper positioning of the rubber gasket. Gaskets which have been scoured or otherwise damaged shall not be used.
 - g. Maintain an adequate supply of gaskets and joint lubricant at the site at all times when pipe jointing operations are in progress.
3. Proprietary Joints:
- a. Pipe which utilizes proprietary joints such as Megalug, by EBBA Iron, Inc.; Lok-Ring, by American Cast Iron Pipe Company; restrained joints described under Article 3.8, or other such joints shall be installed in strict accordance with the manufacturer's instructions.
4. Flanged Joints:

- a. Assemble flanged joints using 1/8-inch ring-type gaskets for raised face flanges for pipe diameters less than or equal to 42-inch use 1/4-inch American Biltrite Neoprene gaskets for raised face flanges for pipe diameters greater than 42-inches. Use full face gaskets for flat face flanges, unless otherwise approved by ENGINEER. Gaskets shall be suitable for the service intended in accordance with the manufacturer's ratings and instructions. Gaskets shall be properly centered.
 - b. Bolts shall be tightened in a sequence which will ensure equal distribution of bolt loads.
 - c. The length of bolts shall be uniform, and they shall not project beyond the nut more than 1/4-inch or fall short of the nut when fully taken up. The ends of bolts shall be machine cut so as to be neatly rounded. No washers shall be used.
 - d. Bolt threads and gasket faces for flanged joints shall be lubricated prior to assembly.
 - e. After assembly, coat all bolts and nuts with two 8-mil coats of a high-build epoxy or bituminous coating as manufactured by Tnemec, or equal.
5. Prestressed Concrete Cylinder Pipe Joints:
- a. Immediately before making the joint, completely clean the bell and spigot surfaces to be jointed.
 - b. Apply a lubricant supplied by the pipe manufacturer to the sealing surfaces of the bell and spigot and the gasket. After lubrication, install the gasket in the spigot groove and ensure that the stretch in the gasket is equalized.
 - c. After the pipe is lowered into place, align the spigot and bell so that the spigot will squarely enter the bell.
 - d. Before the joint is fully assembled, check the position of the gasket in the bell using methods recommended by the pipe manufacturer and approved by the ENGINEER.
 - e. If the gasket is found to be in the correct position around the entire circumference of the bell, remove temporary joint stoppers, if used, and shove the pipe completely home. If the gasket is not in the proper location, the joint shall be opened and reinstalled using a new gasket.
 - f. Where a joint opening is required to make a grade or alignment adjustment, the joint shall be installed completely closed first, then opened as necessary on one side. Joint openings shall not be greater than 75 percent of the maximum opening recommended by the pipe manufacturer.
 - g. Strap a diaper to the outside of the completed joint straddling the external joint recess. Pour a grout mix consisting of Portland cement and sand in proportions recommended by the pipe manufacturer to completely fill the external joint recess. In lieu of the joint diaper, with written approval of the pipe manufacturer, use a polyurethane foam joint protector with unhydrated Portland cement dispersed throughout the protector. The protector shall have the cross-sectional shape required for the type of joint being installed and shall be formed in a loop to fit the size of pipe on which it is to be used.

- h. Point interior joint recess of all pipe 24-inches in diameter and larger with Portland cement/sand mortar mixed in proportions recommended by the pipe manufacturer. Strike off grout smooth with the interior face of the pipe. For pipes 20-inches in diameter and smaller which convey sewage or nonpotable water, the interior surfaces of the steel joint ring shall be protected by a flexible mastic joint filler applied to the bell socket just prior to joining the pipe such that the mastic squeezes out to fill the internal joint recess.
 - i. Coat all exterior exposed steel portions of the pipe, flanges, couplings, bolts and nuts with two 8-mil coats of high-build epoxy or bituminous coating as manufactured by Tnemec, or equal.
 - j. Maintain a sufficient quantity of joint lubricant, gaskets, joint diapers and joint fillers at the site of the Work at all times.
 - k. Do not use gaskets which have been scored or otherwise damaged.
 - l. Where welded joints are required to handle thrust, the steel spigot shall be cut at the trailing edge of the gasket groove to provide a surface suitable for welding in the field. All field welded joints shall be full circumferential welds designed to take the thrust at the joint location. A minimum 3/16-inch weld is required. The exposed steel surface of the pipe joints shall have a temporary protection system of a rust and corrosion inhibitor applied which need not be removed prior to welding. After welding is complete, the joint protection shall be completed with interior and exterior cement mortar grouting.
6. Rubber Gasket Reinforced Concrete Pipe:
- a. Immediately before making the joint, completely clean the bell and spigot surfaces to be jointed.
 - b. Apply a lubricant supplied by the pipe manufacturer to the sealing surfaces of the bell and spigot and the gasket. After lubrication, install the gasket in the spigot groove and ensure that the stretch in the gasket is equalized.
 - c. After the pipe is lowered into place, align the spigot and bell so that the spigot will squarely enter the bell.
 - d. Before the joint is fully assembled, check the position of the gasket in the bell using methods recommended by the pipe manufacturer and approved by the ENGINEER.
 - e. If the gasket is found to be in the correct position around the entire circumference of the bell, remove temporary joint stoppers, if used, and shove the pipe completely home. If the gasket is not in the proper location, the joint shall be opened and reinstalled using a new gasket.
 - f. Where a joint opening is required to make a grade or alignment adjustment, the joint shall be installed completely closed first, then opened as necessary on one side. Joint openings shall not be greater than 75 percent of the maximum opening recommended by the pipe manufacturer.
 - g. Joints with gap greater than 2” or as recommended by PVC Liner’s Manufacturer’s representation shall be grouted with non-shrink grout in accordance with Section 3600, Grout.
 - h. Do not use gaskets which have been scored or otherwise damaged.
7. HDPE Pipe Joints:

- a. Joints in HDPE pipe shall be butt fusion joints, except that flexible couplings, mechanical couplings, or flanged connections shall be provided at connections to valves, meters and similar equipment.
 - b. Fusion shall conform to the requirements of AWWA Manual M55 .
 - c. After fusion, the joint shall be held together under pressure until the fusion joint cools to the touch.
 - d. Where flanged connections or couplings are provided, the flanges, couplings, bolts and nuts shall be coated with two 8-mil coats of high-build epoxy or bituminous coating as manufactured by Tnemec, or equal.
8. Thermoplastic Pipe Joints:
- a. Solvent Cement Joints:
 - 1) Bevel pipe ends and remove all burrs before making joints. Clean both pipe and fittings thoroughly. Do not attempt to make solvent cement joints if temperature is below 40°F or above 90°F when exposed to direct sunlight or in wet conditions.
 - 2) Use solvent cement supplied or recommended by the pipe manufacturer.
 - 3) Apply joint primer and solvent cement and assemble joints in strict accordance with the recommendations and instructions of the manufacturer of the joint materials and the pipe manufacturer.
 - 4) Observe safety precautions with the use of joint primers and solvent cements. Allow air to circulate freely through pipelines to permit solvent vapors to escape. Slowly admit water when flushing or filling pipelines to prevent compression of gases within pipes.
 - b. Push-On Joints:
 - 1) Bevel all field-cut pipes, remove all burrs and provide a reference mark the correct distance from the pipe end.
 - 2) Clean the pipe end and the bell thoroughly before making the joint. Insert the O-ring gasket, making certain it is properly oriented. Lubricate the spigot well with an approved lubricant; do not lubricate the bell or O-ring. Insert the spigot end of the pipe carefully into the bell until the reference mark on the spigot is flush with the bell.
9. Copper Tubing Joints:
- a. Assemble copper tubing with soldered joints. Solder shall be 95-5 tin-antimony solder conforming to ASTM B 32.
 - b. Ream or file pipe to remove burrs.
 - c. Clean and polish contact surfaces of joints.
 - d. Apply flux to both male and female ends.
 - e. Insert end of tube into full depth of fitting socket.
 - f. Heat joint evenly.
 - g. Form continuous solder bead around entire circumference of joint.
 - h. Runs shall contain unions at connection to equipment and at reasonable distances along the lengths of runs to permit convenient disassembly of piping and removal of equipment.
10. Mechanical Coupling Joints:

- a. Prior to the installation and assembly of mechanical couplings, the joint ends shall be cleaned thoroughly with a wire brush to remove foreign matter. Following this cleaning, lubricant shall be applied to the rubber gasket or inside of the coupling housing and to the joint ends. After lubrication, the gasket shall be installed around the joint end of the previously installed piece and the joint end of the subsequent piece shall be mated to the installed piece. The gasket shall be positioned and the coupling housing placed around the gasket and over the grooved or shouldered joint ends. The bolts shall be inserted and the nuts screwed up tightly by hand. The bolts shall then be tightened uniformly in order to produce an equal pressure on all parts of the housing. When the housing clamps meet metal to metal, the joint is complete and further tightening is not required.
11. HDPE Double Containment Pipe (Containment and Carrier Pipe):
- a. Joints of double containment piping system shall be installed in strict accordance with the manufacturer's instructions and shall be of the butt fusion process.
- H. Connections to Valves and Hydrants:
1. Install valves and hydrants as shown on the Drawings.
 2. Provide suitable adapters when valves or hydrants and piping have different joint types.
 3. Provide thrust restraint at all hydrants and at valves at pipeline terminations.
- I. Transitions from One Type of Pipe to Another:
1. Provide all necessary adapters, specials and connection pieces required when connecting different types and sizes of pipe or connecting pipe made by different manufacturers.
- J. Closures:
1. Provide all closure pieces shown on the Drawings or required to complete the Work.

3.8 THRUST RESTRAINT

- A. Provide thrust restraint on all pressure piping systems and where otherwise shown on the Drawings and specified. Refer to Section 03200, Concrete Reinforcement.
- B. Thrust restraint shall be accomplished by means of restrained pipe joints. Concrete thrust blocks shall be used only when specifically shown on the Drawings or as directed by the ENGINEER. Thrust restraints shall be designed for the axial thrust exerted by the test pressure for each piping system as specified in Section 15050, Piping Systems.
- C. Restrained Pipe Joints:
 1. Pipe joints shall be restrained by means suitable to the type of pipe being installed.
 - a. Prestressed concrete cylinder pipe shall be restrained utilizing welded joints. Concrete pipe requiring restraint shall have sufficient longitudinal steel

reinforcement provided to handle the thrust forces at a maximum design stress of 12,500 psi. The thrust forces in the longitudinales must be transmitted directly to the steel joint bands using welded connections sufficient to carry the stresses involved. No allowance for the concrete to handle any tensile forces is permitted.

- b. Ductile-iron push on joints and mechanical joints shall be restrained utilizing a proprietary restrained joint system such as American Lok-Ring, Ebba Iron, Inc., Series 1100 Megalug, U.S. Pipe TR Flex System, lugs, and tie rods, or other system approved by ENGINEER.
- c. Steel pipe shall have butt-welded joints, flanged joints, or flexible or mechanical coupling connectors as specified in Section 15050, Piping Systems. Tie rods connected to ears welded to the steel pipe shall be provided for restraint at all flexible coupling connectors.
- d. Thermoplastic and copper piping shall generally be installed with soldered, solvent weld, threaded, flanged, or similar type joints. Where push-on type or other non-restrained joints are used, provide tie rods or other suitable joint restraint system for these joints, subject to the approval of ENGINEER.
- e. Harnessed lengths for buried pipe shall be determined by the pipe manufacturer in accordance with the formula for determination of buried pipe harnessed lengths located at the end of this Section.
- f. Concrete cylinder pipe thrust restraint shall be in accordance with AWWA Manual M-9, Chapter 7.

D. Concrete Thrust Blocks:

1. Thrust blocks shall be constructed of Type 2 concrete.
2. Blocks shall be placed against undisturbed soil as shown on Drawings or as directed by the ENGINEER. Concrete shall be placed so that pipe joints and fitting joints will be accessible for repair.
3. Size of concrete thrust blocks shall be as shown on the Drawings, or as directed and approved by ENGINEER.
4. Provide concrete thrust blocks on pressure piping at all changes in alignment of 15 degrees or more, at all tees, plugs and caps and where shown on the Drawings.

3.9 BACKFILL

A. General:

1. Backfill begins after the placement of the pipe bedding/granular embedment. Pipeline trenches may be backfilled prior to pressure testing, but no structure shall be constructed over any pipeline until it has been tested.
2. Place and compact backfill as construction progresses.
3. Compacted backfill shall be required for the full depth of the trench above the granular pipe embedment material. Where the trench for one pipe passes beneath the trench for another pipe or electrical duct bank, the lower trench shall be compacted to the level of the bottom of the upper trench.

4. Each layer of backfill material shall be compacted by at least two complete coverages of all portions of the surface of each lift using approved compaction equipment. One coverage is defined as the conditions reached when all portions of the fill lift have been subjected to the direct contact of the compacting surface of the compactor.
5. The method of compaction and the equipment used shall be appropriate for the material to be compacted and shall not transmit damaging shocks to the pipe.
6. The degree of compaction required for all types of fills shall be as listed below. Material shall be moistened or aerated as necessary to provide the moisture content that will facilitate obtaining the specified compaction.
7. The trench backfill shall be thoroughly compacted to no less than the following densities when tested and determined by ASSHTO T-99 and T-191 or ASTM D 2922 and D 3017. When ASSHTO T-99, Method A or B, and T-191 are used for density determination, MAG Detail 190 will be used for rock correction. The minimum density required is identified below:

Material Thickness (inches)	Required Minimum Density-Percent Compaction (ASTM D 698)	Maximum Uncompacted Lift (inches)
Aggregate Base Course :		
Below asphalt paving	100	8
Trench Backfill above pipe	95	8
Granular Pipe Embedment Material	100	6
Sand Embedment Material	95	6
On-site batched flowable backfill*	See below *	See below *

* On-site batched flowable back fill shall be in accordance with Paragraph 2.1.A., above. Testing shall be in accordance with MAG 728 and testing methods described in Section 03300, Cast-In –Place Concrete.

- a. All fill must be wetted and thoroughly mixed to achieve optimum moisture content, within three percent, with the following exceptions: For on-site clayey soils, the optimum moisture content may range from the target value to +3 percent.
 - b. Natural undisturbed soils or compacted soil subsequently disturbed or removed by construction operations shall be replaced with materials compacted as specified above.
8. OWNER'S testing service shall perform tests required to provide data for selection of fill material and control of placement water content.
 9. Field density tests, to ensure that the specified density is being obtained, shall be performed by OWNER'S testing service during each day of compaction Work.
 10. If the tests indicate unsatisfactory compaction, provide the additional compaction necessary to obtain the specified degree of compaction. All additional compaction

work shall be performed by CONTRACTOR, at no additional cost to the OWNER, until the specified compaction is obtained. This work shall include complete removal of unacceptable (as determined by the ENGINEER) fill areas and replacement and recompaction until acceptable fill is provided.

- B. Replacement of Unacceptable Excavated Materials: In cases where over-excavation for the replacement of unacceptable soil materials is required, the excavation shall be backfilled to the required subgrade with select backfill material and thoroughly compacted as specified in Paragraph 3.8.I.1., above. Sides of the excavation shall be sloped in accordance with the maximum inclinations specified for each structure location.
- C. Perform backfill around structures using the specified procedures, except that within ten feet of foundations and underground structures, light compaction equipment shall be used, with the gross weight of the equipment not exceeding 7,000 lbs. Provide equipment that is capable of the required compaction within restricted areas next to structures and around piping.

3.10 GRADING

- A. General: Uniformly grade areas within limits of grading shown on the Drawings or specified, including adjacent transition areas. Smooth subgrade surface within specified tolerances, compact with uniform levels or slopes between points where elevations are shown on the Drawings, or between such points and existing grades.
- B. Turfed Areas: Finish areas to receive topsoil to within not more than 1-inch above or below the required subgrade elevations.
- C. Walks: Shape surface of areas under walks to line, grade and cross-section, with finish surface not more than 1-inch above or below the required subgrade elevation.
- D. Pavements: Shape surface of areas under pavements to line, grade and cross-section, with finish surface not more than 1/2-inch above or below the required subgrade elevation.
- E. Slabs: Grade smooth and even, free of voids, compacted as specified, and to required elevation. Provide final grades within a tolerance of 1/2-inch when tested with a 10-foot straightedge.
- F. Compaction: After grading, compact subgrade surfaces to the depth and percentage of maximum density required.

3.11 PAVEMENT SUBBASE COURSE

- A. General: Place subbase material, in layers of specified thickness, over ground surface to support pavement base course.

1. Refer to Section 02742, Bituminous Paving.
- B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.
- C. Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials, placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least a 12-inch width of shoulder simultaneously with compacting and rolling of each layer of subbase course.
- D. Placing: Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.
 1. When a compacted subbase course is shown on the Drawings to be 6-inches thick or less, place material in a single layer. When shown on the Drawings to be more than 6-inches thick, place material in equal layers, except no single layer more than 6-inches or less than 3-inches in thickness when compacted.

3.12 DISPOSAL OF EXCAVATED MATERIALS

- A. Material removed from the excavations which does not conform to the requirements for fill or is in excess of that required for backfill shall be hauled away by CONTRACTOR and disposed of in compliance with municipal, county, state, federal or other applicable regulations at no additional cost to OWNER.

3.13 RESTORING AND RESURFACING EXISTING ROADWAYS AND FACILITIES

- A. Place 1-1/2-inches of temporary bituminous pavement immediately after backfilling trenches in paved roadways. Maintain the surface of the paved area over the trench in good and safe condition during progress of the entire Work, and promptly fill all depressions over and adjacent to the trench caused by settlement of backfill. Immediately prior to constructing the permanent paving and base, remove and dispose of temporary pavement. Permanent replacement pavement shall be equal to that of the existing roadways unless otherwise shown on the Drawings or specified.
- B. Pavement, gutters, curbs, walks, driveways and roadways disturbed or damaged by CONTRACTOR'S operations, except areas designated "New Pavement" or "Proposed Pavement", shall be restored or replaced at CONTRACTOR'S expense to as good condition as they were previous to the commencement of the Work and in accordance with applicable local and state highway specifications.

3.14 WORK AFFECTING EXISTING PIPING

- A. Location of Existing Piping:
 1. Locations of existing piping shown on the Drawings should be considered approximate.

2. Determine the true location of existing piping to which connections are to be made, and location of other facilities which could be disturbed during earthwork operations, or which may be affected by CONTRACTOR'S Work already installed.
 3. Conform to applicable requirements of Division 1, General Requirements, pertaining to cutting and patching, and connections to existing facilities.
 4. CONTRACTOR shall pothole all utility crossings as shown per the contract drawings for all new utilities, i.e., electrical conduits, piping, instrumentation conduits, irrigation, etc, crossing existing utilities prior to construction. CONTRACTOR shall provide as-builts showing elevations and northing and eastings of all crossings.
- B. Taking Existing Pipelines Out of Service:
1. Do not take pipelines out of service unless specifically listed below, or approved by ENGINEER.
 - a. Refer to Section 01143, Coordination with OWNER'S Operations.
 2. Notify ENGINEER at least 48 hours prior to taking any pipeline out of service.
- C. Work on Existing Pipelines:
1. Cut or tap pipes as shown on the Drawings or required with machines specifically designed for this Work. All taps shall be made at the spring line except for air release taps. Taps to buried piping 16-inches in diameter and larger shall be protected by an access vault to the surface or shall be 4-inches larger, with a shut off ball valve and a riser to the surface. Taps made to pipe smaller than 16-inches may be 2-inch taps. Taps shall not be located under slabs.
 2. Install temporary plugs to prevent entry of mud, dirt, water and debris.
 3. Provide all necessary adapters, fittings, pipe and appurtenances required to complete the Work. Provide all necessary adapters, fittings, pipe and appurtenances required to complete the Work.
 4. Existing pipelines which are cut and abandoned shall be adequately capped or filled with grout.

3.15 TESTING OF PIPING

- A. General:
1. Test all piping, except as otherwise authorized by ENGINEER.
 2. Notify ENGINEER and local authorities having jurisdiction at least 48 hours in advance of testing if their presence is required.
 3. Conduct all tests in the presence of the ENGINEER.
 4. Remove or protect any pipeline-mounted devices which may be damaged by the test pressure.
 5. Provide all apparatus and services required for testing, including but not limited to, the following:
 - a. Test pumps, bypass pumps, hoses, calibrated gauges, meters, test containers, valves and fittings.
 - b. Temporary bulkheads, bracing, blocking and thrust restraints.

6. Provide air if an air test is required and power if pumping is required.
7. Unless otherwise specified, OWNER will provide fluid required for testing.
8. Repair and retest pipelines that fail to hold specified test pressure or which exceed the allowable leakage rate.
9. Unless otherwise noted, pipelines shall hold specified test pressure for two hours.
10. Unless otherwise specified, test pressures required are at the lowest elevation of the pipeline section being tested.

B. Schedule of Pipeline Tests:

1. Refer to Section 15050, Piping Systems, for the type of test required and the required hydrostatic test pressure.
2. Unless otherwise specified, the required hydrostatic test pressures are at the lowest elevation of the pipeline.
3. For piping not listed in Section 15050, Piping Systems:
 - a. Hydrostatically test pipe that will be operating at a pressure greater than five psig.
 - b. Use exfiltration testing or low-pressure air testing for all other piping.
4. Hydrostatic Test Pressure:
 - a. Use test pressures listed in Section 15050, Piping Systems.
 - b. If a test pressure is not listed in Section 15050, Piping Systems, or if a hydrostatic test is required for piping not listed in Section 15050, Piping Systems, the test pressure will be determined by the ENGINEER based on the maximum anticipated sustained operating pressure and the methods described in the AWWA Manual or Standard which applies to the piping system.
5. CONTRACTOR shall provide a test plan 14 days prior to performing the hydrostatic pressure tests on the pipe lines.

C. Hydrostatic Testing:

1. Preparation for Testing:
 - a. For plastic pipe, including fiberglass pipe, follow procedures described in Section 7 of AWWA Standard C605.
 - b. For all other piping follow procedures described in AWWA Manual M9 except that the minimum wetting period required immediately prior to testing for cement-lined steel pipe and asbestos cement pipe shall be 24 hours rather than the 48 hours prescribed for concrete pipe. A wetting period is not required for metal pipe that is not cement-lined or for plastic pipe.
 - c. Ensure that adequate thrust protection is in place and that all joints are properly installed.
2. Test Procedure:
 - a. Complete backfill and compaction at least to the pipe centerline before testing, unless otherwise required or approved by ENGINEER.
 - b. Allow concrete for thrust blocks to reach design strength before testing.
 - c. Fill pipeline slowly to minimize air entrapment and surge pressures. Fill rate should not exceed one foot per second in the pipe being tested. Install corporation cocks, if necessary, to remove all air.

- d. Examine exposed joints and valves, and correct visible leakage.
 - e. After the wetting period prescribed above, add fluid to pressurize line to the required test pressure. Maintain test pressure for a stabilization period of ten minutes before beginning test.
 - f. After the stabilization period, maintain test pressure for the duration specified in Section 15050, Piping Systems. Add fluid to restore test pressure if pressure drops five psi below test pressure at any time during the test period.
 - g. Pump from a test container to maintain test pressure. Measure the volume of fluid pumped from the container and record on the test report. Record pressure at the test pump at 15 minute intervals for the duration of the test.
3. Allowable Leakage Rates:
- a. Conduct leakage test for all liquid piping after satisfactory completion of pressure test.
 - b. Allow concrete pipe to stand full of water at least 12 hours prior to starting leakage test.
 - c. Maintain test pressure constantly for the minimum test period and accurately measure the amount of water which must be added to maintain the test pressure.
 - d. Allowable Leakage Rates (in gallons per hour per 1,000 feet per inch diameter):
 - 1) DIP Push On or Mechanical Joints: 0.075.
- D. Required Tests for Gravity Sewer and Storm Drains:
1. Elect to test piping, using either air or water test procedures. Notify ENGINEER, in writing, in advance of all testing, which method he plans to utilize and must follow through with the same method on all pipeline testing.
 - a. Gravity sewers shall be tested with either air or water testing; however, storm drains may only be water tested.
 - b. Tests shall be performed after backfilling is completed, but shall be performed before final cleanup and acceptance of Work.
 - c. Tests shall be performed prior to final acceptance.
 - 1) Test all piping and manholes for leakage by means of the tests described below.
 - 2) Test to be performed between adjacent manholes or as approved by the ENGINEER.
 - d. Prior to making tests, submit details of his testing procedures, with a description of methods and equipment CONTRACTOR proposes to use, to the ENGINEER for approval. Furnish all necessary labor, equipment, water, watertight bulkheads, rodding machine, generator, pumps and all else necessary to carry out the required tests.
 2. Air Test:
 - a. Wet and thoroughly clean the inside of the pipe before test is performed.
 - b. Insert test plugs in ends of pipe to be tested.
 - c. Securely brace test plugs.

- d. Measure and record groundwater height above the pipe invert. All gage pressures in the test shall be increased by the amount of the back pressure due to groundwater submergence.
- e. Slowly fill the pipe with air to a pressure of four psig. Maintain pressure between 4 and 3.5 psig for at least two minutes for temperature stabilization.
- f. Check all plugs for tightness.
- g. With a pressure of approximately four psig in pipe, disconnect air supply.
- h. Allow pressure to decrease to 3.5 psig.
- i. When the pressure reaches 3.5 psig, record the time required to decrease to 2.5 psig using a stopwatch.
- j. The line is considered acceptable if the time for the pressure to decrease from 3.5 psig to 2.5 psig is not less than the amount shown on the following table for the respective pipe diameters.

Minimum Acceptance Times	
Pipe Diameter (Inches)	Time
6	2 min. 50 sec.
8	3 min. 50 sec.
10	4 min. 45 sec.
12	5 min. 40 sec.
14	6 min. 40 sec.
16	7 min. 5 sec.
18	7 min. 35 sec.
20	9 min. 30 sec.
21	9 min. 55 sec.
24	11 min. 20 sec.
27	12 min. 45 sec.

- k. If the leakage in the section tested exceeds the specified amount, make the necessary repairs or replacements required to reduce the leakage to within the specified limits and the test shall be repeated until the leakage requirement is met.
 - l. No one shall be allowed in the manhole during air testing.
3. Water Test:
- a. When water test is performed for reinforced concrete pipe, the test section shall be filled with water and allowed to stand for 24 hours. The water shall then be replenished and the test performed.

- b. Insert test plugs and securely brace.
 - c. Fill the pipe and manhole with water to provide a positive differential head on the top of the pipe at the highest point of the pipeline under test of at least the test pressure specified in Section 15050, Piping Systems.
 - d. The amount of water added to maintain this head shall be the leakage.
 - e. Test for a period of at least four hours.
 - f. Total leakage of any section tested shall not exceed the following rates:
 - 1) Gravity Sewer: 0.5 gallons per hour per 100 feet of pipe per inch diameter of pipe.
 - 2) Storm Drains: 2.0 gallons per hour per 100 feet of pipe per inch diameter of pipe.
 - g. If the leakage in the section tested exceeds the specified amount, make the necessary repairs or replacements required to reduce the leakage to within the specified limits and the test shall be repeated until the leakage requirements is met.
 - h. On steep grades it may be necessary to place plugs in the pipe between manholes to avoid excessive pressures in the pipe.
4. Visual Inspection:
- a. Prior to final acceptance, a visual inspection by ENGINEER of all appurtenant structures, (e.g., manholes, chambers, etc.), shall be required. Any visual leaks, regardless of their magnitude shall be repaired by CONTRACTOR.
5. Watertight Sewers:
- a. It is imperative that all sewers and appurtenant structures be constructed as watertight as practicable. Adhere rigidly to all requirements of the Contract Documents and follow all directions of the ENGINEER to secure a watertight sewer. If, during the Work or after its completion, any leaks are discovered, they shall be repaired in a satisfactory manner at the expense of CONTRACTOR even though the pipe and appurtenant structures may have already successfully passed the leakage tests.
- E. Vertical Deflection Test for Thermoplastic Pipe:
1. The vertical deflection test shall be conducted after the final backfill has been in place at least 30 days.
 2. Manually pull a pin-type vertical gauge mounted on a sled through the pipe. Gauge shall be set so that if vertical deflection of pipe exceeds five percent, it will stop. Excavate and reinstall all such piping. Gauge shall be as manufactured by Quality Test Products, or equal.

3.16 DISPOSAL OF WATER

- A. Provide suitable means for disposal of test and flushing water so that no damage results to facilities or waterways.
- B. Means of disposal of test and flushing water shall be subject to the approval of ENGINEER, local governing authorities and regulatory agencies.

- C. Responsibility belongs to CONTRACTOR for any damage caused by water disposal operations.

3.17 CLEANING AND DISINFECTION

A. Cleaning:

1. Thoroughly clean all piping and flush in a manner approved by ENGINEER, prior to placing in service.
2. Piping 24-inches in diameter and larger shall be inspected from inside and all debris, dirt and foreign matter removed.
3. If piping which requires disinfection has not been kept clean during storage or installation, swab each section individually before installation with a five percent hypochlorite solution, to ensure clean piping.

B. Disinfection:

1. Disinfect all potable and finished water piping. Comply with requirements of Section 15141, Potable Water Piping System.
2. A suggested procedure for accomplishing complete and satisfactory disinfection is specified below. Other procedures will be considered for approval by the ENGINEER.
 - a. Thoroughly flush piping prior to disinfection with water. For pipelines 24-inches in diameter and larger, pipelines shall be manually cleaned, carefully removing all sweepings, dirt and debris prior to disinfection.
 - b. Conform to procedures described in AWWA C 651. Continuous feed method of disinfecting shall be used, unless alternative method is acceptable to ENGINEER.
3. Water for initial flushing, testing and chlorination will be furnished by the OWNER. Provide all temporary piping, hose, valves, appurtenances and services required. Cost of water required for re-disinfection will be paid by CONTRACTOR to OWNER at OWNER'S standard rates.
4. Chlorine will be supplied by CONTRACTOR.
5. Bacteriologic tests will be performed by OWNER. A certified test laboratory report will be made available to CONTRACTOR, if requested.
6. Chlorine concentration in the water entering the piping shall be between 50 and 100 parts per million, such that a minimum residual concentration of 25 mg/l will be left after a 24-hour retention period. Care shall be taken to ensure disinfection of the piping in all its parts. The operation shall be repeated as necessary to provide complete disinfection.
7. After the required retention period, the heavily chlorinated water shall be flushed to drain, unless otherwise directed by the ENGINEER.
8. CONTRACTOR to provide a disinfection plan for all pipelines 30 days prior to disinfection. CONTRACTOR shall develop MOPO procedures to be submitted to the City of Phoenix Operations or Water Treatment Plant Staff for review 14 days prior to disinfection. MOPO shall be in the City of Phoenix requested format

provided by the City prior to developing the MOPO. Disinfection is subject to approval from the OWNER prior to performing any disinfection.

3.18 INSTALLATION OF DETECTABLE PIPE LOCATING TAPE

A. Underground Pipe Locating Tape:

1. Refer to paragraph 2.3.A of this Section, and Section 15050, Piping Systems.
2. Detectable pipe locating tape shall be placed above all underground pipelines three inches in diameter or greater. Tape shall be buried 12-inches below finished grade directly above entire pipeline length.
3. Detectable pipe locating tape for reuse water shall be buried on top and in contact with the pipe in addition to 12-inches below finished grade.

FORMULA FOR DETERMINATION OF BURIED PIPE HARNESSED LENGTHS

Lengths shall be based on the following:

$$\text{Harnessed Length (L) on each side of bend} = \frac{T}{f \sum W}$$

$$T = 1.25 PA \sin \Delta/2$$

T = Thrust (lbs)

P = Test Pressure (psi), refer to Section 15050, Piping Systems.

A = Pipe Area (sq.in.)

Δ = Angle of Bend

f = friction factor between soil and pipe = 0.3*

$\sum W = W_p + W_s + W_w$

W_p = weight pipe (pounds per linear foot-PLF)

W_s = weight soil (PLF)**

W_w = weight fluid (PLF)

* For ductile iron and steel pipe: friction factor = 0.1.

** Based on depth of cover on pipe, and outside diameter of pipe.
Soil weight = 100 pcf.

++ END OF SECTION ++

SECTION 15064

VITRIFIED CLAY PIPE

PART 1 - GENERAL

1.1 SUMMARY

- A. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown on the plans, specified and required to furnish and install vitrified clay pipe, fittings and appurtenances.
- B. The CONTRACTOR shall replace all existing roadway pavement, utility services, ditches, monuments and other existing structures to their original condition.
- C. Any pipe, which does not meet specifications or has been rejected, shall be removed from the job site at no cost to the OWNER.
- D. The extent of vitrified clay pipe is shown within the Drawings and in the schedules included in Section 15051, Buried Piping Installation.

1.2 SECTION INCLUDES

- A. Vitrified Clay Pipe (VCP).

1.3 RELATED SECTIONS

- A. Section 02200, Earthwork.
- B. Section 15050, Piping Systems.
- C. Section 15051, Buried Piping Installation.

1.4 REFERENCES

- A. National Clay Pipe Institute (NCPI) Engineering Manual.
- B. ASTM C12 – Standard Practice for Installing Vitrified Clay Pipe.
- C. ASTM C301 – Test Methods for Vitrified Clay Pipe.
- D. ASTM C425 – Compression Joints for Vitrified Clay Pipe and Fittings.
- E. ASTM C700 – Vitrified Clay Pipe, Extra Strength, Standard Strength, and Perforated.
- F. ASTM C828 – Test Method for Low-Pressure Air Test of Vitrified Clay Pipe Lines.

- G. ASTM C896 – Terminology Relating to Clay Products.
- H. ASTM C1091 – Test Method for Hydrostatic Infiltration Testing of Vitrified Clay Pipe Lines.

1.5 SUBMITTAL

- A. Shop Drawings: Submit for approval the following:
 - 1. Detailed drawings and data on pipe, fittings, gaskets, and appurtenances. Submit these with Shop Drawings required under Section 15051, Buried Piping Installation.
- B. The manufacturer shall submit design calculations to the ENGINEER. The design calculations shall be signed and sealed by a Registered Professional Engineer licensed in the State of Arizona. The design calculations shall indicate that the pipe wall thickness will be satisfactory for all conditions of external pressure and earth loadings, special physical loadings, and internal pressure.
- C. Certificates: Submit certificates of compliance with referenced standards.
- D. Also shall be in accordance with Section 15050, Piping Systems submittal information.
- E. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
- F. Certified dimensional drawings of all pipe, fittings and appurtenances.

1.6 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 15051, Buried Piping Installation.

- B. Refer to Manufacturer's recommendations.

PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS

A. General:

1. Pipe shall be designed for an external live loading, including impact, equal to AASHTO, H-20 truck loading with earth cover as shown on the Drawings. The external loading shall be calculated in accordance with the National Clay Pipe Institute (NCPI) Engineering Manual and in accordance with City of Phoenix Standard Details P1120-R through P1127-R.

B. Service Conditions:

1. Liquid Service: (Refer to Section 15051, Buried Piping).
2. Pipe overburden and trench bedding condition: Refer to Drawings.

2.2 MATERIALS

- A. All materials used in the manufacturing of the piping and its components shall be new and of the best quality used for the purpose of commercial practice.

2.3 VITRIFIED CLAY PIPE (VCP) AND FITTINGS

A. General:

1. All VCP and fittings shall be suitable for use as a gravity sewer conduit. VCP shall be Extra Strength Vitrified Clay Pipe conforming to all the requirements of ASTM C700 and MAG Specifications Section 743.
2. Fittings shall be made to such dimensions as will accommodate the joint system specified. Wye and Tee branch fittings shall be furnished with spurs securely fastened by the manufacturer to the barrel of the fitting. There shall be no projection on the inner surface of the barrel.
Joints for vitrified clay pipe and fittings shall be factory applied mechanical flexible-compression type and shall conform to ASTM C425 – Compression Joints for Vitrified Clay Pipe and Fittings. Clay pipe joint material shall be polyurethane. The polyurethane joint must be a standard joint for the pipe manufacturer furnishing pipe on this project for a minimum of five years for all pipe sizes specified. The polyurethane joint must meet all requirements of ASTM C425.
 - a. Bell and Spigot joints shall be used on mainline sewer pipe.
 - b. Rubber couplings used for lateral connections or reconnecting services shall be a stainless steel shielded rubber coupling. Gasket to meet ASTM C-425-91 Table 2. Shear ring to be Series 300 stainless steel with a minimum thickness of .012". Tightening bands shall be Series 316 stainless steel with

stainless steel nut and bolt tightening clamps. Shear ring and clamps to meet all requirements of ASTM A-240-94A.

3. All pipe load tested shall be loaded to the ultimate limit. The load test is destructive and any pipe section tested shall be rejected from installation.

PART 3 - EXECUTION

3.1 TRENCHING, BACKFILLING, AND SUBGRADE PREPARATION

- A. Trenching, backfilling, and sub-grade preparation shall conform to MAG Specifications Section 601 and 615, Section 15051 - Buried Pipe Installation, and the City of Phoenix Standard Details P1120-R through P1127-R. . Bury depth shall be as shown in the Plans.
- B. Sheet, shore, and brace trenches, as necessary, to prevent caving or sliding of trench walls, to provide protection for workmen and the pipe, and to protect adjacent structures and facilities.
- C. Where solid timber sheeting is driven to a level below the top of pipe, it should not be removed after the pipe has been installed. The sheeting may be cut off at the level of the top of the pipe.
- D. If a movable shield is used, it is imperative that pipe already laid be securely blocked or braced to prevent opening of pipe joints when the shield is advanced in the trench.
- E. The bedding shall be placed on a flat undisturbed or restored trench bottom with a minimum thickness beneath the pipe barrel of 6 inches or one eighth of the outside diameter of the pipe, whichever is greater.
- F. After laying the pipe, the bedding material shall be carefully placed in the haunches of the pipe to fill the voids, consolidate the material and support the pipe barrel. Haunches shall be filled with a flattened shovel or other suitable tool.
- G. Pipe barrel shall be placed so that it is true to line and grade and to provide uniform and continuous support. Bell or coupling holes shall be dug so that the load is entirely supported by the pipe barrel. The bell or coupling shall not support any portion of the pipe load. Bell or coupling holes shall be no larger than necessary to ensure that the pipe barrel is resting firmly and evenly on the trench bottom or bedding material. Bell or coupling holes are properly dug when there is 1-inch minimum clearance between the bottom of the bell and the bottom of the bell or coupling hole.
- H. A foundation may be required if soft, spongy, unstable, or other similar material is encountered upon which bedding material or pipe is to be placed. Unstable material shall be removed to a depth ordered by the ENGINEER and replaced with foundation material suitably densified.

- I. Bedding and Backfill Material shall be in accordance with COP standard details P1120-R through P1127-R. CONTRACTOR shall take care to not float VCP when using CLSM bedding. CONTRACTOR shall place CLSM in layers so as to not float pipe. CLSM shall be placed directly on top of pipe so that there is an even layer of CLSM on both sides of the pipe, thus preventing lateral movement of the pipe inside the trench.
- J. There shall be a minimum of 5 feet of cover over the top of the pipe prior to use of any heavy mechanical compaction equipment (sheepsfoot roller, hydraulic vibration compactor, etc.) when using ABC backfill is being used. Walk behind and hand held compaction equipment shall be used within the trench for depths below 5ft top of pipe cover.

3.2 VITIRFIED CLAY PIPE (VCP) CONNECTIONS TO JUNCTION STRUCTURES AND MANHOLES

- A. General:
 1. VCP shall have a flexible connection between a junction structures and manholes. Concrete, Mortar or Grout shall not be used to connect or seal VCP to structures.
 2. Points of flexibility shall be used within 36-inches of junction structure or manholes. This shall be accomplished by installing the following on each pipe to structure connection:
 - a. One short length of pipe 24 – inches per connection and
 - b. One flexible boot per connections. Boots shall conform to ASTM C923 standard specification for resilient connectors between reinforced concrete manhole structures, pipe, and laterals.
 - 1) Cast in Place Junction Structures shall have flexible boots cast into the structure.
 - 2) Precast Manholes boots shall use expansion clamps to seal the flexible boot to the manhole structure. Expansion clamps shall be made with type 316 stainless steel. Expansion seal clamps shall seal against the precast manhole wall without excessive deformation of the seal. Single adjustable clamps shall be used for pipe sizes equal to or smaller than 26 inches, Double adjustable seals shall be used for pipe sizes between 26 and 32 –inches.

3.3 TESTING

- A. The CONTRACTOR shall be responsible for testing all pipelines. All testing shall be performed in the presence of the ENGINEER and conform to the following paragraphs.
- B. After installation, backfilling, compaction, cleaning and before paving, acceptance testing shall be performed by low pressure air testing.

C. Air Testing:

1. Testing shall be performed by the low pressure air test method conforming to ASTM C828 - Standard Test Method for Low Pressure Air Test of Vitrified Clay Pipe.
2. Each section between manholes or structures will be plugged. Plugs shall be secured prior to air pressurization.
3. Air shall be added until a pressure of 4-psi is reached. Air pressure will fluctuate after initial pressurization and will need to be stabilize do to temperature changes. After pressure stabilization, reduce the pressure to 3.5 psi and start the test time:
4. The system passes the test is the rate of air loss, as measured by the pressure drop from 3.5 psi to 2.5 psi, does not exceed the following table.

Table 1
Minimum Test Time for Various Pipe Sizes

Nominal Pipe Size, in.	T (time) min/100 ft	Nominal Pipe Size, in.	T (time) min/100 ft
4	0.3	24	3.6
6	0.7	27	4.2
8	1.2	30	4.8
10	1.5	33	5.4
12	1.8	36	6.0
15	2.1	39	6.6
18	2.4	42	7.3
21	3.0		

Lines which fail any testing will be evaluated, repaired/replaced and retested for compliance with these specifications and the cost of any re-testing shall be borne by the contractor.

++ END OF SECTION ++

SECTION 15070

HIGH DENSITY POLYETHYLENE PIPE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. The CONTRACTOR shall provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish, install and test high density polyethylene (HDPE) pipe and fittings for sanitary sewer gravity application in accordance with ASTM and AWWA as modified by the Contract Documents.
2. A single pipe supplier shall be responsible for furnishing all HDPE pipe. This does not prevent multiple pipe and fitting manufacturers; however, supplier of the HDPE pipe shall direct all Work. The responsibility of the pipe supplier, at a minimum, shall include:
 - a. Certify all pipe and fittings are being manufactured in full accordance with the Contract Documents.
 - b. Manage the design and fabrication of the pipe and fittings.
 - c. Prepare and submit all submittal information and shop drawings.
 - d. Make any corrections that may be required to the submittal information and shop drawings.

B. Related Sections:

1. Section 01300, Submittals.
2. Section 15051, Buried Piping Installation.

1.2 REFERENCES

- A. ASTM A193, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
- B. ASTM A194, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
- C. ASTM D2774, Standard Practices for Underground Installation of Thermoplastic Pressure Piping
- D. ASTM D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
- E. ASTM D3261, Standard Specification for Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing .

- F. ASTM F714, Standard Specification for Polyethylene (PE) Pipe (SDR-PR) Based on Outside Diameter.
- G. ASTM F1055, Standard Specification for Electrofusion for Outside Diameter Controlled Polyethylene Pipe and Tubing.
- H. ASTM F2164, Standard Practice for Field Leak Testing of Polyethylene (PE) Pressure Piping System Using Hydrostatic Pressure.
- I. ASTM F2620, Standard Practice for Heat Fusion Joining of Polyethylene Pipe and Fittings .
- J. ANSI/ASME B16.5, Pipe Flanges and Flanged Fittings: NPS 1/2 through 24 - Metric/Inch Standard.
- K. ASME B 18.2.1, Square, Hex, Heavy Hex, and Askew Head Bolts and Hex, Heavy Hex, Hex Flange, Lobed Head, and Lag Screws (Inch Series).
- L. AWWA C906, Polyethylene (Pe) Pressure Pipe & Fittings 4 In (100 Mm) Thru 63 In (1,575 Mm) For Water Distribution And Transmission.
- M. AWWA Manual M55, PE Pipe – Design and Installation.
- N. Plastic Pipe Institute Handbook of Polyethylene Pipe, 2nd Edition.
- O. Plastic Pipe Institute Technical Report TR-33, Generic Butt Fusion Joining Procedure for Field Joining of Polyethylene Pipe.
- P. Plastic Pipe Institute Technical Note TN-44, Recommended Minimum Training Guidelines for PE Pipe Butt Fusion Joining Operators for Municipal and Industrial Projects.

1.3 SUBMITTALS

- A. Contractor shall submit shop drawings, product technical data, test reports and record drawings in accordance with Section 01300, Submittals.
- B. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining

- acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
- C. Certified dimensional drawings of all pipe, fittings and appurtenances.
- D. Pipe Laying Schedule Information.
1. Pipe laying schedule, marking diagrams that indicate the unique identification number of each pipe and fitting and the location of each pipe and the direction of each fitting in the completed line. In addition, the line layouts shall include the station and centerline or invert elevation to which the pipe will be laid; all elements of curves and bends, both in horizontal and vertical alignment and the limits of concrete encasement.
 2. The pipe laying schedule shall have a sequence of laying and an explanation of all abbreviations used in the schedule. For long, straight pipe runs, the pipe laying schedule shall list the pipeline station and either the pipe centerline or invert elevation coordinated with the Drawings at least every 100 feet.
 3. Drawings showing proposed location and details for hydrostatic testing of the pipeline.
 4. Details and locations of closures for length adjustment.
 5. The method that the CONTRACTOR proposes to use for measuring deflection of pipe joints.
- E. Fusion Information. Submit the following prior to performing any Work:
1. Written fusion procedures.
 2. Certification of compliance that fusion operators have received training and comply with installation procedures per the manufacturer's recommendations. Certificates shall be submitted prior to beginning of construction.
 3. Data Logger specification and sample report. At a minimum, reports shall include fusion operator, time, date, heater temperature, pressure, and station number of joint.
 4. Log listing for all fusion operators to be used for the Work.
 5. Fusion map showing the sequence of fusions.
 6. Fusion machine(s) specification and maintenance log.
 7. Shop drawings and fusion information together as a complete package.
- F. Detail drawings indicating the type, number and other pertinent details of the slings and other methods proposed for pipe support and handling during manufacturing, transport, and installation. Documentation confirming that the handling and support system has been designed and sealed by a registered professional engineer, licensed in the State of Arizona. The recommended methods of handling and placement of the

- pipe shall be submitted to the ENGINEER as a record copy prior to transporting of any pipe to the Site. All pipe handling equipment and methods shall be acceptable to the ENGINEER.
- G. For record copy, detailed drawings indicating loading and shipping procedures that are designed to minimize damage to pipe
 - H. Pipe manufacturer's Written Quality Assurance/Control Program.
 - I. Sample of pipe identification tape.

1.4 MANUFACTURER QUALIFICATIONS

- A. The CONTRACTOR shall submit the qualifications for the pipe manufacturers. Qualifications shall include the following:
 - 1. Pipe Supplier Information. Submit company name, contact name, and contact number.
 - 2. Years of Experience. Submit written verification that the pipe manufacturer has been manufacturing ASTM F714 pipe with similar design pressure and size as this Project for a minimum of five years.
 - 3. Project Experience. Submit written verification that the pipe manufacturer has produced a minimum of 45,000 linear feet of 24-inch or larger pipe. Submit reference names, telephone numbers, and descriptions of projects for pipe conforming to ASTM F714 and this requirement. Descriptions for applicable projects shall include, but not be limited to, length, diameter, SDR, location of facility where pipe was manufactured and names and titles of key plant personnel involved with the Work.
 - 4. Production and Delivery Capability. Submit written verification from the pipe manufacturer/fabricator demonstrating compliance with the production and delivery schedule of the pipe as indicated in the CONTRACTOR's preliminary construction schedule.

1.5 QUALITY ASSURANCE

- A. The pipe manufacturer shall provide the services of an experienced, competent, and authorized representative to visit the site of the work to advise and consult with CONTRACTOR during joining and installation of the pipe. The manufacturer's representative shall not directly supervise CONTRACTOR's personnel, and CONTRACTOR shall remain responsible for the pipeline work.
- B. Fusion joints shall be made by qualified fusion technicians who shall demonstrate fusion experience on projects completed within a year of the CONTRACTOR's NTP date which included similar or larger installation lengths, similar pipe sizes (+/- 2 pipe sizes) and similar DRs (+/- 2 DRs).

- C. Storage and handling shall meet the requirements of Product Storage and Handling Requirements section, and shall be in accordance with Chapter 7, Transportation, Handling and Storage of Pipe and Fittings of AWWA Manual M55, to ensure installation in sound, undamaged conditions. Pipe shall not be stored uncovered in direct sunlight.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Pipe

1. Pipe shall be 36-inch ductile iron pipe size (DIPS) and dimension ratio DR 20 with a pressure class of 100-pound per square inch, unless otherwise specified on the plans.
2. PE4710 (ASTM F714) high density polyethylene, minimum cell classification 445574C as determined by ASTM D3350.
3. Thermal butt fusion joints per ASTM F2620 and ASTM F3190.
4. A green stripe shall be integrated into the pipe for sewer service identification.
5. Piping and fittings shall be manufactured with a minimum of 2% of carbon black for ultraviolet protection.

B. Heat Fusion Joints

1. Butt fusion joints, ASTM F2620; .
2. Transitions between unlike wall thickness equal to one Standard DR shall be butt fusion joints, ASTM F2620. Shall have the same pressure rating as the adjoining pipe unless otherwise specified.

C. Flanged Joints

1. HDPE Flange Adapters: PE4710 (ASTM F714) high density polyethylene, minimum cell classification 445574C. Shall have a manufacturing standard of ASTM D3261. Shall have the same pressure rating as the adjoining pipe unless otherwise specified. Stub Ends are not allowed.
2. Backup Rings: Convuluted Type per ANSI/ASME B16.5, Class 150, AISI 316, or 316L. Rings shall be equally or greater pressure rated than the pipe, unless otherwise specified. Plate rings are not allowed.
3. Flange Bolts: ASTM A193 Class 2, AISI Type 316, ANSI B18.2.1, heavy hex head, length such that, after installation, the bolts will project 1/8 to 3/8 inch beyond outer face of the nut.
4. Flange Nuts: ASTM A194, AISI Type 316, ANSI/ASME B18.2.2, heavy hex pattern. Washers shall be installed under the nuts.
5. Dismantling Joints: Smith Blair, Model 975, AISI Type 316. All dismantling joints shall be restrained

D. Fittings

1. PE4710 (ASTM F714) high density polyethylene, minimum cell classification 445574C.
 2. Electrofusion Type: ASTM F1055 having pressure class equivalent to the pipe or greater as required.
 3. Fabricated Type: Meet applicable AWWA C906 requirements; pressure class and cell class equivalent to the pipe or greater as required.
 4. Molded Types: Shall be manufactured and tested in accordance with ASTM D3261. Shall have the same pressure rating as the adjoining pipe unless otherwise specified.
 5. Other Types: Subject to review by the Engineer.
 6. Bends shall have a radius to pipe outside diameter ratio of two ($R/D = 2$) for the cleaning pig.
- E. Coal Tar Epoxy:
1. High build coal tar epoxy; Ameron "Amercoat 78HB Coal Tar Epoxy", Carboline "Bitumastic 300 M", Tnemec "46H 413 Hi Build Tneme Tar", or Sherwin-Williams "Hi-Mil Sher-Tar Epoxy".
- F. Conductive Tracer:
1. Detection tape, 3 inches wide; aluminum foil core, 0.5 mil thick, encased in a protective inert plastic jacket; 5,000 psi min tensile strength; 2.5 lb/inch per 1,000 feet min weight; color coded in accordance with APWA Uniform Color Code; Allen Systems "Detectatape", Lineguard "Type III", or Reff Industries "Terra Tape D".

PART 3 - EXECUTION

3.1 INSPECTION

- A. Pipe and fittings shall be carefully examined for cracks and other defects immediately before installation, with special attention to pipe ends. All defective pipe and fittings shall be removed from the site of the work. Pipe with cracks greater than 10 percent of the thickness of the pipe shall be removed from pipe by cutting pipe square and removing the defective portion of the pipe.

3.2 INSTALLATION

- A. Laying Pipe: Pipe shall be protected from lateral displacement. Pipe shall not be laid in water or under unsuitable weather or trench conditions, and shall be protected against entry of foreign matter.
1. During cold weather with ambient conditions 40°F or below, particular care shall be taken in handling and laying pipe to prevent damage by impact. Fusion Operators shall protect fusion equipment in cold weather and keep it out of wind and precipitation.

2. Whenever pipe laying is stopped, the open end of the line shall be closed with a tight-fitting end board to keep out sand and earth. The end board shall have several perforations near its center to admit water into the pipe, to prevent flotation in the event the trench is flooded. Any standing water shall be removed from the trench before the end board is removed.
 3. Pipe installed in warm weather shall be cooled prior to jointing to a structure or a valve. Cooling shall be done by bedding and backfilling pipe upto 12-inches above top of pipe. Enough room shall be left in the trench for fusion equipment jointing.
 4. Pipe shall be protected from extended exposure to sunlight, shall be kept as cool as possible during installation, and shall be covered with backfill immediately after installation.
- B. Cleaning: The interior of all pipe and fittings shall be thoroughly cleaned before installation and shall be kept clean until the work has been accepted.
- C. Alignment: Piping shall be laid to the lines and grades indicated on the drawings. Pipelines or runs intended to be straight shall be laid straight. Deflections from a straight line or grade shall not exceed the maximum deflection specified by the manufacturer.
1. Unless otherwise specified or indicated on the drawings, and subject to acceptance of the Engineer, either shorter pipe sections or fittings shall be installed as required to maintain the indicated pipeline alignment or grade.
- D. Cutting Pipe: Cutting shall be in accordance with the pipe manufacturer's recommendations. Cuts shall be smooth, straight, and at right angle to the pipe axis. After cutting, the end of the pipe shall be dressed to remove all roughness and foreign matter in accordance with the manufacturer's instructions.
- E. Jointing: Jointing of pipe and fittings shall be performed in accordance with the instructions and recommendations of the pipe manufacturer and in accordance with ASTM F2620. Sections of HDPE pipe shall be joined above ground into continuous lengths by the thermal butt fusion method. All fusions shall be made with fusion equipment equipped with a Data Logger.
1. Where required, electrofusion shall be performed in accordance with ASTM F1055 and the manufacturer recommended procedure.
 2. Socket fusion and extrusion welding or hot gas welding will not be acceptable.
 3. All joining procedures shall be acceptable to ENGINEER.
 4. Fusion equipment and operators shall be protected from cold temperatures, elevated temperatures, wind, and dust during the fusion process.
- F. Connections with Existing Piping: Connections between new work and existing piping shall be made using suitable fittings per ENGINEER'S approval. Each connection with an existing pipe shall be made one at a time and under conditions which will least interfere with service to customers, and as authorized by the OWNER.

- Facilities shall be provided for proper dewatering and for disposal of all water removed from the dewatered lines and excavations without damage to adjacent property.
- G. Flange Installation: Flange connections shall be installed in accordance with the manufacturer's recommended procedure. Flanges shall be centered and aligned to the mating component before assembling and tightening bolts. In no case shall flange bolts be used to draw the connection into alignment. Bolt threads shall be lubricated, and flat washers should be used under the nuts. Bolts shall be evenly tightened according to the tightening pattern and torque step recommendations of the manufacturer. At least 1 hour after initial assembly, flange connections shall be re-tightened following the tightening pattern and torque step recommendations of the manufacturer. Connections shall be retightened a second time after at least 4 hours in accordance with manufacturer's recommendations. The final tightening torque shall be as recommended by the gasket manufacturer
- H. Concrete Encasement : Concrete encasement shall be installed as indicated on the drawings. Concrete and reinforcing steel shall be as specified in the Cast-in-Place Concrete section. All pipes to be encased shall be suitably supported and blocked in proper position and shall be anchored against flotation.
- I. Reaction Anchorage and Blocking: All tees, plugs, and other fittings installed in piping subject to internal hydrostatic head in excess of 30 feet shall be provided with suitable reaction blocking, anchors, joint harnesses, or other acceptable means of preventing movement of the pipe caused by internal pressure.
1. Concrete blocking shall extend from the fitting to solid undisturbed earth and shall be installed so that all joints are accessible for repair. The dimensions of concrete reaction blocking shall be as indicated on the drawings or as directed by Engineer.
 2. Reaction blocking, anchorages, or other supports for fittings installed in fill or in other unstable ground shall be provided as indicated on the drawings or as directed by Engineer.
- J. Protective Coating: All steel clamps, rods, bolts, and other metal components of tapping saddles or reaction anchorages subject to submergence or in contact with earth or other fill material, and not encased in concrete, shall be protected from corrosion by two coats of coal tar paint applied to clean, dry surfaces. The first coat shall be dry and hard before the second coat is applied.
- K. Internal Bead Removal: HDPE pipe containing raw sewage shall have internal beads removed from pipe prior to bedding and backfilling pipe. CONTRACTOR shall use a manufacturer approved internal bead removal equipment.

3.3 FIELD QUALITY CONTROL

- A. Hydrostatic Tests: After installation, HDPE piping shall be hydrostatically tested for defective workmanship and materials per ASTM F2164.
- B. Leakage: All HDPE piping with butt fusion welded fittings shall have zero leakage. Each leak that is discovered within the correction period stipulated in the General Conditions shall be repaired by and at the expense of CONTRACTOR.
- C. Fusion Joint Tests. The first butt fusion joint of the project shall be tested and approved. In addition, a new fusion operator shall have a sample butt fusion joint tested and approved prior to working on the project. The CITY may randomly request a fusion joint be tested at the expense of the CONTRACTOR. The CONTRACTOR shall submit testing procedures and minimum desired results conforming to manufacturer's recommendations for approval by the ENGINEER. The fusion joints may be tested by the following:
 - 1. Bend Back Test (recommended for HDPE pipe thickness less than 1-inch).
 - 2. The CONTRACTOR may wish to use an alternative test (ie, tensile test or side-bend test).
- D. Pipe Deflection Tests: Pipe shall be measured for deflection at 50 foot intervals unless otherwise required by the City.
- E. Fusion Bead Visual Inspection. Each fusion joint shall be inspected to check for fusion uniformity and alignment. A double-bead will be formed in the fusion process. Each side of the double bead shall be equally rolled over the surface of the pipe, uniformly rounded, and consistent in size around the perimeter of the joint. The width of the double bead should be 2 to 2 ½ times the bead height above the pipe surface. The v-groove depth between the beads should not be more than ½ the bead height. A fusion bead troubleshooting guide from the pipe supplier shall be available on site at all times.
- F. Any portion of the pipe not meeting field quality control shall be removed and a new section of pipe installed.

++ END OF SECTION ++

SECTION 15120

PIPING SPECIALTIES AND ACCESSORIES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install all piping specialties and accessories. Included, but not limited to, are: flexible couplings, mechanical couplings, flanged and harnessed adapters, and expansion joints.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications:

1. Manufacturer shall have a minimum of five years experience of producing substantially similar types of piping specialties specified and shall be able to show evidence of at least five installations in satisfactory operation for at least five years.
2. Each type of piping specialty and accessory shall be the product of one manufacturer.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:

1. Detailed drawings and data on each type of coupling, adaptor and expansion joint to be furnished. Submit and coordinate these with Shop Drawings required for piping systems. Comply with requirements of Section 01330, Submittals, and Section 01332, Shop Drawing Procedures.
2. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
3. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Referenced and applicable sections to be marked up and submitted include:
 - a. 15050 - Piping Systems.
4. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written

explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 15051, Buried Piping Installation, and Section 15052, Exposed Piping Installation.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Couplings: Unless otherwise specified, piping 2-inches in diameter and larger passing from concrete to earth shall be provided with two pipe couplings or flexible joints as specified within 2-feet or one pipe diameter of the structure, whichever is greater.
 - 1. Sleeve Type, Flexible Couplings:
 - a. Pressure and Service: Same as connected piping.
 - b. Material: Carbon steel for carbon steel and exposed ductile iron piping systems, or stainless steel for stainless steel and buried or submerged ductile iron piping systems.
 - c. Gasket: Suitable for water service.
 - d. Bolts and Nuts: Alloy steel, corrosion-resistant, prime coated. Buried couplings shall have Type 316 stainless steel bolts and nuts.
 - e. Harnessing:
 - 1) Harness couplings to restrain pressure piping. Test pressures for pressure pipelines shall conform to the requirements of Section 15050, Piping Systems.
 - 2) Adjacent flanges shall be tied with bolts of corrosion resistant alloy steel. Provide flange mounted stretcher bolt plates as shown on the Drawings and to be designed by manufacturer, unless otherwise approved by the ENGINEER.
 - 3) Conform to dimensions, size, spacing and materials for lugs, bolts, washers and nuts as recommended by manufacturer and approved by ENGINEER for the pipe size, wall thickness and test pressure required. However, the following minimum bolting shall be provided, unless otherwise approved by the ENGINEER.

<u>Pipe Diameter (Inches)</u>	<u>Number of Bolts</u>	<u>Bolt Diameter (Inches)</u>	<u>At (Degrees)</u>
4	2	5/8	180
6-8	2	3/4	180
10-12	2	7/8	180 or 250
14-20	4	1	190
24-48	4	1	90
54	4	1	250
60	4	1-1/4	90

- f. Remove pipe stop, unless otherwise shown on the Drawings or specified.
 - g. Product and Manufacturer: Provide one of the following:
 - 1) Style 38, Dresser Industries.
 - 2) Type 411, Smith Blair.
 - 3) Type 501, Romac Industries.
 - 4) Ford FC2A.
 - 5) Or equal.
2. Flanged Coupling Adapters:
- a. Use flanged type adapters as shown per the Drawings.
 - b. Description: One end of adapter shall be flanged and the other end shall have a sleeve type flexible coupling.
 - c. Pressure and Service: Same as connected piping.
 - d. Material: Cast iron or steel.
 - e. Gasket suitable for wastewater and digester gas service and can withstand the specified temperature. EPDM gaskets for 250° F air service.
 - f. Bolts and Nuts: Type 316 stainless steel.
 - g. Harnessing:
 - 1) Harness adapters to restrain pressure piping. Test pressures for pressure pipelines shall conform to the requirements of Section 15050, Piping Systems.
 - 2) For adapters 12-inch diameter and less, provide 1/2- inch minimum stainless steel anchor studs installed in a pressure tight anchor boss. Provide number of studs required to restrain test pressure and service conditions. Harness shall be as designed and recommended by manufacturer; however, the following minimum anchor studs shall be provided, unless otherwise approved by ENGINEER.
 - a) 6-inch diameter and less: Two.
 - b) 8-inch diameter and less: Four.
 - c) 10-inch diameter and less: Six.
 - d) 12-inch diameter and less: Eight.
 - 3) For adapters larger than 12-inch diameter, provide split-ring harness clamps with a minimum of four Type 316 stainless steel bolts. Harness assembly shall be as designed and recommended by manufacturer.

Dimensions, sizes, spacing and materials shall be suitable for service and conditions encountered and shall be approved by ENGINEER.

- 4) Harness couplings to restrain pressure piping.
 - 5) Test pressures for pressure pipe lines shall conform to the requirements of Section 15050, Piping Systems.
 - 6) Harnessing shall conform to the details shown on the Drawings.
 - h. Product and Manufacturer: Provide one of the following:
 - 1) Type 911 or Type 913, Smith Blair.
 - 2) RFCA or Style FC 400, Romac Industries.
 - 3) Or equal.
- B. Packed Expansion Joints:
1. The expansion joint shall be of the slip type containing injectable packing ports, allowing additional packing to be added under full line pressure.
 2. Expansion joints shall be able to handle a 150 psi steam working pressure and to withstand 300°F temperature.
 3. Graphite injectable packing and seals are required.
 4. Internal and external guides are required and shall conform to ASTM SB 169-C614.
 5. An approximate, 360-degree, stainless steel, extension limit stop shall be included on each slip tube. The slip tube shall be made from Schedule 80 carbon steel pipe, conforming to ASTM A 53 GR.B pipe through 16-inches internal pipe size (IPS).
 6. The slip tube shall be hard-chrome plated 0.802-inch thick in accordance with ASTM B 650. The one piece body shall conform to ANSI A 53, GR.B.
 7. A drain port shall be provided.
 8. Flanges shall be ASTM A 105 raised face slip on or flat faced.
 9. Internal and external non-chromed surfaces shall be coated with a 0.008-inch dry-film thickness of Tnemec Potapox epoxy coating.
 10. Expansion joints minimum travel shall be 4-inches, and shall allow 0.5-inch expansion.
 11. Expansion joints full stroke life cycle shall be a minimum of 20,000 full strokes.
 12. Expansion joints shall have the same requirements as listed above.
 13. Product and Manufacturer: Provide packed expansion joints of one of the following:
 - a. Hyspan.
 - b. Or equal.
- C. Dielectric Connections:
1. Where a copper pipe is connected to steel or cast iron pipe or steel pipe is connected to cast iron pipe, an insulating section of rubber or plastic pipe shall be provided. The insulating section shall have a minimum length of 12 pipe diameters. Dielectric unions may be used instead of the specified insulating sections.
 2. Product and Manufacturer: Provide one of the following:
 - a. EPCO.
 - b. Capitol Manufacturing.
 - c. Or equal.

- D. Materials or products which contact drinking water as part of a water treatment process or water supply system including but not limited to pipe, gaskets, fittings, linings, coatings, etc. shall require NSF/ANSI 61, Drinking Water System Components Health Effects, approval or must comply with Arizona Administration Code R18-4-213, Standards for Additives, Materials, and Equipment.

2.2 PAINTING

- A. Clean and shop prime and shop finish coat ferrous metal surfaces of equipment in accordance with the requirements of Section 09900, Painting.
- B. Coat machined, polished and non-ferrous surfaces and similar unpainted surfaces with corrosion prevention compound which shall be maintained during storage and until equipment begins operation.
- C. Field painting shall conform to the requirements of Section 09900, Painting.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install piping specialties and accessories in accordance with manufacturer's instructions and recommendations.
- B. Make adjustments to expansion joints as required to ensure that they will be fully extended when the ambient temperature is at minimum operating temperature and fully compressed at maximum operating temperature for the system in which they are installed.

++ END OF SECTION ++

SECTION 15121

WALL PIPES, FLOOR PIPES AND PIPE SLEEVES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:

1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install all floor pipes, pipe sleeves, wall pipes, and other wall pieces to complete the Work.

B. Coordination:

1. Review installation procedures under this and other Sections and coordinate the installation of items that must be installed with, or before, the wall pipes, floor pipes and pipe sleeves Work.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

1. ANSI B16.1, Cast-Iron Pipe Flanges and Flanged Fittings.
2. ANSI B16.4, Cast-Iron Threaded Fittings.
3. AWWA C104 (ANSI A21.4), Cement-Mortar Lining for Ductile Iron Pipe and Fittings for Water.
4. AWWA C106 (ANSI A21.6), Cast Iron Pipe Centrifugally Cast in Metal Molds, for Water and Other Liquids.
5. AWWA C110 (ANSI A21.10), Ductile Iron and Gray Iron Fittings, 3-inch through 48-inch, for Water and Other Liquids.
6. AWWA C111 (ANSI A21.11), Rubber-Gasket Joints for Ductile Iron and Gray-Iron Pressure Pipe and Fittings.
7. AWWA C115 (ANSI A21.15), Flanged Ductile Iron and Gray Iron Pipe with Threaded Flanges.
8. AWWA C151 (ANSI A21.51), Ductile Iron Pipe, Centrifugally Cast in Metal Molds or Sand-Lined Molds, for Water or Other Liquids.
9. AWWA C200, Steel Water Pipe 6-inches and Larger.
10. ASTM A 312 Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
11. AWWA C 220 Standards for Stainless-Steel Pipe, 1/2 In. and Larger
12. AWWA C 226 Stainless Steel Fittings for Waterworks Service, Sized 1/2 Inch through 72 Inch.
13. NSF/ANSI 61, Drinking Water System Components and Health Effects.

14. Arizona Administrative Code R18-4-213, Standards for Additives, materials, and Equipment.

1.3 SUBMITTALS

- A. Shop Drawings: Submit for approval the following:
 1. Detailed drawings and data on all wall and floor pipe, and pipe sleeves. Submit and Comply with the requirements of Section 01332, Shop Drawing Procedures.
 2. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
 3. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
 4. The CONTRACTOR shall submit the preventive maintenance information package as part of the shop drawing submittal package to the ENGINEER for review and approval. **SHOP DRAWING SUBMITTAL PACKAGE WILL NOT BE APPROVED WITHOUT ACCEPTANCE OF PREVENTIVE MAINTENANCE INFORMATION AS DESCRIBED IN SPECIFICATION SECTION 01785.**
 5. Certificate of compliance with NSF/ANSI 61 Standard or with Arizona Administrative Code R18-4-213, in accordance with Section 01600.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

- A. Refer to Section 15051, Buried Piping Installation and Section 15052, Exposed Piping Installation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wall and Floor Pipes:

1. Material: Same as specified for the piping connected to wall or floor pipe, unless otherwise approved by ENGINEER.
2. Length: Wall fittings shall be equal to the thickness of the wall in which they are installed plus the exterior projection required for connection.
3. End Connections: As shown on the Drawings or approved by the ENGINEER.
4. Thickness: Same as specified for the piping connected to wall or floor pipe, except for stainless steel piping.
5. Collars: Provide collars at mid-point of wall for anchorage and water tightness.
6. Pipes ends shall be flush with wall face, unless otherwise shown on the Drawings.
7. Flanged ends and mechanical joint bells shall be drilled and tapped for studs. Provide studs of same material as connected piping, except submerged and buried studs shall be of Type 316 stainless steel.
8. HDPE pipe which is cast into walls or floors shall have a collar at mid-point of wall for anchorage and water tightness, as shown on the Drawings or as required.

B. Pipe Sleeves:

1. Ferrous and Plastic Pipe: Use stainless steel pipe with integral wall collar continuously welded to mid-point of sleeve for anchorage and water tightness, unless otherwise shown on the Drawings.
2. Size sleeves to provide annular space required to accommodate mechanical link-type seals that are used.
3. Buried steel pipe sleeves shall comply with Section 15102, Steel Pipe.

C. Wall Sleeves:

1. Material: 316 Stainless Steel furnished with integral wall collar.
2. Dimensions: As required for pipe to pass through sleeve. Length as required.

D. Mechanical Seals: Provide link-type mechanical seals in pipe sleeves with adjusting bolts suitable for 20 psi working pressure.

1. Type: Mechanical seals through non-fire rated walls or floors:
 - a. Pressure Plate: 316 Stainless Steel.
 - b. Bolts and Nuts: 316 Stainless Steel.
 - c. Sealing Element: EPDM rubber.
2. Type: Mechanical seals through fire-rated walls or floors; two independent mechanical seal assemblies required:
 - a. Pressure Plate: Low carbon steel, galvanized.
 - b. Bolts and Nuts: Low carbon steel, galvanized.
 - c. Sealing Element: Silicone rubber.
3. Type: Mechanical seals through buried steel sleeves:
 - a. Pressure Plate: Composite.

- b. Bolts and Nuts: Type 316 Stainless Steel.
 - c. Sealing Element: EPDM rubber.
 4. Product and Manufacturer: Provide one of the following:
 - a. Thunderline Corporation.
 - b. Or equal.
- E. Wall and Ceiling Plates:
 1. Bare pipes passing through walls and ceilings in finished rooms: Provide escutcheon plates of chrome plated steel, clevis or split ring and hinged with set screws.
 2. Insulated pipes passing through walls, floors, and ceilings in finished rooms: Provide plated escutcheon plates of 18 gage chrome plated steel.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wall and Floor Pipes: Install as shown on the Drawings and in accordance with approved Shop Drawings and manufacturer's recommendations.
- B. Pipe Sleeves:
 1. Use sleeves wherever pipes pass through walls, partitions, floors, and roofs, unless otherwise shown on the Drawings.
 2. All sleeves through floor slabs in process areas shall extend a minimum of 2-inches above finished floor.
 3. All sleeves through floor slabs in finished areas shall extend a maximum of 1/4-inch above finished floor.
 4. Anchor sleeves to concrete and masonry walls as shown on the Drawings or otherwise approved by the ENGINEER.
 5. Sleeves through walls shall be flush with wall face.
 6. All pipe joints and annular spaces in exterior walls or walls subjected to hydrostatic pressure shall be completely watertight.
 7. For mechanical seals size sleeves to provide annular space required to suit link-type mechanical seals that are provided.
 8. Do not install sleeves and pipes through structural members, unless specifically shown on the Drawings and approved by the ENGINEER. Such sleeves, if required, shall be Schedule 40, steel pipe or approved seamless steel tubing.
 9. Size sleeves to provide annular space as follows:

<u>Pipe Size</u>	<u>Sleeve ID Minus Pipe or Insulation OD</u>
Less than 2-inches	1/2-inch to 3/4-inch
2-inches to 4-inches	3/4 inches to 1-1/4-inch
6-inches to 12-inches	1-1/4 inches to 2-inches
Over 12-inches	2-inches to 3-inches

10. Seal annular spaces between pipe and sleeve, material and installation shall be as specified in Section 07920, Calking and Sealants.
 11. Buried pipe sleeves shall have mechanical seals at each end.
- C. Install wall and ceiling plates in accordance with the manufacturer's recommendations and the approved Shop Drawings.

++ END OF SECTION ++

SECTION 33020

TRENCHLESS INSTALLATION OF STEEL CASING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. General information, products, and execution for trenchless installation of steel casing.
2. The work under this section shall consist of all trenchless installation of steel casing within the project limits and/or within CAWCD right-of-way or easements.
3. This work consists of furnishing all labor, equipment, appliances, and materials required for performing all operations in connection with the trenchless installation of piping.

1.2 MEASUREMENT & PAYMENT

A. Measurement

1. Trenchless installation of steel casing pipe will be measured by liner foot from the end of jacked pipe in the bore pit to the end of jacked pipe in the reception pit and paid as a lump sum.

B. Payment

1. The contract price paid for steel casing pipe shall include full compensation for furnishing all labor, materials, tools, equipment, and incidentals and for doing all work involved in placing steel casing pipe including placement of carrier pipe, annular space fill material (when required), bulkheads and the excavation and backfilling of pits complete in place as shown on the plans, as specified herein, and as directed by CAWCD.
2. Any additional work specified by CAWCD will be paid for per linear foot, in relation to the amount covered within the lump sum contract price.

1.3 DEFINITION

- A. Casing Pipe: An outer sleeve, installed by trenchless or open-cut methods.
- B. Carrier Pipe: Pipe inserted within casing pipe, which acts as a conveyor of liquid or gas.
- C. Launching Pit: The pit where tunneling equipment is installed, and where casing pipe and carrier pipe are launched.

- D. Receiving Pit: The pit located at the end of casing pipe, remote from the launching pit, at the point where carrier pipe emerges from casing pipe.
- E. CAP: Central Arizona Project canal system and all appurtenant features and infrastructure within its legal property limits.
- F. CAWCD: Organization charged with operations & maintenance responsibility of CAP infrastructure.

1.4 SUBMITTALS

- A. Installation Details:
 - 1. Submit a lay schedule showing stationing, elevation, casing pipe lengths, and wall thickness.
 - 2. Submit method for installing carrier pipe inside steel casing, including the CONTRACTOR's proposed method for continuously monitoring the line and grade of casing pipe. The proposed method shall provide the capability to control the line and grade of casing pipe during the operation to ensure the installation remains within the tolerances specified.
- B. Casing Pipe:
 - 1. Product information, including diameter, thickness, and class for each jacked casing crossing.
- C. Casing Spacers:
 - 1. Details of all materials, banding, and insulating material.

1.5 QUALITY ASSURANCE

- A. System Description: The completed installation shall be suitable for transporting liquid or gas without affecting the stability, performance, and integrity of the CAP canal, structural embankments, zoned backfill, canal lining, O&M roads, pipelines, or other features of the CAP canal system.
- B. Steel casing pipe shall be the product of a single manufacturer.
- C. Welders shall be certified in accordance with AWS.
- D. Project Requirements:
 - 1. Discharge from dewatering operations shall be directed into approved receiving basins.
 - 2. Provide maintenance of traffic; establish and maintain safety procedures in road and CAWCD right-of-way during the operation.
 - 3. Inspect locations where operations are to be conducted and casing pipe is to be installed. Verify conditions under which Work is performed. Provide necessary

- details for the orderly installation of Work within CAWCD right-of-way. Verify number, type, and location of existing utilities prior to beginning Work.
4. The method of installation used shall not result in measurable settlement, movement, or cracking of existing structures, buried facilities, irrigation channels, or adjacent roadways and railways. If movement or settlement occurs that causes or may cause damage to these structures over, along, or adjacent to Work, operations shall stop immediately except for activities that assist in preventing further movement, settlement, or damage.
 5. Existing structures, buried facilities, irrigation channels, railways, and roadways damaged by operations shall be repaired or replaced as necessary to restore them to a proper condition, at the CONTRACTOR's expense.
 6. The CONTRACTOR shall submit a written statement that the inspection and the specified tests have been completed and that results comply with the requirements of these Specifications.
- E. Delivery, Storage and Handling
1. Care shall be taken in loading, transporting, and unloading to prevent damage to pipe or coatings. Pipe shall not be dropped. Repair any damage to pipe coatings.
 2. Pipe and materials shall be carefully handled to protect against damage to lining and coating and interior and exterior surfaces, impact shocks, and free fall. Pipe handling equipment shall be acceptable to CAWCD.
 3. Pipe shall not be placed directly on rough ground but shall be supported in a manner that protects it from damage. Damaged pipe shall be repaired in a manner acceptable to CAWCD or new undamaged pipe shall be furnished and installed.
 4. Inspect each pipe to ensure there are no damaged portions. Remove or smooth burrs, gouges, weld splatter, or other small defects prior to laying.

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

- A. Casing Spacers (Skids) and Insulators:
1. Advanced Products & Systems, Inc., Model SI-12
 2. BWM Company, Model SS-12
 3. CCI Pipeline Systems
 4. Pipeline Seal and Insulator, Inc., Model C12G
- B. Composite Sleeve Casing Spacer:
1. Clock Spring Company, L.P.
- C. Casing Joints:
1. Permalok Corporation, Permalok interlocking pipe system
- D. End Seals:

1. Advance Products and Systems, Inc., Model AC or AW
2. Pipeline Seal and Insulator Company, Model C or W

2.2 MATERIALS

A. Steel Casing Pipe:

1. Steel casings shall be leak-proof and in accordance with ASTM A 139, Grade B. Steel casing pipe shall have a minimum yield strength of 36,000 psi and shall be designed to withstand Cooper E-80 live loading with diesel impact and any relevant jacking load.
2. The inside diameter of casing pipe shall be large enough to allow carrier pipe to be installed with casing skids and joint restraint without disturbing casing pipe, adjacent subgrade, or adjacent facilities and structures.
3. Casing pipe shall have the minimum nominal diameter and wall thickness shown on the drawings and listed herein:

Casing Pipe Inside Diameter (Inches)	Casing Pipe Wall Thickness (Inch)
6 to 12	0.250
16 to 20	0.312
22 to 24	0.375
26 to 28	0.437
30 to 34	0.500
36 to 38	0.562
40 to 50	0.625
52 to 58	0.750
60 to 78	0.813
84 to 90	0.875
96 to 102	0.937
108 to 114	1.000
120	1.125

4. Joints:
 - a. Beveled ends for butt-welding.
 - b. Permalok.
5. Grout Ports:
 - a. 2-inch standard pipe IP threaded half couplings welded to the casing pipe and fitted with threaded galvanized iron plugs. Locate grout ports a minimum of every 4 feet along pipe springline and centerline of the pipe section per Grout Injection Port Detail.

B. Casing Spacers (skids) and Insulators:

1. Type: SST, bolt on with a shell made of at least two halves.
 - a. Band: 14 gauge hot-rolled and pickled mild steel coated with a 10 mil to 16 mil fusion-bonded PVC coating.
 - b. Non-conductive PVC liner:
 - 1) Thickness: 0.090 inch minimum.
 - 2) Hardness: Shore durometer A 85 to A 90.
 - 3) Dielectric strength: 60 kV minimum.
 - 4) Surge test, 1/8 inch: 58 kV minimum, step-by-step test.
 - 5) Water absorption: 1% maximum.
 - c. Risers: 10-gauge steel MIG welded to band
 - d. Ultra-high molecular weight polymer glass-reinforced runners with high abrasion resistance and low coefficient of friction meeting the following properties:
 - 1) Tensile strength in accordance with ASTM D 638: 17,600 psi, minimum.
 - 2) Flexural strength in accordance with ASTM D 790: 25,300 psi, minimum.
 - 3) Compression strength in accordance with ASTM D 648, 10% deformation: 18,000 psi, minimum.
 - 4) Deflection temperature at 264 psi in accordance with ASTM D 648: 405°F.
 - e. Studs, nuts, and washers:
 - 1) Studs: 5/16 inch, 18 inches by 2 1/2 inches 18-8 SST.
 - 2) Hex nuts: 5/16-inch SST.
 - 3) Washers: 5/16-inch SAE 2330 SST.
 - f. Width: 12 inches.

C. Composite Sleeve Casing Spacers:

1. Type: A composite sleeve consisting of a three-part system consisting of a unidirectional fiberglass sleeve, high-strength filler, and adhesive.
 - a. Unidirectional fiberglass sleeve:
 - 1) Material: Fiberglass and polyester/vinyl ester resin.
 - 2) Thickness:
 - a) Each layer: 0.065 inch.
 - b) Complete, eight-layer system: 1/2- inch non-conductive PVC liner.
 - 3) Width: 11 1/2 inches.
 - b. Filler: Compressive strength: Greater than 8,000 psi.
 - c. Adhesive: Lap shear strength: Greater than 1,200 psi.

D. End Closure: Pull-on casing seal or wrap-around casing seal.

1. 1/8 inch minimum thick 60 durometer EPDM or neoprene rubber.
2. Wrap around seals shall overlap the casing pipe by 2 inches and shall be held on with AISI 304L SST worm gear clamps held together with mastic strips to seal the edges.
3. Custom pull-on end seals shall be seamless with vulcanized edges.

E. Liner Plate:

1. Plates: Accurately curved to comply with tunnel cross-section and all dimensions of such size and accuracy so that plates of similar curvature will be interchangeable.
2. Connections: Bolts on both the longitudinal and circumferential joints. Bolts and nuts shall not be less than 5/8-inch diameter and in accordance with ASTM A 307, Grade A, and hot-dip galvanized in accordance with ASTM A 153.
3. Zinc coating: Minimum of 2 oz/sf surface area on all sides in accordance with ASTM A 123.
4. Grout ports: 2-inch standard pipe IP threaded half couplings welded to the casing pipe and fitted with threaded galvanized iron plugs. Locate grout ports at a minimum of every 4 feet along pipe alternating between springline and top of pipe.
5. Loading: Soil and HS-20 traffic loading or Cooper E-80 as applicable.

PART 3 - EXECUTION

3.1 GENERAL

- A. Furnish labor, materials, equipment, and incidentals required to install casing pipe and carrier pipe at the locations shown on the drawings.
- B. Work shall include, but not be limited to, steel casing pipe, liner plate, casing spacers, carrier pipe, casing seals, coatings, location markers, and miscellaneous appurtenances as required.
- C. Sending and receiving shaft shoring designs and liner plate designs if liner plate is used, shall be prepared, stamped, and signed by a Registered Professional Engineer.
- D. Provide special insurance, traffic control, flaggers, and any other requirements imposed by CAWCD.
- E. Provide a minimum of 14 days advance notice of the start of excavation for installation. Coordinate with CAWCD regarding casing pipe installation schedule so that CAWCD representative can be onsite during installation.

3.2 PREPARATION

- A. Subgrades shall be kept continuously free from ground and surface waters during casing and carrier pipe installation. Observed water levels prior to the Work shall be below the invert level of the jacking pits and pipe subgrade.
- B. Groundwater control along and at the face of the tunneling operation shall include chemical grout stabilization as required.

- C. Earthwork operations including, but not limited to, trench excavation, pit excavation, pipe bedding, trench backfill, and compaction required for the installation of casing pipe shall be performed as specified in CAP CS 31-2030. In areas outside the steel casing, pipe shall be laid directly on imported bedding material. Blocking is not permitted. The bedding shall form a continuous, solid bearing for the full length of the pipe. Excavations shall be made as needed to facilitate the removal of handling devices after the pipe is laid. Excavation shall be made outside the normal trench section, as needed and at field joints to permit adequate access to the joints for field welding operations.

3.3 INSTALLATION

A. Trenchless Methods:

1. Excavate the launching pit; furnish excavation supports as required. Excavation support shall extend a sufficient depth below the invert of the steel casing pipe to resist any pressure developed by the soil outside the launching pit.
2. Provide a level concrete slab or level stable gravel surface at the bottom of the launching pit. Steel rails or beams may be embedded in the concrete slab to aid in the placement and alignment of casing pipe or carrier pipe during installation operations.
3. Furnish, install, and remove thrust blocks or similar features as may be required in driving casing pipe or carrier pipe forward.
4. Pothole utility crossings in advance of the installation of casing pipe to determine their exact locations; verify there are no conflicts with the boring and jacking operation. Damages and costs that may be realized by the failure to locate and protect utilities are the responsibility of the CONTRACTOR.
5. Maintain proper alignment and elevation of the casing pipe consistently throughout the tunneling operation. The proposed method shall provide the capability to control the line and grade of the casing pipe during the operation to ensure installation remains within the tolerances provided herein.
6. Tolerances for the installation of casing pipe:
 - a. Vertical alignment: ± 3 inches; select casing pipe diameter that is sufficiently large to compensate for off grade installation.
 - b. Horizontal alignment: ± 3 inches.
7. Installation of the casing pipe shall be continuous; take precautions to avoid interruptions that may cause the pipe to freeze in place.
8. Dewatering through the casing pipe during construction is not permitted.
9. Steel casing pipe sections shall have one end square and one end beveled with a single v-groove and full penetration butt-welded on the entire outside circumference of the casing. Prior to butt-welding, the pipe and the pipe joint shall be properly positioned using line up clamps. In the finished joint, the abutting pipe sections shall not be misaligned by more than 1/16 inch. Welding procedures used to install casing pipe shall be prequalified in accordance with AWS D1.1 or ASME Boiler and Pressure Vessel Code, Section IX. ASME certification is required for butt-welded joints. Joints of steel casing shall be butt-welded prior to being subjected to the jacking operation.

10. Jacking shall be performed in a manner that prevents voids from developing outside the jacking sleeve. A jacking shield shall be used to minimize the number of voids produced during excavation in the forward end of the jacking sleeve. If the jacking operation causes an excessive loss of soil, pressure grout the jacked section to fill external voids outside of the jacked casing. CAWCD representative shall be onsite during the installation to view tailings for assessment of existing soil conditions.
11. Install in such a manner as to ensure exterior voids are filled after completion. Provide grout injection ports and fill voids with pressure grout as specified in CS 33-0025.
12. After casing pipe is installed, thoroughly clean its interior; remove excess material leaving a smooth interior throughout.
13. The exit pit shall be excavated to the casing pipe. Provide excavation support as required. Provide sufficient room to continue installation of the carrier pipe.

B. Carrier Pipe:

1. Support the carrier pipe within the casing pipe so that pipe bells do not rest directly on the casing. Distribute the load of the carrier pipe along the casing pipe by using casing spacers.
2. Install within the casing using casing spacers. Install from the jacking pit end of the casing. Each joint within the casing pipe shall be of the restrained push-on type if DI or PVC pipe is utilized, and thoroughly checked prior to being installed into the casing. Steel pipe joints located within a steel casing shall be double welded lap or buttstrap joints.
3. For carrier pipe 24 inches and larger, fill the annular space between the casing pipe and the carrier pipe with sand or grout throughout the length of pipe. The method to be used to place the sand or grout shall be such to ensure complete filling of the annular space.
4. Install a rubber end closure seal after the carrier pipe is installed.

3.4 RESTORATION

- A. Remove excavation support systems for jacking pits. If withdrawal could damage or disturb the roadway, railroad, or ditch subgrade, leave supports in place and cut them off 36 inches below finished grade.
- B. Following the casing and carrier pipe installation and backfill operations, restore the Work area to its original grade and condition. Replace or construct miscellaneous small structures and fencing, if applicable, to match existing.
- C. Remove equipment, supplies, excess excavation materials, and miscellaneous items associated with the casing pipe installation operation. Leave the site in a clean and neat condition.

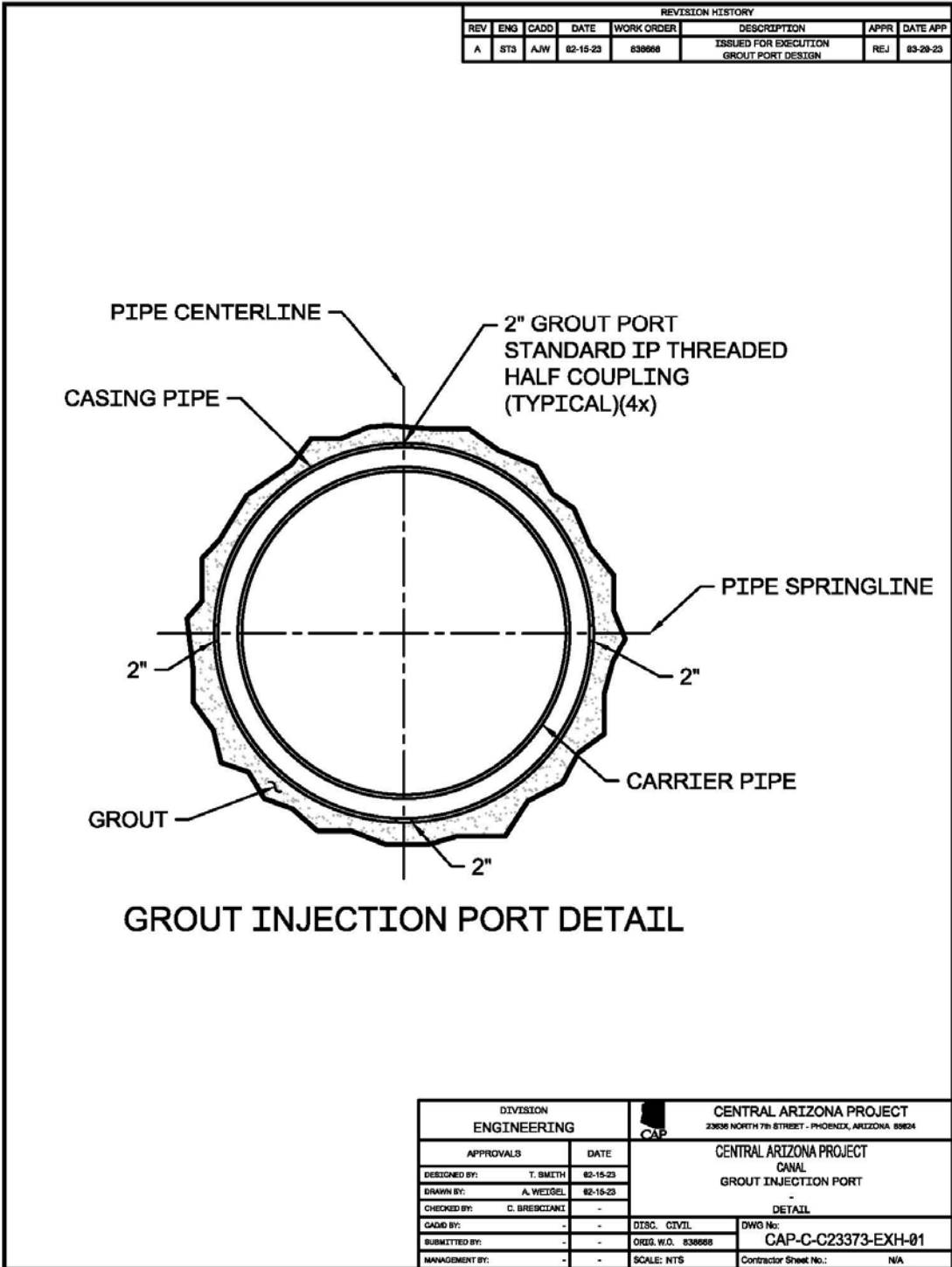
CITY OF PHOENIX: Water Services Department
PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
PROJECT NUMBER: WS90500307 & WS90501004

- D. Launching and receiving pits shall be backfilled with material approved by CAWCD in 8-inch lifts and compacted to 95% of maximum dry density per ASTM D698. The backfilled area shall be left slightly higher than surrounding grade to allow for unforeseen future settlement.
- E. If required by CAWCD, coordinate, and schedule a final inspection of the Work.

PART 4 - EXCLUSIONS

4.1 Items excluded from this specification: None.

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++ END OF SECTION ++

SECTION 33025

GROUTING OF STEEL CASING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
1. General information, products, and execution for grouting of steel casing.

1.2 MEASUREMENT & PAYMENT

- A. Measurement
1. Grout will be measured on a cubic foot basis and paid as a lump sum.
- B. Payment
1. The payment shall be made for this item at the contract lump sum price.
 2. Any additional work specified by CAWCD will be paid for per cubic foot, in relation to the amount covered within the lump sum contract price.

1.3 DEFINITION

- A. Contact Grouting: The controlled injection of fluid grout at the interface between casing pipe and the ground.
- B. Casing Pipe: An outer sleeve, installed by trenchless or open-cut methods.
- C. Carrier Pipe: Pipe inserted within casing pipe, which acts as a conveyor of liquid or gas.
- D. CAP: Central Arizona Project canal system and all appurtenant features and infrastructure within its legal property limits.
- E. CAWCD: Organization charged with operations & maintenance responsibility of CAP infrastructure.

1.4 SUBMITTALS

- A. Pre-Construction:
1. A detailed description of the grouting operation including:
 - a. Procedures for monitoring grout placement and controlling pressures.
 - b. Grout mix design including fluidifiers, accelerators, and other additives.
 - c. Grout material and properties including density, viscosity, bleeding, shrinkage, expansion, and set time.
 - d. Grout manufacturer's instruction. Mixing and installation instructions including data on water volume, workability, setting times, and temperatures.
 2. The proposed method of verifying that voids have been successfully grouted.

B. Construction:

1. Grout logs; within 1 day of grouting, submit field logs containing as a minimum:
 - a. A description of injection points using stationing along the tunnel and degrees clockwise looking up station from the crown.
 - b. The volume of grout taken at each injection point.
 - c. The maximum sustained pressure at each injection point.
 - d. Grout time for each hole from beginning to end of injection.
 - e. Grout sequence and stages, both longitudinal to and in a cross-section of the tunnel.
 - f. Grout equipment and setup including, as a minimum, mixers, pumps, agitators, circulation or deliver circuit, and gauges.
 - g. Grout mix pumped.

1.5 QUALITY ASSURANCE

A. Performance Requirements:

1. Design, plan, and perform grouting by or under the supervision of an experienced reputable firm regularly engaged in the type of work involved for at least 5 years.
2. Determine contact grouting equipment, materials, and methods subject to the limitations specified herein.
3. Ensure that the tunnel's final lining, utilities, and other facilities are not damaged by contact grouting operations

PART 2 - PRODUCTS

2.1 APPROVED MANUFACTURERS

A. Dry Pack Mortar:

1. Sika Corporation, Sika Repair 223
2. Williams Form Engineering Corporation, Wil-X Cement Grout, mixed with sand.

2.2 MATERIALS

A. Grout:

1. Stable colloidal suspension of cement, bentonite, water, fluidifier, and admixtures. Sand may be added provided the grout is demonstrated to have suitable flow characteristics. It may also be used to fill voids at the locations specified.
2. Design the grout mix to achieve the material properties specified, to grout the tunnel and anticipated ground conditions, and to be compatible with the grouting equipment.

3. Adjust the grout mix as necessary to address different tunnel and ground conditions.
 4. Unconfined compressive strength: Minimum 200 psi at 28 days; minimum 20 psi in 1 day.
 5. Adjust the w/cm of the grout as necessary to fill voids within the zone of grout influence, however, at all times the grout shall have a w/cm of between 1 to 1 and 3 to 1 by volume and a bentonite content of no more than 2%. No hole shall be completed with a w/cm above 1 to 1 by weight.
 6. Grout shall not show shrinkage when tested in accordance with ASTM C 827.
 7. Grout components and the handling and storage of grout components including, but not limited to, cement, fly ash, bentonite, pozzolans, admixtures, and water shall be as specified in this Section and as recommended by the Manufacturer.
 8. Store bulk cement and fly ash in suitable moisture-proof enclosures. Cement and fly ash that have become caked or lumpy shall not be used.
 9. Store sand in a manner that prevents segregation and the inclusion of foreign materials. The bottom 6 inches of sand piles in contact with the ground shall not be used.
- B. Cement:
1. In accordance with ASTM C 150, Type II, with less than 1% retained on the No. 200 sieve.
- C. Fly Ash:
1. In accordance with ASTM C 618.
- D. Admixtures:
1. Grout admixtures shall be compounds possessing characteristics which will increase the flowability of the grout mixture, assist in dispersal of the cement grains, retard or accelerate the set time, minimize bleed voids in grout, and neutralize the setting shrinkage of the grout.
 2. In accordance with ASTM C 494 and compatible with grout materials, including other admixtures.
 3. Approved by the CAWCD prior to use.
- E. Fluidifier:
1. Fluidifier holds the solid constituents of the grout in colloidal suspension and is compatible with the cement, sand, gravel, and water used in the grouting program.
 2. Fluidifier contains an expansive shrinkage compensator. Fluidifier shall not contain bentonite and other clay-like substances.
 3. Approved fluidifiers: Calcium ligno-sulfonate and sodium ligno-sulfonate.
 4. Storage: Furnish fluidifier in sealed containers and protect from moisture. Material that has become caked due to moisture adsorption will be rejected.

- F. Dry Pack Mortar:
 - 1. A specially proportioned mixture of Type II Portland cement, sand, quick-setting admixture, and water, or an approved, commercially manufactured mortar.

- G. Water:
 - 1. Water used in drilling grout holes and preparing grout shall be clean, and free from sewage, oil, acid, alkali, chlorides, salts, organic materials, and other impurities.

- H. Bentonite:
 - 1. Pulverized or powdered premium grade natural sodium cation bentonite in accordance with API 13A with a minimum yield of 90 barrels per ton.

- I. Sand:
 - 1. In accordance with ASTM C 144.

2.3 FABRICATION

- A. Grout Ports:
 - 1. 2-inch standard pipe IP threaded half couplings welded to the casing pipe and fitted with threaded galvanized iron plugs. Locate grout ports a minimum of every 4 feet along pipe springline and centerline of the pipe section per Grout Injection Port Detail.

PART 3 - EXECUTION

3.1 GENERAL

- A. The purpose of contact grouting is to fill voids completely behind casing pipe to result in firm contact between the ground and the structural elements of the tunnel.

3.2 INSTALLATION

- A. Equipment:
 - 1. Controls and instrumentation:
 - a. Grout flow: At the grout injection point, provide suitable valves and accurate pressure gauges so the pressure and grout flow at the grout holes may be monitored and regulated by increasing or decreasing the flow in the grout return line.
 - b. Volume of grout: Provide means for accurately determining the amount of grout injected into each hole.
 - c. Stop valves: Provide suitable stop, check, or ball valves at the collar of the hole for use in maintaining pressure as required until the grout has set.

- B. Contact Grouting:
1. Inject contact grout through grout ports in casing pipe to fill the annular space between the casing pipe and the excavated ground.
 2. Grouting behind casing pipe shall immediately follow the jacking of casing pipe into its final position.
 3. Grouting shall fill annular space over the entire 360-degree circumference of the casing pipe.
 4. Vent air and fluids (e.g., water, grout, and slurry) through the upper holes. Continue grouting until grout appears in the next set of grout holes which shall be kept open during grouting to permit the release of air and water.
- C. Mixing and Injection of Grout:
1. Grout materials shall be free of lumps when put into the mixer and the grout mix constantly agitated. Screen grout before entering the pump. Grout shall flow unimpeded and shall completely fill voids. Grout that has not been injected after 90 minutes of mixing shall not be used.
 2. Make connections for injecting grout at each grout fitting of the casing pipe as shown on the approved plans at each grout connection. The injection of grout during any stage of grouting shall be performed continuously, filling the spaces and voids, and avoiding the disturbance of grout that has taken initial set. The grouting process shall be operated and controlled so that grout will be delivered uniformly and steadily.
 3. Grouting shall progress from the grout hole in the sequence shown in the approved construction submittal.
 4. Maintain grout injection pressure so as not to heave or deform the ground surface or leak grout onto the ground surface. Grout injection pressure shall be determined by the CONTRACTOR but in no case shall pressure exceed 1 psi per vertical foot of over burden cover.
 5. Maintain grout injection pressure so as not to deform casing pipe.
 6. After the grouting of any pipe is finished, pressure shall be maintained by means of a ball or check valve or other suitable device until the grout has set to the extent that it will be retained in the hole.
 7. After removing the packer or grout pipe, fill any void left with dry pack mortar. Replace grout plugs in the pipe at the completion of grouting. Dry pack mortar shall be used to fill any recesses.

3.3 PROTECTION

- A. Take necessary precautions to protect and preserve the interior of the pipe from damage. Any damage to the lining caused by or occurring during the grouting operations shall be repaired by a method approved by and at no additional cost to CAWCD. Minimize grout spills and clean-up immediately after grouting.

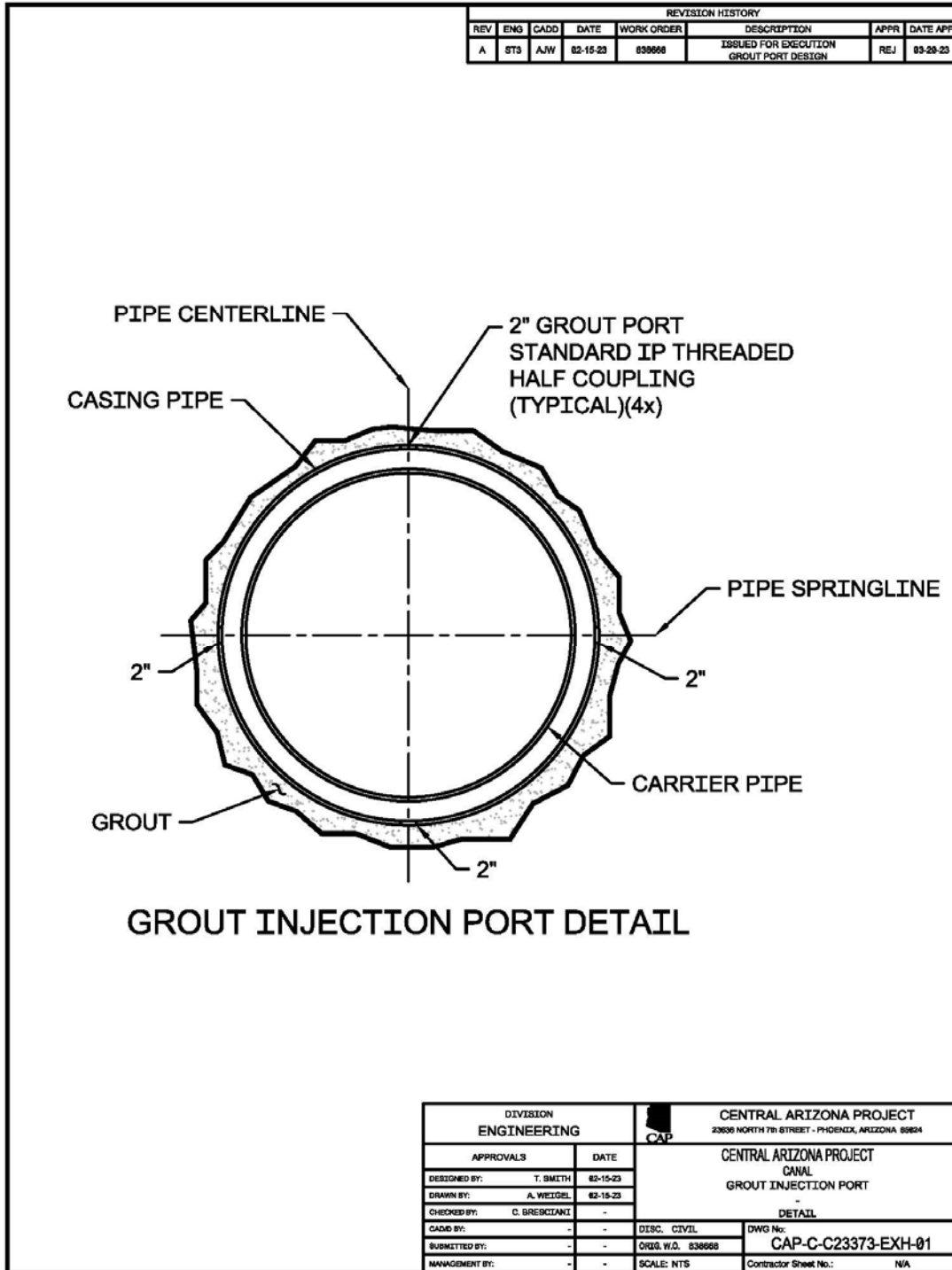
CITY OF PHOENIX: Water Services Department
PROJECT NAME: Northwest Wastewater Master Plan Package 4B – 51st Ave Sewer
PROJECT NUMBER: WS90500307 & WS90501004

3.4 QUALITY CONTROL

- A. Perform Work in the presence of CAWCD. Provide notification to the CAWCD, in writing, 14 days in advance of the start of a grouting operation.

PART 4 - EXCLUSIONS

4.1 Items excluded from this specification: None.



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++ END OF SECTION ++