



CITY OF TEMPE, ARIZONA  
PUBLIC WORKS DEPARTMENT  
ENGINEERING DIVISION

CONTRACT DOCUMENTS

FOR

GILBERT METERING STATION IMPROVEMENTS

PROJECT NO. 3206061



APPROVED BY:

Andrew H. Y. Goh, P.E.  
Deputy Public Works Director/City Engineer

CITY COUNCIL MEMBERS

Mayor – Mark W. Mitchell

Onnie Shekerjian	Joel Navarro
Corey Woods	Robin Arredondo-Savage
Shana Ellis	Kolby Granville

CITY MANAGER

Andrew B. Ching

**CITY OF TEMPE, ARIZONA  
PUBLIC WORKS DEPARTMENT  
DIVISION OF ENGINEERING**

February 27, 2014

**GILBERT METERING STATION IMPROVEMENTS**

**PROJECT NO. 3206061**

**ADDENDUM NO. 1 TO THE CONTRACT DOCUMENTS:**

The original contract documents are modified or interpreted as stated herein. Receipt of this Addendum No. 1 shall be acknowledged by inserting its number and date in the space provided on the Competitive Sealed Bid Forms page B-3. Failure to acknowledge may subject bidder to disqualification.

This Addendum No. 1 consists of 1 page.

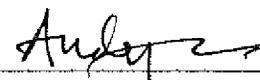
**INVITATION FOR BIDS**

***INSTRUCTION TO BIDDERS***

Refer to page 29, Section 4.1 SEALED BIDS, *replace* "Sealed bids will be received and the time of delivery recorded by the City of Tempe, Arizona, Public Works Department, Engineering Office, City Hall West Garden Level, 31 East Fifth Street, Tempe, Arizona 85281, until 9:00 a.m. (Arizona time), March 6, 2014" *with* "Sealed bids will be received and the time of delivery recorded by the City of Tempe, Arizona, Public Works Department, Engineering Office, City Hall West Garden Level, 31 East Fifth Street, Tempe, Arizona 85281, until **10:00 a.m. (Arizona time), March 25, 2014.**"



exp. 9/30/15

  
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Andy Goh, P.E.  
Deputy PW Manager/City Engineer

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**CITY OF TEMPE, ARIZONA  
PUBLIC WORKS DEPARTMENT  
ENGINEERING DIVISION**

**NOTICE TO CONTRACTORS**

**GILBERT METERING STATION IMPROVEMENTS  
PROJECT NO. 3206061**

**1. INTRODUCTION**

THIS INVITATION FOR BIDS is hereby offered by the City of Tempe, an Arizona municipal corporation ("City"), for Gilbert Metering Station Improvements, as set forth herein, and shall be identified as Project No. 3206061.

**1.1. OVERVIEW OF PROJECT**

The scope of work includes improvements to the Gilbert Sewer Metering Station located on the south side of Gilbert Road, west of Scottsdale Road.

**1.2. EXAMINATION OF PREMISES, SPECIFICATIONS, AND CONTRACT**

Bidder shall visit the site of the Project and shall fully acquaint itself with all conditions as they exist, so that it may fully understand the site, difficulties, and restrictions attending the execution of the work.

Bidder shall also thoroughly examine and be familiar with the specifications, plans, and the Contract documents. Failure of Bidder to obtain, receive, or examine any addenda to the proposed Contract, or to visit the site and acquaint itself with the conditions there existing, shall not relieve it from any obligation with respect to the submitted bid.

By submitting a bid, Bidder agrees that it has examined the site, specifications, plans, and Contract, and accepts, without recourse, all site conditions, the proposed Contract, and all exhibits and addenda thereto.

**1.3. START OF WORK / TERM OF CONTRACT**

Work shall start as soon as practicable, but not later than seven (7) calendar days after the Notice to Proceed date and shall be completed within one hundred eighty (180) calendar days following the Notice to Proceed date.

2. **SCOPE OF WORK**

The proposed work will consist of **CONSTRUCTION OF NEW ENTRY STRUCTURE, STAIRWAY FLUME COVER, VENTILATION BLOWER AND OTHER MISCELLANEOUS IMPROVEMENTS**, together with associated work.

2.1. **CONTRACTOR'S CONSTRUCTION SCHEDULE**

Prior to the start of work, a construction progress schedule shall be required and shall comply with the requirements of MAG Specifications 108.4. In addition, a schedule update comparing actual progress with scheduled progress will be required with the submission of each monthly pay request.

2.2. **UNIFORM STANDARD SPECIFICATIONS**

All work done under this Contract shall be accomplished in accordance with the Maricopa Association of Governments Uniform Standard Specifications and Details for Public Works Construction – 2013 Revision to the 2012 Edition (“MAG Specifications”) and the City of Tempe Supplement to the MAG Uniform Standard Details and Specifications for Public Works Construction – 2010 (“City of Tempe Supplement”), except as modified in the Contract.

In the case of a discrepancy or conflict, the order in which documents and Contract sections govern is as follows, from highest to lowest: special terms and conditions, technical specifications, plans, general terms and conditions, City of Tempe Supplement, and MAG Specifications.

All bids shall be made in accordance with the General Conditions of the MAG Specifications.

2.3. **CONTRACTOR'S REPRESENTATIVE**

Contractor shall at all times be present at the worksite or represented by a superintendent or other properly designated agent. Instructions and information given by City construction project manager to Contractor's superintendent or agent on the work shall be considered as having been given to Contractor.

2.4. **SUPERVISION BY CONTRACTOR**

Contractor will supervise and direct the work. It will be solely responsible for the means, methods, techniques, sequences, and procedures of construction. Contractor will employ and maintain on the work a qualified superintendent who shall be designated in writing by Contractor and approved by City as Contractor's representative at the site. The superintendent shall have full authority to act on behalf of Contractor and all communications given to the superintendent shall be as binding as if given to Contractor. The superintendent shall be present on the site at all times in order to perform adequate supervision and coordination of the

work. No substitution of the superintendent will be permitted without prior written request by the Contractor and written consent of City.

**2.5. AUTHORITY OF CITY ENGINEER'S APPOINTED REPRESENTATIVE**

City construction project manager shall act as City Engineer's designated representative during the construction period. He or she shall advise on questions concerning coordination with City, public safety, and quality and acceptability of materials and work performed. City Engineer, City construction project manager, or their assigned inspector shall interpret the intent of the Contract plans, specifications, and technical provisions in an unbiased manner.

City Engineer, City construction project manager, or their assigned inspector shall be present on the site at times during construction to monitor the work and to maintain records for Contract management. City construction project manager shall promptly make decisions relative to the interpretation of the Contract so as to minimize delays in construction. City construction project manager will not be responsible for directing construction, control, techniques, sequence, or procedures, or for directing job safety.

**2.6. BENEFICIAL OCCUPANCY**

Beneficial occupancy is use of a facility or project, in whole or in part, by City for its intended purpose. This may occur even though some work of the Contract remains undone. Prior to such use or occupancy, City will provide notice to Contractor and accomplish a partial acceptance inspection. Beneficial occupancy will apply to general right-of-way projects only.

**2.7. SUBSTANTIAL COMPLETION**

Substantial completion is work that is ready for occupancy and use for its intended purpose as certified by City and a certificate of occupancy. This term will be applied to building construction projects only.

**2.8. PROJECT COMPLETION**

Project completion is full completion of all construction associated with the Contract, including, but not limited to, punch list items, close-out documentation, operations and maintenance manuals, warranties, and record plans as certified by the architect/engineer of record. Contractor may be found in default of this Contract in accordance with MAG Specifications 108.10 should project completion fall behind substantial completion by more than forty-five (45) days.

**2.9. CONTRACT COMPLETION DATE**

The Contract completion date established by reference to the Notice to Proceed date is for completion of all or specified portions of the work. This includes items

of work to be completed under an owner allowance or as part of a contingency item. The stated Contract completion date will take into account anticipated or actual weather conditions that are not unusually severe for the area and time of year. This date may be expressed as a calendar date or as a number of calendar days after the Notice to Proceed date.

If time extensions are issued by City, the revised Contract completion date will be referred to as the adjusted Contract completion date.

**2.10. FINAL INSPECTION**

Contractor is responsible for complying with the specifications and is hereby forewarned that final approval of any work will not be given until the entire project is completed and accepted by City. Prior to final inspection on any City facilities requiring a building permit, Contractor must call for final inspection from the Community Development Department and Public Works Department of City. The final inspection must be completed prior to final acceptance and payment.

**2.11. FINAL ACCEPTANCE & GUARANTEE**

Final acceptance shall mean a written final acceptance of the work. City Engineer shall make the final acceptance promptly after the work has been inspected and found to be completed in accordance with the Contract. The work performed under this Contract shall be guaranteed for a period of one (1) year from the date of final acceptance.

**2.12. AS-BUILT DRAWINGS**

Contractor shall provide and maintain accurate field data on a redlined set of Contract drawings, which are to be kept current and submitted as complete at the conclusion of the construction. These record drawings will be used as documentation for progress payments, and upon project completion, for the preparation of record drawings by the architect/engineer. Final payment will not be issued until all record drawings are submitted by Contractor, and are certified to be complete by the architect/engineer of record.

**2.13. SHOP DRAWINGS, SCHEDULES & SAMPLES**

In time for each to serve its proper purpose and function, Contractor shall submit to City construction project manager such schedules, reports, drawings, lists, literature samples, instructions, directions, and guarantees as are specified or reasonably required for construction, operation, and maintenance of the facilities to be built and/or furnished under this Contract.

Shop drawings and data shall be submitted to City construction project manager as one (1) hard copy and one (1) legible electronic PDF document of each submittal.

The submittal shall clearly indicate the specific area of the Contract for which the submittal is made. The additional copies received will be returned to Contractor's representative at the job site. City construction project manager's notations of the action taken will be noted on one (1) of these returned copies.

The above drawings, lists, prints, samples, and other data shall become a part of the Contract and a copy of the same shall be kept with the job site Contract, and the fabrications furnished shall be in conformance with the same.

City construction project manager's review of the above drawings, lists, prints, specifications, samples, or other data shall in no way release Contractor from its responsibility for the proper fulfillment of the requirements of this Contract, nor for fulfilling the purpose of the installation, nor from its liability to replace the same should it prove defective or fail to meet the specified requirements.

#### **2.14. QUALITY CONTROL**

All material shall be new and of the specified quality and equal to the accepted samples, if samples have been submitted. All work shall be done and completed in a thorough, workmanlike manner, notwithstanding any omission from the Contract, and it shall be the duty of Contractor to call City construction project manager's attention to apparent errors or omissions and request instruction before proceeding with the work.

City Engineer may, through appropriate instruction, correct errors and supply omissions. Instructions provided by City Engineer shall be as binding upon Contractor as though contained in the original Contract.

At the option of City construction project manager, material to be supplied under this Contract will be tested and/or inspected either at its place of origin or at the site of the work. Contractor shall give City construction project manager written notification well in advance of actual readiness of material to be tested and/or inspected at point of origin. Satisfactory tests and inspections at the point of origin shall not be construed as a final acceptance of the material, nor shall it preclude retesting or reinspection at the site of the work.

#### **2.15. EXCESS MATERIALS**

Excess or unsuitable material, broken asphaltic concrete, and broken Portland cement concrete shall be disposed of by Contractor. Contractor shall, prior to commencement of the work, submit a letter to City Engineer stating the location

of disposal site(s) for all excess or unsuitable material and certifying that it has obtained the property owner's permission for the disposal of all surplus material.

**2.16. MISCELLANEOUS REMOVAL AND RELOCATIONS**

Miscellaneous removals and relocations shall be performed by the Contractor, and is construed to mean the removal of all unsuitable materials, whether designated or implied by the plans and specifications, and shall include but not be limited to removal of items of every nature and description such as pipes, concrete, asphalt, block, brick, rock, and metal, including temporary removal and reinstallation, unless such items are specifically designated in a separate bid item. In addition, certain items requiring temporary removal and reinstallation such as mail box stands, sign posts, survey monument frames and covers, shall be included in this category.

**2.17. PROTECTION OF FINISHED OR PARTIALLY FINISHED WORK**

Contractor shall properly guard and protect all finished or partially finished work, and shall be responsible for the same until that phase is completed and accepted by City.

Estimate or partial payment of completed work shall not release Contractor from such responsibility prior to City's acceptance, but Contractor shall turn over the entire work in full accordance with these specifications before final payment can be made.

**2.18. SURVEY CONTROL POINTS**

Existing survey monuments shall be protected by Contractor or removed and replaced under the direct supervision of City of Tempe Engineering Division Land Services Section.

One week prior to construction, Contractor shall notify City of Tempe Engineering Division Land Services Section of any survey monuments that need to be relocated. Any monuments damaged or lost due to the Contractor's negligence and/or lack of notification to City of Tempe Engineering Division Land Services Section shall be replaced at Contractor's expense. In the event a lot corner will be disturbed, Contractor shall notify affected property owner(s) and obtain consent prior to any construction. Any lot corners disturbed or lost due to Contractor's negligence shall be replaced at Contractor's sole expense.

**2.19. HINDRANCES AND DELAYS**

Except as provided herein, no charge shall be made by Contractor for hindrances or delays from any cause during the progress of any portion of the work set forth in this Contract; however, delays due to no fault or neglect of Contractor may

entitle Contractor to a time extension sufficient to compensate for the delays. The amount of the time extension, if any, shall be determined by City Engineer provided Contractor gives City Engineer immediate notice in writing of the cause of such delay.

The parties agree to negotiate in good faith for the recovery of damages related to expenses incurred by Contractor for a delay for which City is solely responsible that is unreasonable under the circumstances, and that was not within the contemplation of the parties to the Contract at the time the Contract was entered into.

**2.19.1.** Unless specifically provided for herein, the maximum compensation for an unreasonable or unforeseen delay shall not exceed the daily amount specified for liquidated damages in MAG Specification 108.9, as based on the original Contract amount.

**2.19.2.** This section shall not be construed to void any provisions of this Contract, which require notice of delays, or which provide for alternative dispute resolution, other procedures for settlement, or which provide for liquidated damages.

However, if the parties cannot reach agreement for the recovery of damages as set forth herein, the determination of City shall be final.

**2.20. SUBSIDIARY WORK**

All work called for in the plans and specifications shall be performed by Contractor, and unless a specific bid item is provided for the work, then such portion of the work will be considered subsidiary to other work for which payment is provided.

**2.21. MISCELLANEOUS WORK AND ALLOWANCES**

Unless otherwise specified in the Contract, the following items will be included in the work with no direct payment allowed. Payment shall be included in the payment for other items for which direct payment is made.

**2.21.1.** Contractor's expenses for, but not limited to, mobilization, job site office, storage facilities, traffic control and public safety devices, sanitary facilities, utilities, and telephone.

**2.21.2.** Cleanup, including day-to-day cleanup.

**2.21.3.** Notification to residents adjacent to this project prior to the start of work on construction that may affect them.

- 2.21.4. Water required for compaction or dust control.
- 2.21.5. Miscellaneous removals and relocations not otherwise specified in the Technical Specifications.
- 2.21.6. Power pole bracing.
- 2.21.7. Removal of trees twelve inches (12") or less in diameter.
- 2.21.8. Removal, relocation, and/or modification of existing walls and fences.
- 2.21.9. Trimming of trees and bushes.
- 2.21.10. Replacement of plant material and repair of irrigation equipment to meet or exceed conditions existing prior to Contractor beginning work.

**2.22. CHANGE ORDERS**

In the event that significant changes in the scope of the work and/or changes in the quantities due to contingencies of construction become necessary, such changes shall be made in accordance with Section 104.2 of the General Conditions in the MAG Specifications.

The costs associated with any extra work as authorized by City must be approved prior to the start of work. The final costs for additional work shall also include all charges associated with extended general conditions or Contract acceleration. Pay requests for extra work performed shall be submitted with the next billing cycle and shall not exceed thirty (30) days from the date extra work was performed.

**2.23. ADDITIONAL SERVICES**

Additional services that are outside the scope of basic services contained in this Contract shall not be performed by Contractor without prior written authorization from City. Additional services, when authorized by an executed Contract or an amendment to this Contract, shall be compensated for by a fee mutually agreed upon between City and Contractor.

**3. SPECIAL TERMS AND CONDITIONS**

**3.1. PAYMENT BOND; PERFORMANCE BOND**

A payment bond and a performance bond, each in an amount equal to the full contract amount, will be required of the Contractor immediately after notice of Contract award, and before final Contract execution. Each bond shall be in accordance with Arizona Revised Statutes (A.R.S.) § 34-201, *et seq.*, as amended from time to time.

Arizona law provides that the bonds shall be executed solely by a bonding company, liability insurance carrier, or excess insurance carrier that holds a certificate of authority to transact surety business in Arizona, issued by the director of the department of insurance pursuant to A.R.S. title 20, chapter 2, article 1, as amended from time to time. Additionally, the City requires that the bonding company, liability insurance carrier, or excess insurance carrier have a Financial Strength Rating of A- or better and a Financial Size Category of VII or higher, as listed in the most recent "Best's Key Rating Guide – Property/Casualty," published by A.M. Best Company. An individual surety or sureties shall not execute either bond, even if the requirements of A.R.S. § 7-101 are satisfied.

### 3.2. INSURANCE

Certificates of Insurance verifying insurance coverage that meets the following minimum requirements will be required of the Contractor immediately after notice of Contract award, and before final Contract execution.

Arizona law provides that the insurer must hold a certificate of authority to transact insurance in Arizona, issued by the director of the department of insurance pursuant to Arizona Revised Statutes, title 20, chapter 2, article 1, as amended from time to time. Additionally, the City requires that the insurance company have a Financial Strength Rating of A- or better and a Financial Size Category of VII or higher, as listed in the most recent "Best's Key Rating Guide – Property/Casualty," published by A.M. Best Company. This requirement does not apply to the Workers' Compensation / Employer's Liability portion of the Certificate of Insurance.

#### 3.2.1. Contractor shall maintain limits no less than:

- a. **Commercial General Liability:** \$2,000,000 combined single limit per occurrence for bodily injury and property damage, including coverage for contractual liability (including defense expense coverage for additional insureds), premises/operations, underground explosion and collapse hazard, personal injury, broad form property damage, products and completed operations, independent contractors and product liability. The general aggregate limit shall apply separately to this project/location or the general aggregate shall be twice the required occurrence limit.
- b. **Automobile Liability:** \$1,000,000 combined single limit per accident for bodily injury and property damage, including coverage for owned, hired, and non-owned vehicles as applicable.
- c. **Excess Liability (umbrella form):** As required.

- d. **Workers' Compensation and Employer's Liability:** Workers' Compensation and Employer's Liability statutory limits as required by the State of Arizona.
- e. **Health Insurance:** As required by City.

City shall have no responsibility or liability for such insurance coverage.

### 3.2.2. **Deductibles and Self-Insured Retentions**

Any deductibles or self-insured retentions must be declared and approved by City. At the option of City, either the insurer shall reduce or eliminate such deductibles or self-insured retentions as respects City, its officials, employees, and volunteers, or Contractor shall procure a bond guaranteeing payment of losses and related investigations, claims administration, and defense expenses.

### 3.2.3. **Other Insurance Provisions**

The policies or self-insurance certifications are to contain, or be endorsed to contain, the following provisions:

#### a. **Commercial General Liability and Automobile Liability Coverage:**

City, its officers, officials, employees, agents, and volunteers are to be covered as additional insureds with respect to: liability arising out of activities performed by or on behalf of Contractor including the insured's general supervision of Contractor; products and completed operations of Contractor; premises owned, occupied, or used by Contractor; or automobiles owned, leased, hired, or borrowed by Contractor. The coverage shall contain no special limitations on the scope of protection afforded to City, its officers, officials, employees, agents, or volunteers, for work related to Contractors', employees', agents', subcontractors', or sub-subcontractors' activities.

Contractor's insurance coverage shall be primary with respect to City, its officers, officials, employees, agents, and volunteers. Any insurance or self-insurance maintained by City, its officials, employees, or volunteers shall be in excess of Contractor's insurance and shall not contribute to it.

Any failure to comply with reporting provisions of the policies shall not affect coverage provided to City, its officers, officials, employees, agents, or volunteers.

Coverage shall state that Contractor's insurance shall apply separately to each insured against whom claim is made or suit is brought, except with respect to the limits of the insurer's liability.

**b. Workers' Compensation and Employer's Liability Coverage**

The insurer shall agree to waive all rights of subrogation against City, its officers, officials, employees, agents, and volunteers for losses arising from work performed by Contractor for City.

**c. Health Insurance Requirements**

All Contractors who enter into a contract in excess of \$30,000 with City must certify that Contractors have, and all of their subcontractors will have, health insurance for all project employees. Health insurance must be offered to eligible dependents of all such employees. An affidavit must be signed in the form included herein (Exhibit 8.9). Major subcontractors are defined as entities doing work in excess of \$30,000 as determined at the start of each project. All required health insurance must be maintained during the entire time of the Contract with the City.

Health insurance is required for all Contractor and major subcontractor employees who work more than one hundred and twenty (120) days in any calendar year. A "work day" consists of any time within a twenty-four (24) hour period, regardless of number of hours that the individual is paid. At this time, health insurance is not required for temporary employees or students working part-time who are enrolled in a recognized educational institution.

The health insurance requirements shall apply to all employees directly involved with this City project including support and administrative personnel.

All complaints concerning violations of the health insurance requirements shall be filed, in writing, with the Public Works Department, within thirty (30) days from discovery of the violation. An administrative hearing will be held before the Public Works Director, and a written decision of findings will be provided to the parties to the hearing within ten (10) days thereafter. Appeal from the decision of the Public Works Manager may be made within ten (10) days of the date of the decision by filing a notice of appeal in writing with the Public Works Department. If an appeal is timely filed, an administrative hearing will be held before an administrative hearing officer appointed by the City Manager. The decision of the administrative hearing officer shall be final.

In the event of a finding of violation of the insurance provisions, the company in violation of the provision shall be barred from bidding on, or entering into, any Public Works contract with City for a period of three (3) years from the execution of the Contract.

All Contractors subject to the health insurance requirements shall post, in English and Spanish, notice of the health insurance requirements at its office and at the job site.

**d. All Coverages**

Each insurance policy required by this Contract shall be endorsed to state that the coverage shall not be suspended, voided, and/or canceled by either party, reduced in coverage or in limits, except after thirty (30) days' prior written notice by certified mail, return receipt requested, has been given to City.

**3.2.4. Other Insurance Requirements**

Contractor shall:

- a. Immediately after notice of Contract award, and before final Contract execution, furnish City with certificates of insurance, in form and with insurers acceptable to City, which shall clearly evidence all insurance required in this Contract and provide that such insurance shall not be canceled, allowed to expire, or be materially reduced in coverage except on thirty (30) days' prior written notice by certified mail to City, and in accord with stated insurance requirements of this bid solicitation. MAG Specification 103.6 is fully incorporated into this Contract, except to the extent it conflicts with the limits set forth in this Contract. The insurance policies required by MAG Specification 103.6 shall additionally provide full coverage of indemnity to City, including an increase in the minimum limits to \$2,000,000 combined single limit coverage for General Liability. Prior to execution of the Contract, Contractor shall furnish City with a Certificate of Insurance as evidence that policies providing the required coverages, conditions, and limits are in full force and effect. Such certificates shall identify the project and shall provide for not less than thirty (30) days' advance written notice to City, by certified mail, of cancellation or termination. Any cancellation clause shall not include the phrases "endeavor to" or "but failure to do so shall impose no obligation or liability of any kind upon the insurer, its agents or representatives." City shall not be obligated, however, to review same or to advise Contractor of any deficiencies in such policies and endorsements, and such receipt shall not relieve Contractor from, or be deemed waiver of City's right to

insist on, strict fulfillment of Contractor's obligations under this Contract.

- b. Provide certified copies of endorsements and policies if requested by City in addition to certificates of insurance.
- c. Replace certificates, policies, and endorsements for any such insurance expiring prior to completion of services.
- d. Maintain such insurance from the time services commence until services are completed. Should any required insurance lapse during the Contract term, requests for payments originating after such lapse shall not be processed until City receives satisfactory evidence of reinstated coverage as required by this Contract, effective as of the lapse date. If insurance is not reinstated, City may at its sole option, terminate this Contract effective on the date of such lapse of insurance.

### **3.2.5. Subcontractors and Sub-Subcontractors**

Contractor shall include all subcontractors and sub-subcontractors as insureds under its policies. All coverage for subcontractors and sub-subcontractors shall be subject to all of the requirements stated herein for Contractor.

### **3.3. INDEMNIFICATION**

To the fullest extent permitted by law, Contractor shall defend, indemnify, and hold City harmless, including City's agents, officers, assigns, officials, and employees, from and against all claims, damages, losses, liability, and/or expenses, relating to, arising out of, or resulting from, any negligent acts, errors, mistakes, or omissions in the work or services performed by Contractor and its agents, employees, subcontractors, or assigns, for whom Contractor may be deemed responsible, relating to any goods, services, or materials arising from, or relating to, any term or covenant of this bid. The amount and type of insurance coverage required of Contractor as set forth herein will in no way be construed as limiting the scope of Contractor's duties to indemnify City. This provision shall survive the Contract term.

### **3.4. PAYMENT**

**3.4.1. Method of Payment.** Payment shall be made as directed in MAG Specifications 109.

### **3.4.2. Measurement of Payment.**

- a. Quantities of materials for this work shall be paid under the appropriate schedule of values based on costs for portions of the work that will be established at the pre-construction meeting, with no allowances for waste. Payment will be made after completion upon acceptance by City, and upon City's receipt of approved invoices.
- b. Payment for various items in the bid shall be compensation in full for furnishing all materials, labor, tools, equipment, and appurtenances necessary to complete the work in a satisfactory manner as specified. No additional payment will be made for work related to any item unless specifically called for in the bid.
- c. Materials placed without approval of the inspector, or materials rejected due to improper placing, improper proportions of materials, or materials found to be defective, will not be paid for.

### **3.5. PRE-CONSTRUCTION MEETING**

Contractor shall meet with the City Engineer for a preconstruction conference prior to commencing work. At the preconstruction conference, Contractor shall submit a progress schedule showing the order in which Contractor proposes to carry out the work; the dates on which Contractor and its subcontractors will start the salient features of the work, including procurement of materials, equipment, etc.; the ordering of articles of special manufacture; the furnishing of drawings, plans, and other data for the review and approval of the City Engineer; the inspection of structural steel fabrication; and the contemplated dates for the completion of the said salient features. The schedule may be in a bar chart format or a critical path method format. No schedule activity shall be shorter than one day or longer than 15 working days. The schedule must show interrelationships among the activities, and the controlling items of work throughout the project shall be identified. If requested by the City Engineer, Contractor shall furnish information needed to justify activity time durations. Such information shall include estimated manpower, equipment, unit quantities, and production rates. The schedule shall illustrate the completion of the work not later than the contract completion date.

Contractor shall furnish authorized signature forms and a list of Contractor's proposed subcontractors and major material suppliers.

Progress schedules shall have considered the time requirement for ordering articles of special manufacture to meet specific requirements of the work when structural steel fabrication inspection is required.

Contractor shall submit a traffic control plan in accordance with the subsection of Special Terms and Conditions titled Traffic Control.

Contractor shall also submit a safety plan and designate an employee as Safety Supervisor, in accordance with ADOT Standard Specifications Subsection 107.08. If approved by the City Engineer, Contractor may designate one employee to be responsible for both the traffic control and safety plans.

If the project requires that Contractor or City personnel to work from falsework, within shoring, or in any other hazardous area, Contractor shall submit as part of Contractor's safety plan specific measures it will use to ensure worker safety.

Contractor shall also submit a program for erosion control and pollution prevention, as set forth in ADOT Standard Specifications Subsection 104.09, on all projects involving clearing and grubbing, earthwork, structural work, or other construction, when such work is likely to create erosion or pollution problems.

If Contractor fails to provide the required submissions, the City Engineer may order the preconstruction conference suspended until such time as they are furnished. Work shall not begin until the preconstruction conference has been concluded and the safety plan has been approved, unless authorized by the City Engineer. Contractor shall not be entitled to additional compensation or an extension of contract time resulting from any delays due to such a suspension.

When the specifications require specific quality control measures for certain materials, Contractor shall designate a qualified employee as Quality Control Manager. The Quality Control Manager shall be responsible for the implementing and monitoring of the quality control requirements described in ADOT Standard Specifications Subsection 106.04(C).

A Schedule of Values identifying all of the components of the work is required. The City Engineer will comment on the required breakdown of the contract work. An approved Schedule of Values is required prior to submittal of the first payment application.

### **3.6. CONTRACT EXTENSION**

The prices bid in this Contract will be maintained for any extension period unless Contractor can demonstrate, to the satisfaction of City that the cost of their materials or service has increased. All work set forth in this Contract will be completed or scheduled for completion prior to any extension being granted.

**3.7. SUBLETTING OF CONTRACT**

In accordance with MAG Specifications Section 108, Contractor shall perform, with Contractor's own organization, construction work that amounts to not less than fifty percent (50%) of the total Contract price for pipeline construction, roadway construction, or roadway maintenance.

**3.8. LICENSES**

The low bidder and all subcontractors must carry the appropriate State of Arizona contractor's license(s) for the proposed work prior to award of the Contract. Should the lowest responsive bidder not be able to obtain the required license(s), the project may be awarded to the next lowest responsive bidder who has the required license(s).

Prior to execution of the Contract, the low bidder must possess a valid City Transaction Privilege License and shall provide the permit number of such for validation.

**3.9. HAUL PERMIT**

In any operation where more than one-tenth of an acre of surface area is disturbed and/or when unpaved onsite haul roads are used, Contractor will obtain a Maricopa County Air Quality Department permit as required under Rule 200 of the Maricopa County Air Pollution Control Rules and Regulations. This permit will require that a control plan to mitigate dust and tracking problems be submitted to the County for approval prior to issuance of the Earth Moving Permit. The control plan should be submitted to City for review prior to County submittal to ensure that all elements of the planned operation are covered. Please contact the Maricopa County Air Quality Department at 602-506-6010 for additional details.

In addition, all Contractors hauling fill or excavation materials where the haul exceeds five thousand (5,000) cubic yards, or when the duration of the haul is more than ten (10) working days, are required to obtain a City haul permit before the hauling operation begins.

Prior to receiving a hauling permit, Contractor must submit the required certificate of insurance, a plan showing the proposed haul routes, and a complete schedule of the hauling operation to the City Transportation Division. Prior to submittal, Contractor should contact Engineering Services for complete details for issuance of a City haul permit.

### **3.10. LANDSCAPING AND IRRIGATION REQUIREMENTS**

As applicable, Contractor shall be required to construct the landscape and irrigation improvements in accordance with the requirements of MAG Specifications Sections 430, 440, and 795, and the City of Tempe Public Works Department Standard Landscape and Irrigation Details and Specifications, latest edition (available at the City of Tempe Engineering Division, 31 East Fifth Street for five dollars (\$5.00) or online at <http://www.tempe.gov/engineering>). In addition, the landscape plant establishment and maintenance period will be ninety (90) days.

### **3.11. SPECIFIC PRODUCTS OR BRANDS**

In accordance with MAG Specification 106.4, specific brands and/or models of equipment, materials, or patented processes listed in the plans, specifications, standard details, and standard specifications are for demonstrative purposes only. They should not be construed as a sole source request for a specific product or brand. Contractor shall provide City with the required product data including, but not limited to, manufacturers' standard catalog cuts, brochures, diagrams, schedules, performance charts, illustrations, calculations, schematic drawings, printed installation, erection, application, and placing instructions, and other descriptive data related to the product in order for City to determine if the product is equivalent to the product listed for approval.

### **3.12. ENVIRONMENTAL REQUIREMENTS**

**3.12.1.** Contractor covenants and agrees that it shall, at all times during the term of the Contract, and at its sole cost and expense, comply with and assume sole responsibility and liability under all environmental laws applicable to use of or operations at the project site by Contractor, its agents, assigns, and/or employees. Contractor agrees that should it or any of its agents, assigns, or employees know of (a) any violation of environmental laws relating to the project site, or (b) the escape, release, or threatened release of any hazardous materials in, on, under, or about the project site, Contractor shall promptly notify City in writing of such, and that it will provide all warnings of exposure to hazardous materials in, on, under, or about the project site, in strict compliance with all applicable environmental laws. Further, Contractor covenants and agrees that it shall at no time use, analyze, generate, manufacture, produce, transport, store, treat, release, dispose of, or permit the escape of, or otherwise deposit in, on, under, or about the project site, any hazardous materials, or permit or allow any of its agents, assigns, or employees to do so. Prior to use of the project site, Contractor shall provide City an inventory of all equipment and materials stored and/or to be stored at the project site.

**3.12.2.** For purposes of this Contract, hazardous materials shall include but is not limited to, any and all substances, chemicals, wastes, sewage, or other

materials that are now or hereafter regulated, controlled, or prohibited by any environmental laws, including, without limitation, any (a) substance defined as a "hazardous substance", "extremely hazardous substance", "hazardous material", "hazardous chemical", "hazardous waste", "toxic substance", or "air pollutant" by federal laws, including, but not limited to, the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. § 9601, *et seq.*; the Resource Conservation and Recovery Act, 42 U.S.C. § 6901 *et seq.*; the Hazardous Materials Transportation Act, 49 U.S.C. § 1801, *et seq.*, the Toxic Substances Control Act, 15 U.S.C. § 2601, *et seq.*, and all amendments thereto or other similar governmental restrictions; and (b) any chemical, compound, material, substance, or other matter that: (i) is a flammable explosive, asbestos, radioactive material, nuclear material, drug, vaccine, bacteria, virus, hazardous waste, toxic substance, injurious by itself or in combination with other materials; (ii) is controlled, designated in, or governed by any hazardous materials laws; (iii) gives rise to any reporting, notice, or publication requirements under any hazardous materials laws; or (iv) gives rise to any liability, responsibility, or duty on the part of City or Contractor with respect to any third person under any hazardous materials laws.

3.12.3. In addition, Contractor must comply with the following requirements:

- a. Non-pick-up sweepers will not be allowed except as required to make joints during chip sealing operations.
- b. Water flooding of trenches with potable water will not be permitted.
- c. All paints applied by sprayers shall be of a water-based type.
- d. Provisions shall be made to prevent the discharge of construction silt, mud, and debris into City storm drains or streets.
- e. Spills of oil, gas, chemical, or any other hazardous materials must be reported and removed by approved procedures. Mitigation measures shall be taken to prevent contamination of construction storage sites.
- f. Concrete waste must be disposed of in an approved location and at least twenty-five (25) feet from established landscaping.
- g. City refuse roll-off containers shall be used on City projects unless otherwise directed by the City of Tempe Solid Waste Supervisor. If you should have any questions concerning any of the requirements or charges, please contact the Solid Waste Supervisor, at 480-350-8268.

- h. Hazardous wastes shall not be discharged into City's sanitary sewers or storm drainage system. All waste products shall be disposed of in accordance with applicable regulations.
- i. When archaeological features are encountered or unearthed, Contractor shall promptly report to the Director of the Arizona State Museum and to City. Excavation shall not resume in the identified area until approved by City Engineer.
- j. Contractor shall take whatever steps, procedures, or means to prevent abnormal, material spillage, or tracking conditions due to their construction operations in connection with the Contract. The dust control measures shall be maintained at all times during construction of the project, to the satisfaction of City Engineer, in accordance with Rule 200 of the Maricopa County Health Department Air Pollution Control Regulations, which require that an Earth Moving Permit be issued and a Control Plan be approved prior to commencement of work. Contact Maricopa County at 602-506-6700 for details.
- k. Contractor shall comply with all applicable federal regulations concerning National Pollutant Discharge Elimination System (NPDES) permits for storm discharges from construction sites.
- l. All materials supplied by Contractor shall be one hundred percent (100%) asbestos free unless otherwise approved by City.

No additional payment will be made for compliance with the above items.

In addition to the above, the use of new products made with reclaimed material and that meet project specifications is encouraged.

### **3.13. SAFETY REQUIREMENTS**

Contractor shall comply with all applicable federal, state, and local health and safety regulations, ordinances, and requirements including, but not limited to, the Federal Occupational Safety and Health Act of 1970 (29 U.S.C. § 651 *et seq.*), and all rules, regulations, and orders adopted pursuant thereto.

### **3.14. TRAFFIC CONTROL**

**3.14.1.** All traffic shall be regulated in accordance with the MAG Specifications; the City of Tempe Traffic Barricade Manual, latest edition; the Manual on Uniform Traffic Control Devices (MUTCD); and any special provisions included herein.

At the time of the pre-construction conference, Contractor shall designate an American Traffic Safety Services Association (ATSSA) certified individual, who is well qualified and experienced in construction traffic

control and safety, to be responsible for implementing, monitoring, and altering traffic control measures, as necessary, to ensure that traffic is carried through the work area in an effective manner and that motorists, pedestrians, bicyclists, and workers are protected from hazard including, but not limited to, motor vehicle accidents. City shall designate a representative who will oversee and monitor Contractor's agent and enforce City's requirements set forth herein. Contractor covenants to give City any assignment and/or assurances which may be necessary to effect such right of direct enforcement.

Contractor is solely responsible for, and assumes full liability for, the traffic control relating to this project. Contractor shall submit a final traffic control plan to City for its review and approval no less than one (1) week prior to commencing work under this Contract. Traffic, as referenced herein, shall include any and all motor vehicles, bicyclists, and pedestrian traffic on roadways, sidewalks, bicycle paths, alleys, and/or rights of way at, attendant to, and/or adjacent to the Project.

In the event alteration of traffic control is required for work or services provided herein, alterations shall be made in accordance with the latest edition of Part VI of the Manual on Uniform Traffic Control Devices, "Traffic Control for Streets and Highway Construction and Maintenance Operations," or the City of Tempe Traffic Barricade Manual, latest edition. The most restrictive provision shall apply. Unless identified otherwise in the Technical Specifications, City will undertake no responsibility or expenses relating to measurement, payment, or alteration of traffic control. All costs or expenses related to traffic control shall be considered incidental to other pay items. Any and all revisions relating to traffic and/or traffic control shall be submitted to City for review and approval in City's sole discretion.

Contractor is solely responsible for any and all loss, damage, replacement, or repair necessitated to any traffic signal equipment, traffic signal conduit, and/or circuits, arising from or relating to Contractor's work or services performed hereunder. Contractor shall have all repairs performed immediately at its sole expense by a licensed electrical contractor with experience in traffic signal repair, subject to pre-approval by City. Any and all repairs and/or replacement costs expended by City in this regard shall be reimbursed by Contractor at twice City's actual cost.

Contractor shall notify all adjacent or affected residents or businesses at least forty-eight (48) hours in advance of any street, alley, sidewalk, and/or driveway closures or modifications, and make suitable arrangements to have all vehicles moved to a satisfactory location outside the closed area. Pedestrian access shall be maintained along the length of the project at all times per the requirements of the Americans with

Disabilities Act and as approved by City. Contractor shall abide by applicable speed limits. Additional information may be obtained by contacting the City Transportation Division at 480-350-8219.

**3.14.2. Temporary Barricades**

Temporary barricades shall be regulated in accordance with the City of Tempe Traffic Barricade Manual, latest edition.

No additional payment by City will be made to Contractor or its subcontractor for temporary barricades, unless otherwise specified in the bid.

**3.15. CLEAN-UP**

Contractor agrees and covenants to adequately protect the work site, adjacent property, and the public in all phases of the work and/or services provided herein. Contractor shall be solely responsible for all damages or injuries due to action or neglect pursuant to this section. Contractor shall maintain access to all phases of the project pending inspection by City. Contractor hereby agrees to the following as to the job site: continually keep the job site free from debris, waste, and accumulation of materials; immediately clean up any oil, fuel, or chemical spills and take any and all remediation necessary; keep machinery clean and free of weeds and debris; remove all construction stains, smears, and debris from finished surfaces; perform site preparation to limit the spread of weeds, debris, and other nuisances prior to submission of final invoice to City; and remove all equipment, materials, tools, and Contractor's personal property prior to submission of final invoice to City.

In accordance with MAG Specifications Section 105, Contractor shall respond within twenty-four (24) hours after notice by City of any defects and/or maintenance requests to immediately remedy the condition of the job site. Should Contractor fail to respond promptly as set forth herein, City shall correct the job site at the expense of Contractor, and recover all attendant costs.

**3.16. APPROXIMATE QUANTITIES**

It is expressly understood and agreed by the parties hereto that the quantities of the various classes of work to be done and material to be furnished under this Contract, which have been estimated, as stated in the Invitation for Bids, are only approximate and are to be used solely for the purpose of comparing, on a consistent basis, the bids offered for the work under this Contract. Contractor further agrees that City will not be held responsible for any claim for damages or for loss of profits because of a difference between the quantities of the various classes of work as estimated and the work actually done.

If any error, omission, or misstatement is found to occur in the estimated quantities, the same shall not invalidate this Contract or release Contractor from the execution and completion of the whole or any part of the work in accordance with the plans and specifications herein mentioned, and for the prices herein agreed upon and fixed therefore, or excuse Contractor from any of the obligations or liabilities hereunder, or entitle Contractor to any damages or compensation, except as may be provided for in this Contract.

**3.17. BLUE STAKE & CALL BEFORE YOU DIG**

Contractor is required to use Arizona Blue Stake, Inc., at 602-263-1100, to comply with the statutory requirements in A.R.S. title 40, chapter 2, article 6.3 (Underground Facilities); A.R.S. § 40-360.21, *et seq.*, as amended from time to time.

Where railroad property may be impacted, Contractor must also notify and secure a current Call Before You Dig (CBUD) Ticket at 1-800-336-9193 from Union Pacific Railroad's Response Management Communications Center (RMCC), wait for the site to be marked, respect all markings, and dig with care.

**3.18. PROTECTION OF EXISTING FACILITIES**

Contractor shall protect all existing facilities during construction or work. Utility poles that may be affected by construction activities shall be protected and/or braced by the Contractor. Contractor shall notify the appropriate utility company or agency of any construction or work that may affect their facilities and state the course of action which will be taken to protect such facilities.

**3.19. UNDERGROUND UTILITIES**

Underground utilities indicated on the plans are in accordance with maps furnished by City and by each utility company. The locations are approximate and require verification prior to construction, as mandated by the City of Tempe Utility Permit and Construction Manual, latest edition, available at <http://www.tempe.gov/engineering>.

**3.20. RELOCATION OF UTILITIES**

All utilities in conflict with the new work will be relocated by the utility company, except as otherwise provided in the plans and specifications.

**3.21. NOTIFICATION OF PROPERTY OWNERS**

Contractor shall notify all property owners who may be affected by the proposed construction activities of the scope and duration of the construction activities at least forty-eight (48) hours in advance of the start of any work or construction.

**3.22. ACCESS**

Contractor shall maintain public access to businesses adjacent to the job site at all times during construction. Where property has more than one access point, no more than one access point shall be restricted or closed at any one time. If only

one driveway exists, access shall be maintained to at least one-half of the driveway at all times. Access to adjacent private driveways shall be maintained by Contractor during all non-working hours.

**3.23. UTILITY AND PUBLIC AGENCY CONSTRUCTION CLEARANCE AGREEMENT**

Utilities and other public agencies may require all contractors, if working on their facilities, to sign a standard form "Construction Clearance Agreement," or other form of agreement, prior to issuance of a license. Contractor shall execute the Construction Clearance Agreement with the utility or public agency, if required, and furnish a copy to City prior to proceeding with any construction on utility or public agency facilities. This agreement sets forth the requirements to complete the proposed work in an allotted time frame or to pay full costs for others to complete. It also obligates Contractor to comply with all applicable federal, state, and local laws, rules, regulations, and ordinances including, but not limited to, the OSHA Permit Required Confined Space rules, as amended.

**3.24. GOVERNMENT APPROVALS AND PERMITS**

**3.24.1.** Unless otherwise provided, Contractor shall obtain all necessary permits, approvals, and licenses required for the commencement of the work from any government or quasi-government entity having jurisdiction over the project at its sole expense. Contractor expressly covenants and agrees that it will obtain any and all necessary environmental permits and/or file the necessary environmental notices at its cost prior to undertaking work or performing services hereunder.

**3.24.2.** Copies of all permits and notices shall be provided to City prior to starting any work or performing services pursuant to the permitted activity. This provision does not constitute an assumption by City of an obligation of any kind for violation of said permit or notice requirements.

**3.24.3.** City agrees to be responsible for City's own review and permit(s) fees for building and demolition permits only. In addition, City shall bear its own review fees for grading and drainage, water, sewer, and landscaping. City may agree to pay utility design fees for permanent services in its sole discretion. Contractor shall be solely responsible for

any and all other permit(s) and review fees not specifically designated herein.

- 3.24.4. Contractor is responsible for all costs of water meter(s), water and sewer taps, fire lines and taps, and all water bills on the project meters until completion of the project. Arrangements for water at the site or for construction purposes are the Contractor's sole responsibility.

**3.25. KEY CONTACTS**

City of Tempe Engineering	Wendy Springborn	480-350-8250
Blue Stake Center		602-263-1100
Call Before You Dig (UPRR)		800-336-9193

**3.26. DUST PREVENTION**

Contractor shall take all necessary steps to ensure dust-free conditions on property within the City to the satisfaction of the City Engineer, and fully comply with A.R.S. § 49-474.06 and Maricopa County Air Pollution Control Rules and Regulations Rule 200 § 305-306, concerning dust-generating operations as defined by Maricopa County Rule 310. In any operation where more than one-tenth of an acre of surface area is disturbed and/or when unpaved onsite haul roads are used, Contractor shall obtain a Maricopa County dust control permit. Contractor shall provide assurance that subcontractors used on the dust-generating portion of the Project are registered with the Maricopa County Air Quality Department and that only certified PM-10 efficient street sweepers shall be used to sweep City streets, as required by Tempe City Code Sec. 26A-25. Contractor shall provide its subcontractor(s)' registration number and dust control plan, if applicable, to the City Engineer prior to engaging in any dust-generating activities. Project related hauling activities to and/or from storage located on property owned by City shall be listed on the approved dust control permit and shall be subject to control measures in the approved dust control plan. When hauling fill or excavation materials exceeding five thousand (5,000) cubic yards or when the duration of the haul is more than ten (10) working days, Contractor shall obtain a City haul permit before the hauling operation begins. Prior to receiving a haul permit, Contractor must submit the required certificate of insurance, a plan showing the proposed haul routes, and a complete schedule of the hauling operation to the City Engineer.

All costs associated with the submittal, approval, and implementation of the permit and dust control plan as approved by Maricopa County Air Quality Department shall be borne solely by the Contractor. Failure to fully comply with this provision shall be considered a material breach of the Contract, and shall subject the Contract to termination by the City, in addition to other legal remedies.

**3.27. COMPLAINTS FROM THE GENERAL PUBLIC**

Contractor shall respond to any and all claims or complaints from the general public in a reasonable and prompt manner. Information on any complaint shall be reported to the Project Manager promptly, but in no event more than forty-eight (48) hours of receipt of complaint.

**4. INSTRUCTION TO BIDDERS**

**4.1. SEALED BIDS**

Sealed bids will be received and the time of delivery recorded by the City of Tempe, Arizona, Public Works Department, Engineering Office, City Hall West Garden Level, 31 East Fifth Street, Tempe, Arizona 85281, until 9:00 a.m. (Arizona time) March 6, 2014. At that time and place, bids will be opened and the amount of each bid and the name of each bidder publicly read in the Public Works Conference Room. Bids received after the time specified will be returned unopened. All bids shall be submitted in a sealed envelope. The outside lower right-hand corner shall be marked:

**BID OF \_\_\_\_\_, CONTRACTOR**

**FOR: GILBERT METERING STATION IMPROVEMENTS  
PROJECT NO. 3206061**

If a bid is mailed or delivered via overnight mail service, the outside envelope should be marked with the **date and time of the bid opening, as well as the words "PUBLIC WORKS ENGINEERING BID OPENING."** Please allow sufficient time for delivery.

Please see the BIDDER'S CHECK SHEET in the Exhibits section of this Invitation for Bid.

Each bid shall be accompanied by a bid guarantee for ten percent (10%) of the amount of the bid. See the subsection of Instructions to Bidders titled Bid Security.

Each bid also shall be accompanied, in a separate envelope, by the bidder's current loss history information from all of the bidder's insurance carriers. The information specific to workers' compensation insurance carriers must include a three-year (3-year) history of the bidder's Experience Modification Factor (EMOD) and its loss ratio.

In addition, each bidder is required to submit an affidavit certifying that its company and all of its subcontractors, defined as doing work in excess of \$30,000 as determined at the start of each project, will have and will continue to have

during the course of the Contract, health insurance in force for all project employees. The employer must also offer insurance to project employees for their eligible dependents.

**Plans and specifications are available for download from the City of Tempe Engineering Division at [www.tempe.gov/engprojectsbidding](http://www.tempe.gov/engprojectsbidding). When the documents are downloaded, Contractors MUST register on-line as a plan holder to be notified of project addenda. If addenda are issued for this project the City of Tempe will attempt to notify plan holders at the email address provided. It is the Contractor's sole responsibility to confirm that they have received all addenda prior to submitting a bid. The City is not responsible for providing notification or addenda to Contractors.**

When it is in the best interests of the City of Tempe, the City may cancel this solicitation, or may reject any and all bids in whole or in part, or may waive any informalities in the bids received.

Award will be made or bids rejected within sixty (60) days after bid opening.

Please direct any questions to City of Tempe Engineering Division at 480-350-8200.

**Anyone wishing to receive future notices through automatic notification by email can register their company name and email address at [www.tempe.gov/enews](http://www.tempe.gov/enews) (select the following e-notify list: Engineering Bid/RFQ Notification).**

**4.2. ADDENDA**

Addenda issued prior to the deadline for bidding shall be attached to and made a part of the Contract. Contractor shall acknowledge receipt of all addenda on the Competitive Sealed Bid form.

**4.3. BID SECURITY**

Each bid shall be accompanied by a bid guarantee for ten percent (10%) of the amount of the bid, executed in accordance with the requirements of A.R.S. § 34-201, *et seq.*, as amended from time to time. The bid guarantee shall be in the form of a certified check, cashier's check, or surety bond. If a surety bond is used, the bond shall be executed solely by a surety company or companies holding a certificate of authority to transact surety business in Arizona, issued by the director of the department of insurance pursuant to Arizona Revised Statutes, title 20, chapter 2, article 1, as amended from time to time. The surety bond shall not be executed by an individual surety or sureties, even if the requirements of A.R.S. § 7-101 are satisfied. Additionally, the City requires that a bonding company, liability insurance carrier, or excess insurance carrier issuing a surety bond have a

Financial Strength Rating of A- or better and a Financial Size Category of VII or higher, as listed in the most recent "Best's Key Rating Guide – Property/Casualty," published by A.M. Best Company.

Bid guarantees shall be returned to bidders whose bids are not accepted, and to the successful Contractor upon its execution of the Contract and delivery of a satisfactory performance bond, payment bond, and certificate of insurance.

**4.4. BIDS**

Bids shall be properly executed upon the Competitive Sealed Bid Forms attached and made a part of this Contract. Electronic signatures will not be accepted. The completed forms shall be without interlineations, alterations, or erasures. Unit prices should be rounded to the nearest whole cent (two spaces behind the decimal point). In case of an error in the extension of unit prices and the totals, the unit price shall govern.

Bids shall not contain any recapitulations of the work to be done. Alternative bids will not be considered except as called for. No oral or electronic bids or modifications will be considered.

**4.5. IRREGULAR BIDS**

Bids may be considered irregular and may be rejected if any of the unit prices quoted in the bidding schedule are unbalanced, either above or below the amount of a reasonable bid price, to the potential detriment of City.

**4.6. BIDDING PHASE REQUIREMENTS**

4.6.1. Pursuant to A.R.S. § 1-502, any individual/sole proprietor who responds to this Invitation for Bids by signing the Competitive Sealed Bid Forms shall also sign a sworn Affidavit Demonstrating Lawful Presence in the United States (see Exhibits) and present one of the documents listed on the affidavit to verify lawful presence in the United States. Failure to sign said affidavit and present one of the listed documents **shall result in rejection of the bid.**

4.6.2. Each bid shall be accompanied, in a separate envelope, by the bidder's current loss history information from all of the bidder's insurance carriers. The information specific to workers' compensation insurance carriers must include a three-year (3-year) history of the bidder's Experience Modification Factor (EMOD) and its loss ratio. This information must be provided with the bidder's proposal.

**4.7. PRE-CONTRACT AWARD REQUIREMENTS**

4.7.1. Contractor shall provide a copy of its written health and safety program and any required employee training records or certificates.

4.7.2. **Taxes.** All applicable taxes due and owing by Contractor and all subcontractors shall be considered by City in determining award. At all times, the determination of applicable taxes and rates, and remitting taxes owed, shall be the sole responsibility of Contractor. Should any taxes owed to City by Contractor or any subcontractors, including privilege (sales) and use tax, not be remitted in full prior to Contract award, the bid shall be considered non-responsive and rejected by City.

**4.8. BID QUANTITIES**

The quantities listed in the specifications are for bid purposes. The actual quantities provided to Contractor may be adjusted to accommodate field requirements.

**4.9. PROTEST PROCEDURE**

A bidder or contractor who believes they are aggrieved in connection with the City's solicitation or award of a contract may file a protest with the Engineering Division procurement office, as set forth in Section 26A-21 of the Tempe City Code.

**5. EVALUATION AND AWARD**

**5.1. AWARD AND EXECUTION OF CONTRACT**

Except as provided herein to the contrary, the respective rights and remedies of the parties to this Contract shall be cumulative and in addition to any rights and remedies not specified in this Contract. It is understood that there are no oral or written agreements or representations between the parties hereto affecting this Contract, and that this Contract supersedes any and all prior negotiations, arrangements, representations, and understandings between the parties. No provision of this Contract may be amended except by an agreement in writing signed by City. This Contract, including exhibits and attachments attached hereto, signed by City and Contractor, constitutes the entire agreement between the parties.

This Contract shall be in full force and effect only after it has been awarded by the City Council of Tempe, Arizona.

Contractor shall execute the Contract and all exhibits and attachments thereto, counterparts permitted, within ten (10) calendar days after being given formal notice of City Council's award of the Contract.

Contractor's failure to execute this Contract and to file satisfactory contract bonds and insurance certificates as provided herein within ten (10) calendar days after being given formal notice of Contract award shall result in immediate cancellation of the award.

**5.2. PLANS TO THE SUCCESSFUL BIDDER**

The successful bidder may obtain (7) sets of plans and specifications for this project from the office of City Engineer, at no cost.

**5.3. ISSUANCE OF THE NOTICE TO PROCEED**

Notwithstanding unforeseeable circumstances, the Notice to Proceed shall be issued by City within thirty (30) days of contract award.

**6. GENERAL TERMS AND CONDITIONS**

**6.1. LIQUIDATED DAMAGES**

Unless otherwise specified, liquidated damages will be applied in accordance with the MAG Specifications 108.9. Completion of the work as stated in this Contract is the same as completion of the work as stated in MAG Specifications 108.9. Damages will be applied at the amounts specified in MAG Specifications Table 108-1.

**6.2. ESCROW AND HOLDBACK**

In the event of a dispute arising under this Contract that is not summarily resolved by the parties concerning any withholding or nonpayment of funds by the City, the parties agree that said disputed funds may be held back and placed into a neutral escrow account, in the form of an interest bearing savings account, until the dispute is resolved. By signing this Contract, Contractor acknowledges and agrees to the deposit of any and all disputed funds into an escrow account into the financial institution of the City's election.

Except as to those amounts withheld, at City's direction, the balance of the funds shall be paid to Contractor or subcontractor(s), as set forth by Arizona law. Any funds remitted to City in excess of the amount allowed by statute will be reimbursed to Contractor. In no event shall City be liable to Contractor for damages resulting from a claimed loss due to payment of the excess funds or due to a delay in reimbursing the excess payment.

Once per calendar month, the financial institution shall furnish the City and Contractor with a statement reflecting the funds held as of the last day of the preceding calendar month, and showing the transactions for that prior month. At the request of Contractor or City, the financial institution shall furnish both parties with an interim statement showing funds held as of the 25th day of the most recent month or, if a non-business day, the following business day of that month.

Contractor acknowledges and agrees that all fees, costs, and charges imposed by any financial institution in connection with the maintenance and administration of the disputed funds shall be charged to, and paid by, Contractor. The funds shall be free of any claim for such fees, costs, or charges. However, the financial institution may obtain payment for any such accrued fees, costs, and charges owed by Contractor related to said funds out of available interest earned on the funds, or deduct the same from any funds to be paid to Contractor, according to written disbursement instructions from City.

The parties acknowledge and agree that in the event of no resolution between the parties concerning distribution of the disputed funds, the funds may be interplead in a court of competent jurisdiction in Maricopa County, Arizona.

It is understood that financial institution shall not be deemed liable, nor responsible, for the collectability of any funds assigned or held in connection with this provision.

### 6.3. TERMINATION

In addition to MAG Specifications 108.11, City, at its sole discretion, may terminate this Contract for convenience or abandon any portion of the project for which services have not been performed by Contractor, upon fourteen (14) days' written notice delivered to Contractor personally or by certified mail.

Immediately after receiving such notice, Contractor shall discontinue advancing the services under this Contract and proceed to close said operations under this Contract. Contractor shall appraise the services it has completed and submit an appraisal to City for evaluation. City shall have the right to inspect and approve Contractor's work to appraise the services completed.

Contractor shall deliver to City all drawings, special provisions, field survey notes, reports, estimates, and any and all other documents or work product generated by Contractor under the Contract, entirely or partially completed, together with all unused materials supplied by City.

In the event of such termination or abandonment, Contractor shall be paid for services approved and accepted by City that Contractor performed prior to receipt of said notice of termination, including reimbursable expenses previously incurred.

If the remuneration scheduled hereunder is based upon a fixed fee or definitely ascertainable sum, the portion of such sum payable shall be proportionate to the percentage of work completed, as reviewed and approved by City, based upon the scope of work. However, in no event shall the fee exceed the full cost of the Contract.

If City terminates or abandons the Contract, City shall make final payment within sixty (60) days after Contractor has delivered the last of the completed items and City has approved and determined the final fee.

In the event this Contract is terminated or abandoned prior to completion, City may complete the work, or enter into a Contract with another party for the remaining work.

In no event shall the City be obligated, liable, or responsible for performance of the obligations set forth herein, any provision of this Contract, or any expenses incurred by Contractor in securing this Contract (including, but not limited to, purchasing insurance coverage, performance bonds, or other security), at any time, including prior to or following City Council's approval of this Contract, should funds not be appropriated by the City through its Council or staff, in order to complete the Project. In the event that funds are not appropriated to meet or complete this Contract, then City shall immediately provide notice to Contractor of such non-allocation and terminate the Contract. City shall incur no resulting liabilities or penalties for termination under this Section.

This Contract may be terminated pursuant to A.R.S. § 38-511.

#### **6.4. DEFAULT PROVISIONS**

Contractor shall be deemed in default under this Contract upon the occurrence of any of the following events:

- 6.4.1. Contractor provides material that does not meet the specifications of the Contract and fails to cure such non-performance within ten (10) days after written notice from City;
- 6.4.2. Contractor fails to adequately perform the services set forth in the plans and specifications of and fails to cure such non-performance within ten (10) days after written notice from City;
- 6.4.3. Contractor fails to complete the work required or furnish the materials required within the time stipulated in the Contract and fails to cure such non-performance within ten (10) days after written notice from City;
- 6.4.4. Contractor fails to make progress in the performance of the Contract and/or gives City reason to believe that Contractor will not or cannot

perform the requirements of the Contract and fails to cure such non-performance within ten (10) days after written notice from City;

- 6.4.5. Contractor fails to perform any other term or condition of this Contract and fails to cure such non-performance within ten (10) days after written notice from City.

In the case of default, City may terminate the Contract, in whole or in part, and/or may resort to any other remedy as provided by law. City may also perform any test or analysis on materials for compliance with the specifications of the Contract. Contractor shall pay the actual expense of testing if the results of any test or analysis indicate a material to be non-compliant with the specifications.

6.5. **WARRANTY**

Contractor warrants to City that the construction, including all materials and equipment furnished as part of the construction, shall be new, unless otherwise specified in the Specifications and Contract; of good quality; in conformance with the Specifications; and free of defects in materials and workmanship. Contractor's warranty obligation excludes defects caused by abuse, alterations, or unreasonable failure to maintain the construction by persons other than Contractor, Subcontractors, or others under Contractor's control. Nothing in this warranty shall limit any manufacturer's warranty which provides City with greater warranty rights than set forth herein. Contractor will provide City with all manufacturers' warranties and operation and maintenance manuals upon substantial completion of the work. Contractor's warranty shall be for one (1) year and will commence for all portions of the work upon final acceptance of the entire work as determined by City under the Contract. All statutory or other warranties, express or implied, related to latent defects will remain in force and are not limited by this provision.

6.6. **OWNERSHIP OF DOCUMENTS / INFRINGEMENT OF PATENT OR COPYRIGHT**

All work products (electronically or manually generated) including, but not limited to, plans, specifications, cost estimates, tracings, studies, design analyses, original mylar drawings, computer aided drafting and design (CADD) file diskettes which reflect all final drawings, and other related products which are prepared in the performance of this Contract, are the property of City and are to be delivered to City before the final payment is made to Contractor. City shall retain ownership of these original drawings, however, if approved in writing by City, Contractor may retain the original drawings and supply City with reproducible mylar copies. Contractor shall endorse by their professional seal all plans and special provisions furnished by them.

In the event these documents are used for another project without further consultation with Contractor, City agrees to indemnify and hold Contractor harmless from any claim arising from the reuse of the documents. City shall remove Contractor's seal and title block from such documents.

Contractor agrees to save, keep, hold harmless, and fully indemnify City, and any of its officers, officials, employees, and agents, from any and all damages, costs, or expenses, in law or equity, that may at any time arise out of any infringement of the patent right, copyright, or trademark of any person, persons, or entity in consequence of use by City, or by any of its officers, officials, employees, or agents, of materials supplied by Contractor, and of which Contractor is not a patentee or signee or lawfully entitled to sell the same.

Contractor agrees to indemnify and hold harmless City and its officers, officials, employees, and agents from any and all license, royalty, and proprietary fees or costs, including legal costs, which may arise out of City's purchase and use of goods supplied by Contractor.

It is expressly agreed by Contractor that these covenants are irrevocable and perpetual.

## **6.7. COMPLIANCE WITH STATE AND FEDERAL LAWS**

**6.7.1. Specially Designated Nationals and Blocked Persons List.** Contractor represents and warrants to City that neither Contractor nor any affiliate or representative of Contractor (i) is listed on the Specially Designated Nationals and Blocked Persons List maintained by the Office of Foreign Asset Control, Department of the Treasury (OFAC) pursuant to Executive Order No. 13224, 66 Fed. Reg. 49079 ("Order"); (ii) is listed on any other list of terrorists or terrorist organizations maintained pursuant to the Order, the rules and regulations of OFAC or any other applicable requirements contained in any enabling legislation or other related Order(s); (iii) is engaged in activities prohibited in the Order; or (iv) has been convicted, pleaded *nolo contendere*, indicted, arraigned, or custodially detained on charges involving money laundering or predicate crimes to money laundering.

**6.7.2. Employment Laws.** Contractor agrees and covenants that it will comply with any and all applicable governmental restrictions, regulations, and rules of duly constituted authorities having jurisdiction insofar as the performance of the work and services pursuant to the Contract, and all applicable safety and employment laws, rules, and regulations, including, but not limited to, the Fair Labor Standards Act, the Walsh-Healey Act, and the Legal Arizona Workers Act (LAWA), and all amendments thereto, along with all attendant laws, rules, and regulations. Contractor acknowledges that a breach of this warranty is a material breach of this

Contract and that Contractor is subject to penalties for violation(s) of this provision, including termination of this Contract. City retains the right to inspect the documents of any and all contractors, subcontractors, and sub-subcontractors performing work and/or services relating to the Contract to ensure compliance with this warranty. Any and all costs associated with City inspection are the sole responsibility of Contractor. Contractor hereby agrees to indemnify, defend, and hold City harmless for, from, and against all losses and liabilities arising from any and all violations thereof.

**6.7.3. Equal Opportunity.** City is an equal opportunity, affirmative action employer. Contractor hereby covenants that it shall not discriminate unlawfully against any employee or applicant for employment, nor shall it deny the benefits of this Contract, to any person on the basis of race, color, creed, religion, ancestry, national origin, physical or mental disability, age, sex, gender, sexual orientation, gender identity, marital status, or veteran status, with regard to discharging obligations under this Contract. Contractor covenants and agrees that it will comply in all respects with the applicable provisions of Executive Order 11246, Title VII of the Civil Rights Act of 1964, the Americans with Disabilities Act, the Age Discrimination in Employment Act, the Vietnam Era Veterans' Readjustment Assistance Act, the Rehabilitation Act, and any other applicable state and federal statutes governing equal opportunity. Contractor agrees to post hereinafter in conspicuous places, available for employees and applicants for employment, notices to be provided by the contracting officer setting for the provisions of this clause.

**6.7.4. Federal Employer Sanctions Law.** Contractor understands and acknowledges the applicability of the Federal Employment Eligibility Verification Requirements ("Requirements"), including, but not limited to, Executive Order 12989, Federal Acquisition Regulation E-Verify clause (73 F.R. 67704), and 8 U.S.C. § 1324, *et seq.*, as amended from time to time. Contractor warrants current compliance with these and all Federal immigration laws and regulations that relate to their employees, on behalf of the Contractor and all of its subcontractors, including the use of E-Verify to confirm the employment eligibility of all persons hired during a Contract term and current employees performing under the Contract within the United States. Should the Requirements conflict with any applicable state laws or regulations as referenced in 6.7.2., the Requirements shall prevail.

Contractor further agrees to include the provisions of this section in any and all subcontracts hereunder. Any violation of such provisions shall constitute a material breach of this Contract.

**6.8. JURISDICTION**

This Contract will be deemed to be made under, and will be construed in accordance with and governed by, the laws of the State of Arizona, without regard to the conflicts or choice of law provisions. An action to enforce any provision of this Contract or to obtain any remedy with respect hereto will be brought in the Superior Court of Arizona in and for Maricopa County, and for this purpose, each party hereby expressly and irrevocably consents to the jurisdiction and venue of such court.

**6.9. DISPUTE RESOLUTION**

The parties may mutually agree to submit any dispute arising under this Contract to binding arbitration, conducted by a sole arbitrator mutually agreed upon by the parties, to hear and render a decision to resolve said dispute. The arbitration shall be held in Tempe, Arizona, subject to the laws of the State of Arizona. Each party shall bear its own costs and attorney's fees. A decision shall be made by the arbitrator within seven (7) calendar days of the arbitration hearing.

**6.10. SUCCESSORS AND ASSIGNS**

This Contract shall not be assignable except at the written consent of City, and it shall extend to and be binding upon the heirs, executors, administrators, successors, and assigns of the parties hereto.

**6.11. NON-WAIVER**

The failure of either party to enforce any of the provisions of this Contract, or to require performance by the other party of any of the provisions of this Contract, will not be construed as a waiver of such provisions, nor will it affect the validity of this Contract or any part thereof or the right of either party to thereafter enforce each provision.

**6.12. SURVIVAL**

All warranties, representations, and indemnifications by Contractor will survive the completion or termination of this Contract.

**6.13. SEVERABILITY**

If any provision of this Contract or the application thereof to any person or circumstance is held invalid, illegal or unenforceable to any extent, the remainder of this Contract and the application thereof will not be affected and will be enforceable to the fullest extent permitted by law.

**6.14. INTEGRATION**

This Contract contains the full agreement of the parties hereto. Any prior or contemporaneous written or oral agreement between the parties regarding the subject matter hereof is merged and superseded hereby.

**6.15. TIME IS OF THE ESSENCE**

Time of each of the terms, covenants, and conditions of this Contract is hereby expressly made of the essence.

**6.16. THIRD PARTY BENEFICIARY**

This Contract will not be construed to give any rights or benefits in the Contract to anyone other than City and Contractor. All duties and responsibilities undertaken pursuant to this Contract will be for the sole and exclusive benefit of City and Contractor and not for the benefit of any other party.

**6.17. CONFLICT OF INTEREST**

Contractor agrees to disclose any financial or economic interest with the project property, or any property affected by the project, existing prior to the execution of this Contract. Further, Contractor agrees to disclose any financial or economic interest with the project property, or any property affected by the project, if Contractor gains such interest during the course of this Contract.

Contractor's gains of financial or economic interest in the project during the course of this Contract may be grounds for terminating this Contract. Any decision to terminate the Contract shall be at the sole discretion of City.

Contractor shall not engage the services, on this Contract, of any present or former City employee who was involved as a decision maker in the selection or approval processes, or who negotiated or approved billings or Contract modifications for this Contract.

**6.18. COOPERATION AND FURTHER DOCUMENTATION**

Contractor agrees to provide City such duly executed documents as may be reasonably requested by City to implement the intent of this Contract.

This Contract shall be in full force and effect only when it has been approved by the City Council of the City of Tempe, Arizona, and when executed by the duly authorized City officials and the duly authorized agent of Contractor.

**6.19. UNAUTHORIZED FIREARMS & EXPLOSIVES**

No person conducting business on City property shall carry a firearm or explosive of any type. This requirement shall also apply to persons who maintain a concealed weapons permit.

**6.20. NOTICES TO CITY ENGINEER**

All notices to the City relating to this Contract should be sent to the following individual, who is also the administrator of this Contract.

Gilbert Metering Station Improvements  
Andy Goh, City Engineer  
City of Tempe Engineering Division  
31 E. Fifth Street, Garden Level  
Tempe, Arizona 85281  
480-350-8200

**6.21. NOTICES TO CONTRACTOR**

*(To be completed by successful bidder)*

Company Name: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Phone: \_\_\_\_\_

Fax: \_\_\_\_\_

**6.22. GIS DATA DISCLAIMER**

THE CITY OF TEMPE DOES NOT WARRANT THE ACCURACY, COMPLETENESS, CONDITION, SUITABILITY, PERFORMANCE, OR CURRENCY OF THE GIS DATA PROVIDED UNDER THIS CONTRACT. AREAS DEPICTED BY GIS DATA ARE APPROXIMATE, AND NOT GUARANTEED TO BE ACCURATE TO STANDARDS FOR MAPPING, SURVEYING, OR ENGINEERING. THIS DATA IS FOR ILLUSTRATIVE PURPOSES ONLY AND SHOULD NOT BE RELIED UPON FOR SITE-SPECIFIC PURPOSES. THE DATA HEREIN IS SUBJECT TO CONSTANT CHANGE AND MAY NOT BE COMPLETE, ACCURATE, OR UP-TO-DATE.

THE CITY OF TEMPE IN NO WAY ASSUMES LIABILITY OR RESPONSIBILITY FOR ANY INCORRECT DATA OR ANY INFORMATION PROVIDED HEREIN. THE CONTRACTOR ACKNOWLEDGES AND AGREES THAT THE CITY OF TEMPE ASSUMES NO LIABILITY FOR DAMAGES INCURRED DIRECTLY OR INDIRECTLY RESULTING FROM INCOMPLETE, INCORRECT, OR MISSING INFORMATION; INCLUDING ANY DIRECT, INDIRECT, SPECIAL, OR CONSEQUENTIAL DAMAGES, HOWEVER CAUSED OR UNDER ANY THEORY OF LIABILITY, WHETHER IN TORT, CONTRACT, STRICT LIABILITY, OR OTHERWISE. **BY WAY OF THE SIGNATURE ON THIS CONTRACT, THE CONTRACTOR ASSUMES ALL LIABILITY FOR ANY AND ALL DEPENDENCE AND/OR RELIANCE UPON THIS INFORMATION AND ASSUMES ALL RESPONSIBILITY RELATING THERETO. ANY AND ALL EXPRESSED OR IMPLIED WARRANTIES, INCLUDING, BUT NOT LIMITED TO, IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PURPOSE ARE SPECIFICALLY AND EXPRESSLY DISCLAIMED.** CONTRACTOR SHOULD NOT RELY UPON THE GIS DATA WITHOUT PROPER FIELD VERIFICATION FOR ANY PURPOSE.

**6.23. AMENDMENT OF CONTRACT**

No supplement, modification or amendment of any term of this Contract will be deemed binding or effective unless in writing and signed by the parties hereto and in conformation with provisions of this Contract except as expressly provided herein to the contrary.

**6.24. LABOR**

Contractor agrees and covenants to use only licensed contractors and subcontractor(s) in the making and/or installation of any and all repairs, alterations, improvements, or other work of Contractor on the Project. Contractor shall be liable to City for any losses and liabilities associated with any violation of this provision, and the Contract shall immediately be terminated upon any violation by Contractor.

**6.25. PUBLIC RECORDS**

The City is a public entity subject to the provisions of the Arizona Public Records Law, A.R.S. § 39-121, *et seq.* ("Law"). Some or all of the information contained within the Contract and related documents constitutes a public record that the City may be required to disclose to other persons or entities. In the event of receipt of a public records request by the City, Contractor must provide verification that its document falls under the exception to the Law in order to contest disclosure of said document. In the event of Contractor contesting disclosure, said document

shall be submitted to a court of competent jurisdiction for an *in camera* review and determination, at Contractor's sole expense.

**6.26. COUNTERPARTS**

This Contract may be executed in one or more counterparts, each of which shall be deemed an original, but all of which when taken together shall constitute one and the same instrument, and it shall not be necessary that any single counterpart bear the signature of all parties.

**6.27. RECORD RETENTION**

Contractor agrees to retain all records relating to the Contract pursuant to A.R.S. § 35-214, as amended from time to time. Contractor agrees to make those records available at all reasonable times for inspection and audit by City during the term of the Contract and for a period of five (5) years after the completion of the Contract. The records shall be provided at City Public Works Department, Engineering Division, Tempe, Arizona, or another location designated by City upon reasonable notice to Contractor.

**6.28. DRUG-FREE WORKPLACE**

The Contractor is hereby advised that the City has adopted a policy establishing a drug-free workplace for itself and as a requirement for sellers/Contractors doing business with the City to ensure the safety and health of employees working on City license agreements, contracts, and/or projects. The Contractor agrees to require a drug-free workplace for all employees working under this Contract. Specifically, all employees of the Contractor who are performing work under this Contract shall be notified, in writing, by the Contractor that they are prohibited from the manufacture, distribution, dispensation, possession, or unlawful use of a controlled substance in the work place or work site. Any violation of this section constitutes a material breach of this Contract.

**7. EXHIBITS**

The parties agree that all references to this Contract include all exhibits designated in and attached to this Contract, such exhibits being incorporated into and made an integral part of this Contract for all purposes.

- 7.1 BIDDER'S CHECK SHEET**
- 7.2 COMPETITIVE SEALED BID FORMS**
- 7.3 BIDDER'S PROJECT REFERENCES**
- 7.4 BIDDER'S LIST OF PROPOSED SUBCONTRACTORS**
- 7.5 COMPETITIVE SEALED BID CERTIFICATION FORM**
- 7.6 CERTIFICATION BY THE CONTRACTOR AUTHORIZING  
EMPLOYEES TO SIGN BINDING AGREEMENTS**
- 7.7 PERFORMANCE BOND FORM**
- 7.8 PAYMENT BOND FORM**
- 7.9 UNCONDITIONAL WAIVER AND RELEASE FOR CONTRACTOR'S  
PAYMENT AND SETTLEMENT OF CLAIMS**
- 7.10 AFFIDAVIT OF GENERAL CONTRACTOR / PRIME CONSULTANT  
REGARDING HEALTH INSURANCE**
- 7.11 GUIDELINES FOR IMPLEMENTATION OF HEALTH INSURANCE**
- 7.12 PROMPT PAYMENT REQUIREMENTS**
- 7.13 AFFIDAVIT DEMONSTRATING LAWFUL PRESENCE IN THE UNITED  
STATES**

[CONTRACT SIGNATURE PAGE FOLLOWS THIS LIST OF EXHIBITS]

**CONTRACT SIGNATURE PAGE**

**IN WITNESS WHEREOF**, this Contract has been duly executed by the parties below and entered into this \_\_\_\_\_ day of \_\_\_\_\_, 2014.

CITY OF TEMPE, an Arizona municipal corporation

By: \_\_\_\_\_  
Name

Its: \_\_\_\_\_  
Title

ATTEST:

\_\_\_\_\_  
City Clerk

APPROVED AS TO FORM:

\_\_\_\_\_  
City Attorney

Recommended By:

\_\_\_\_\_  
Deputy Public Works Director/City Engineer

**Contractor warrants that the person who is signing this Contract on behalf of Contractor is authorized to do so and to execute all other documents necessary to carry out the terms of this Contract.**

CONTRACTOR:

\_\_\_\_\_  
Company Name

By: \_\_\_\_\_  
Signature

\_\_\_\_\_  
Printed Name

Its: \_\_\_\_\_  
Title

City Transaction Privilege  
License (Sales Tax) Permit No.

\_\_\_\_\_  
(Corporate Seal)

\_\_\_\_\_  
Witness [IF CONTRACTOR IS INDIVIDUAL]

**BIDDER'S CHECK SHEET**

This check sheet lists the items a bidder must include with its sealed bid.

	Included
Competitive Sealed Bid Forms (Confirm receipt of Addenda) ..... B-1 to B-3	<input type="checkbox"/>
Competitive Sealed Bid Certification Forms ..... CF-1	<input type="checkbox"/>
Bidder's Project References ..... PR-1	<input type="checkbox"/>
Bidder's List of Proposed Subcontractors ..... SB-1	<input type="checkbox"/> Separate Envelope
Bidder's Affidavit Regarding Health Insurance ..... AFF-2	<input type="checkbox"/> Separate Envelope
Bidder's Affidavit Demonstrating Lawful Presence in the United States LP-1	<input type="checkbox"/>
10% Bid Guarantee (see Invitation for Bids section 4.3) .....	<input type="checkbox"/>
EMOD and Loss Ratio Information (see Invitation for Bids section 4.6.2) .....	<input type="checkbox"/> Separate Envelope

7.2  
**COMPETITIVE SEALED BID FORMS**

Place: Tempe, Arizona

Date: March 25, 2014

Mayor and City Council  
City of Tempe  
Tempe, Arizona 85281

In compliance with your Invitation for Bids and all conditions of the Contract, Low Mountain Construction, Inc., a corporation or limited liability corporation organized under the laws of the State of Arizona; a partnership consisting of \_\_\_\_\_; or an individual trading as \_\_\_\_\_, of the City of Phoenix, and the County of Maricopa, hereby proposes and agrees to furnish any and all plans, materials, labor, construction equipment, service, and transportation (all applicable taxes included) of the **GILBERT METERING STATION IMPROVEMENTS, PROJECT NO. 3206061**, and to install the material therein for City in a good and workmanlike and substantial manner and to the satisfaction of City or its properly authorized agents and strictly pursuant to and in conformity with the Contract and other documents that may be made by City or their properly authorized agents, as provided herein, at the following prices:

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# City of Tempe



Project No. 3206061

Gilbert Metering Station Improvements

LOW MOUNTAIN CONSTRUCTION

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***Base Bid***

Item No.	Item Name	Quantity	Unit	Unit Cost	Total Cost
1	Construction of Gilbert Metering Station Improvements	1	LS	\$334,000.00	\$334,000.00
				<b><i>Total Base Bid:</i></b>	<b><i>\$334,000.00</i></b>

---

The undersigned hereby declares that Contractor has visited the site and has carefully examined the Contract related to the work covered by the above bid.

The undersigned understands that, when it is in the best interests of the City of Tempe, the City may cancel this solicitation, or may reject any and all bids in whole or in part, or may waive any informalities in the bids received.

Contractor's performance shall not start until after receiving the Notice to Proceed, and the work will be completed within one hundred eighty (180) consecutive calendar days after the Notice to Proceed date.

The undersigned hereby acknowledges receipt of the following Addenda: Addendum No. 1 issued 2/27/14  
and Contractor's bid has been adjusted to reflect any changes.

Respectfully submitted,

By: \_\_\_\_\_  
Signature

\_\_\_\_\_  
Printed Name

Its: \_\_\_\_\_  
Title

A096885, B094132  
Contractor's License No.

86-0705725  
Federal I.D. No./Social Security No.

44621  
City of Tempe Sales Tax License No.

[Corporate Seal])

For: Low Mountain Construction, Inc.  
Company Name

Address: 4105 N. 20<sup>th</sup> Street, Suite 205

Phoenix, AZ 85016

Phone: 602-265-2201

Fax: 602-265-7883





3.5 COMPLETED PROJECTS

THE FOLLOWING PROJECTS HAVE BEEN COMPLETED BY LOW MOUNTAIN CONSTRUCTION, INC.

NAME OF PROJECT	OWNER	ARCHITECT	CONTRACT AMOUNT	COMPLETION DATE
ACADEMY OF MATH AND SCIENCE 3335 W. FLOWER ST. PHOENIX, ARIZONA	ACADEMY OF MATH AND SCIENCE 3448 N. 1st AVENUE TUCSON, AZ 85704 520-293-2676	CARHUFF + CUEVA ARCHITECTS 3149 E. PRINCE RD. SUITE 151 TUCSON, AZ 85716 520-577-4560	\$534,761	FEBRUARY 2014
SUBWAY SITE IMPROVEMENTS 23RD AVE. & DEER VALLEY PHOENIX, ARIZONA	RCC PARTNERS 2501 W. DUNLAP RD. SUITE 10 PHOENIX, AZ 85027 928-243-2780	ANDREWS DESIGN GROUP 1095 W. RIO SALADO PKWY. TEMPE, AZ 85281 480-894-3478	\$249,550	FEBRUARY 2014
HILL DRIVE HOUSING AVONDALE, ARIZONA	CITY OF AVONDALE 11465 W. CIVIC CENTER DR. AVONDALE, AZ 85323 623-333-4213	KELLOGG+ASSOCIATES 4200 N. CENTRAL AVE. PHOENIX, AZ 85012 480-779-9719	\$911,186	JANUARY 2014
SCHNEIDER NATIONAL PHOENIX, ARIZONA	SCHNEIDER NATIONAL, INC. P. O. BOX 2545 GREEN BAY, WI 54313 920-592-3929	SCHNEIDER NATIONAL, INC. P. O. BOX 2545 GREEN BAY, WI 54313 920-592-3929	\$250,000	NOVEMBER 2013
AFFILIATED DERMATOLOGY 13995 W. STATLER BLVD. SURPRISE, ARIZONA	ENSEMBLE REAL ESTATE SERVICES 4722 N. 24TH ST. SUITE 400 PHOENIX, AZ 85016 (602) 277-8558	MATTHEW BUDGE ASSOC. 10005 E. VIA LINDA SUITE 103 SCOTTSDALE, AZ 85258 (480) 874-2800	\$447,129	JANUARY 2013
LEHI EMERGENCY GENERATOR SRPMIC SCOTTSDALE, ARIZONA	SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY 10005 E. OSBORN RD. SCOTTSDALE, AZ 85256 (480) 362-7747	SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY 10005 E. OSBORN RD. SCOTTSDALE, AZ 85256 (480) 362-7747	\$103,984	NOVEMBER 2012
ASU SOLAR TRACKERS 7700 S. RIVER PARKWAY TEMPE, ARIZONA	M+W U.S., INC. 4710 E. ELWOOD SUITE 9 PHOENIX, AZ 85040 (480) 303-6600	SOITEC PHOENIX LABS 7700 S. RIVER PARKWAY TEMPE, AZ 85284 (480) 727-9198	\$212,073	SEPTEMBER 2012
BANNER HEALTH SURPRISE, ARIZONA	ENSEMBLE REAL ESTATE SERVICES 4722 N. 24TH ST. SUITE 400 PHOENIX, AZ 85016 (602) 277-8558	MATTHEW BUDGE ASSOC. 10005 E. VIA LINDA SUITE 103 SCOTTSDALE, AZ 85258 (480) 874-2800	\$1,567,812	SEPTEMBER 2012
CENTER STREET & VICTORY ACRES SCOTTSDALE, ARIZONA	SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY 10005 E. OSBORN RD. SCOTTSDALE, AZ 85256 (480) 362-7747	DOWL HKM 430 W. WARNER TEMPE, AZ 85284 (480) 753-0800	\$2,744,413	AUGUST 2012
SUN VALLEY CHARTER SCHOOL 5806 S. 35TH AVE. PHOENIX, ARIZONA	SUN VALLEY CHARTER SCHOOL 5806 S. 35TH AVE. PHOENIX, AZ 85041	HDA ARCHITECTS, LLC 459 N. GILBERT RD. SUITE C-200 GILBERT, AZ 85234 (480) 539-8800	\$541,700	JULY 2012
SURPRISE MEDICAL PLAZA AT THE CITY SURPRISE, ARIZONA	ENSEMBLE DEVMAN OF ARIZONA 4722 N. 24TH ST. SUITE 400 PHOENIX, AZ 85016 (602) 277-8558	MATTHEW BUDGE ASSOC. 10005 E. VIA LINDA SUITE 103 SCOTTSDALE, AZ 85258 (480) 874-2800	\$3,866,090	JUNE 2012



3.5 COMPLETED PROJECTS

THE FOLLOWING PROJECTS HAVE BEEN COMPLETED BY LOW MOUNTAIN CONSTRUCTION, INC.

NAME OF PROJECT	OWNER	ARCHITECT	CONTRACT AMOUNT	COMPLETION DATE
SRPMIC ELEMENTARY SCHOOL MODULAR CLASSROOMS SCOTTSDALE, ARIZONA	SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY 10005 E. OSBORN RD. SCOTTSDALE, AZ 85256 (480) 362-7747	ARRINGTON WATKINS 5240 N. 16TH ST. SUITE 101 PHOENIX, AZ 85016 (602) 279-9110	\$302,812	NOVEMBER 2011
SRPMIC SHRRP HOMES SRPMIC INDIAN COMMUNITY	SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY 10005 E. OSBORN RD. SCOTTSDALE, AZ 85256 (480) 362-7747	SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY 10005 E. OSBORN RD. SCOTTSDALE, AZ 85256 (480) 362-7747	\$499,279	NOVEMBER 2011
PARADISE HONORS HIGH SCHOOL 175th AVE. & SWEETWATER SURPRISE, ARIZONA	PARADISE EDUCATION CENTER 15533 W. PARADISE LANE SURPRISE, AZ 85374 (623) 455-7400	HDA ARCHITECTS, LLC 459 N. GILBERT RD. SUITE C-200 GILBERT, AZ 85234 (480) 539-8800	\$7,884,451	NOVEMBER 2011
SRPMIC TRAINING FACILITY ACCESS ROADS SCOTTSDALE, ARIZONA	SALT RIVER PIMA-MARICOPA INDIAN COMMUNITY 10005 E. OSBORN RD. SCOTTSDALE, AZ 85256 (480) 362-7747	RED MOUNTAIN ENGINEERING 117 S. ROCKFORD DR. TEMPE, AZ 85281 (480) 237-2708	\$956,579	FEBRUARY 2011
ROBERT L. DUFFY HIGH SCHOOL 2550 E. JEFFERSON ST. PHOENIX, ARIZONA	CAREER SUCCESS SCHOOLS 3816 N. 27TH AVE. PHOENIX, AZ 85017 (602) 380-7993	CRANDALL DESIGN GROUP 922 N. GILBERT RD. SUITE 101 MESA, AZ 85203 (480) 833-3594	\$3,144,000	SEPTEMBER 2010
MOUNTAIN VALLEY PARK PRESCOTT VALLEY, ARIZONA	TOWN OF PRESCOTT VALLEY 7501 E. CIVIC CIRCLE PRESCOTT, VALLEY, AZ 86314 (928) 759-3083	CIVILTEC 2050 N. WILLOW CREEK RD. PRESCOTT, AZ 86301 (928) 771-2376	\$1,355,915	JUNE 2010
PVUSD NETWORK OPERATIONS CENTER PHOENIX, ARIZONA	PARADISE VALLEY UNIFIED SCHOOL DISTRICT 15002 N. 32nd ST. PHOENIX, AZ 85032 (602) 867-5167	HDA ARCHITECTS, LLC 459 N. GILBERT RD. SUITE C-200 GILBERT, AZ 85234 (480) 539-8800	\$3,433,000	MARCH 2010
LITCHFIELD PERIMETER WALL LITCHFIELD PARK, ARIZONA	CITY OF LITCHFIELD PARK 214 W. WIGWAM BLVD. LITCHFIELD PARK, AZ 85340 (623) 935-9040	W. C. SCOUTTEN, INC. 1626 N. LITCHFIELD RD. SUITE 310 GOODYEAR, AZ 85395 (623) 547-4661	\$680,060	JANUARY 2010
ARIZONA ACADEMY OF LEADERSHIP 5660 S. 12th AVE. TUCSON, ARIZONA	ARIZONA ACADEMY OF LEADERSHIP 5660 S. 12th AVE. TUCSON, AZ 85706 (520) 940-3676	BURNS WALD-HOPKINS ARCHITECTS 261 N. COURT AVE. TUCSON, AZ 85701 (520) 795-2705	\$586,522	DECEMBER 2009
VALLEY ACADEMY 1520 W. ROSE GARDEN LN. PHOENIX, ARIZONA	VALLEY ACADEMY, INC. 1520 W. ROSE GARDEN LN. PHOENIX, AZ 85027 (602) 516-7747	HDA ARCHITECTS, LLC 459 N. GILBERT RD. SUITE C-200 GILBERT, AZ 85234 (480) 539-8800	\$6,196,000	AUGUST 2009
EL MIRAGE HERITAGE PARK EL MIRAGE, ARIZONA	CITY OF EL MIRAGE 12145 N.W. GRAND AVE. SUITE B EL MIRAGE, AZ 85335 (623) 933-3258	LOGAN SIMPSON DESIGN, INC 51 W. THIRD ST. SUITE 450 TEMPE, AZ 85281 (480) 967-1343	\$4,333,000	AUGUST 2009



3.5 COMPLETED PROJECTS

THE FOLLOWING PROJECTS HAVE BEEN COMPLETED BY LOW MOUNTAIN CONSTRUCTION, INC.

NAME OF PROJECT	OWNER	ARCHITECT	CONTRACT AMOUNT	COMPLETION DATE
GRIFFIN ACADEMY 1844 S. ALVERNON WAY TUCSON, ARIZONA	THE GRIFFIN FOUNDATION, INC. 1844 S. ALVERNON WAY TUCSON, AZ 85711 (520) 790-8400	BURNS WALD-HOPKINS ARCHITECTS 261 N. COURT AVE. TUCSON, AZ 85701 (520) 795-2705	\$1,324,024	AUGUST 2009
KINO JR. HIGH SCHOOL POOL MESA, ARIZONA	CITY OF MESA 20 E. MAIN ST. SUITE 500 MESA, AZ 85211 (480) 644-2251	LANGDON WILSON 432 N. 44TH ST. SUITE 175 PHOENIX, AZ 85008 (602) 252-2555	\$8,166,000	APRIL 2009
CAMELBACK PARK HAYDEN & CAMELBACK RD. SCOTTSDALE, ARIZONA	CITY OF SCOTTSDALE 7447 E. INDIAN SCHOOL RD. SUITE 205 SCOTTSDALE, AZ 85251 (480) 312-7250	LOGAN SIMPSON DESIGN, INC 51 W. THIRD ST. SUITE 450 TEMPE, AZ 85281 (480) 967-1343	\$4,552,000	DECEMBER 2008
PARADISE VALLEY SCHOOL VARIOUS SITES PHOENIX, ARIZONA	PARADISE VALLEY UNIFIED SCHOOL DISTRICT 15002 N. 32nd ST. PHOENIX, AZ 85032 (602) 867-5167	DLR GROUP 6225 N. 24TH STREET SUITE 250 PHOENIX, AZ 85016 (602) 381-8580	\$2,941,488	NOVEMBER 2008
QUEEN CREEK SWIMMING POOL QUEEN CREEK, ARIZONA	QUEEN CREEK USD 20740 S. ELLSWORTH RD. QUEEN CREEK, AZ 85242 (480) 987-5951	WET DESIGN, INC. P. O. BOX 10630 PHOENIX, AZ 85064 (602) 943-7727	\$2,832,000	OCTOBER 2008
HERITAGE MIDDLE SCHOOL 6805 N. 125th AVENUE GLENDALE, ARIZONA	HERITAGE ELEMENTARY SCHOOL 13419 W. OCOTILLO ROAD GLENDALE, AZ 85307 (623) 935-1931	HUNT ARCHITECTS, INC. 10225 N. 38th STREET PHOENIX, AZ 85028 (602-953-4822	\$6,269,422	SEPTEMBER 2008
SCOTTSDALE PREPARATORY ACADEMY 7496 E. TIERRA BUENA LN. SCOTTSDALE, ARIZONA	GREAT HEARTS ACADEMIES 2020 N. ARIZONA AVE. SUITE G-62 CHANDLER, AZ 85255 (480) 899-9181	SMITH DESIGN STUDIO 1402 W. PEPPER PLACE MESA, AZ 85201 (602) 793-4559	\$776,600	AUGUST 2008
MESQUITE GROVE AQUATIC CENTER CHANDLER, ARIZONA	CITY OF CHANDLER 215 E. BUFFALO ST. CHANDLER, AZ 85225 (480) 782-2400	GABOR LORANT ARCHITECTS, INC. 3100 N. 3rd AVE. SUITE 200 PHOENIX, AZ 85013 (602) 667-9090	\$8,860,339	JULY 2008
ST. DAVID'S EPISCOPAL CHURCH PAGE, ARIZONA	THE EPISCOPAL DIOCESE OF UTAH 80 SOUTH 300 EAST SALT LAKE CITY, UT 84110 (801) 322-4131	BUESE + PETERS, PC 232 S. DUBEI CT. SALT LAKE CITY, UT 84111 (801) 359-4048	\$1,166,024	MAY 2008
DESERT FOOTHILLS LIBRARY EXPANSION CAVE CREEK, ARIZONA	DESERT FOOTHILLS LIBRARY 38443 N. SCHOOL HOUSE RD. CAVE CREEK, AZ 85327 (480) 488-2286	HIDELL ASSOCIATES 3033 KELLWAY DRIVE SUITE 120 CARROLLTON, TX 75006-2605 (972) 416-4666	\$2,895,345	MARCH 2008
PERRY HIGH SCHOOL POOL WILLIAMS FIELD HIGH SCHOOL POOL GILBERT, ARIZONA	TOWN OF GILBERT 50 E. CIVIC CENTER DR. GILBERT, AZ 85296 (480) 503-6284	VERSAR, INC. 4700 S. McCLINTOCK DR. SUITE 150 TEMPE, AZ 85282 (480) 838-5352	\$6,669,785	FEBRUARY 2008

**BIDDER'S LIST OF PROPOSED SUBCONTRACTORS**

Gilbert Metering Station Improvements  
Project No. 3206061

In accordance with the provisions of Section 108.2 of the "Maricopa Association of Governments Uniform Standard Specifications for Public Works Construction", the bidder shall provide the information listed below regarding proposed subcontractors in a separate sealed envelope. Failure to provide complete and accurate information may disqualify the bid.

<u>Subcontractor Name</u>	<u>Address</u>	<u>Type of Work</u>	<u>% of Total Contract</u>	<u>License #</u>	<u>Tempe Privilege Tax License #</u>
<u>PRO-LOW</u> <u>PHOENIX, AZ</u>		<u>Sitework</u>	<u>5</u>	<u>283747</u>	<u>PENDING</u>
<u>SPORTSMAN</u> <u>SANTAN, AZ</u>		<u>Concrete</u>	<u>18</u>	<u>257506</u>	
<u>ESTB</u> <u>PHOENIX, AZ</u>		<u>Steel</u>	<u>6</u>	<u>105068</u>	
<u>BP MECHANICAL</u> <u>CHANDLER, AZ</u>		<u>HVAC</u>	<u>5</u>	<u>278447</u>	
<u>RSK ELECTRICAL</u> <u>TEMPE, AZ</u>		<u>Electrical</u>	<u>18</u>	<u>093226</u>	

**COMPETITIVE SEALED BID  
CERTIFICATION FORM**

Gilbert Metering Station Improvements  
Project No. 3206061

Bidder certifies that it is a: \_\_\_\_\_ proprietorship; \_\_\_\_\_ partnership;  corporation; \_\_\_\_\_ other.

Arizona Sales Tax No. 07435384 P

Use Tax No. for Out-of-State Supplier \_\_\_\_\_

City of Tempe Sales Tax No. 44621

Taxpayer's Federal Identification No. 86-0705725

Bidder certifies that it has read, understands, and will fully and faithfully comply with this Invitation for Bids, its attachments, and any referenced documents. Bidder also certifies that the bid was independently developed without consultation with any other Bidders or potential Bidders.

Company's Legal Name: Low Mountain Construction, Inc.

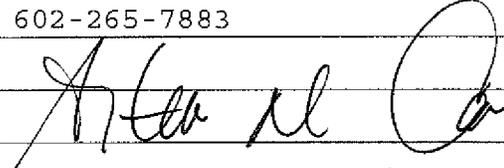
Address: 4105 N. 20th St., Suite 205

City, State and Zip Code: Phoenix, AZ 85016

Telephone Number: 602-265-2201

Company's Fax Number: 602-265-7883

Company's Toll Free Number: \_\_\_\_\_

Signature: 

Printed Name and Title: Arthur D. Case, President

E-Mail Address: acase@lowmountain.com

**MAILING ADDRESSES**

Purchase Order Address: (If different from above)

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City, State and Zip Code: \_\_\_\_\_

Payment Address: (If different from above)

Name: \_\_\_\_\_

Address: \_\_\_\_\_

City, State and Zip Code: \_\_\_\_\_

7.6

**CERTIFICATION BY THE CONTRACTOR AUTHORIZING  
EMPLOYEES TO SIGN BINDING AGREEMENTS**

Gilbert Metering Station Improvements  
Project No. 3206061

The following employees in our organization are duly authorized to sign binding agreements for and on behalf of the Owner, Partner, or Corporation, including, but not limited to, Pay Requests, Change Orders, Required Certifications, etc.:

Type or Print Name

Signature

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Contractor Name

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Signed By

(Owner, Partner, or Principal of the Corporation)

Printed Name

---

Title

---

Date

---

**PERFORMANCE BOND FORM**  
(Bond Amount to Be Equal to 100% of the Contract Amount)

KNOW ALL MEN BY THESE PRESENTS:

That \_\_\_\_\_ (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), are held and firmly bound unto \_\_\_\_\_ (hereinafter called the Obligee) in the amount of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_), for the payment whereof the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the / day of /, 2014, to complete Project No. 3206061, 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 Principal faithfully performs and fulfills all of the undertakings, covenants, terms, conditions and agreements of the Contract during the original term of the Contract and any extension of the Contract, with or without notice to the Surety, and during the life of any guaranty required under the Contract, and also performs and fulfills all of the undertakings, covenants, terms, conditions and agreements of all duly authorized modifications of the Contract that may hereafter be made, notice of which modifications to the Surety being hereby waived, the above obligation is void. Otherwise it remains in full force and effect.

Provided, however, that this bond is executed pursuant to the provisions of title 34, chapter 2, article 2, Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions of title 34, chapter 2, article 2, Arizona Revised Statutes, to the extent as if it were copied at length in this agreement.

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

DATED this \_\_\_\_\_ day of \_\_\_\_\_, 2014.

\_\_\_\_\_  
PRINCIPAL

\_\_\_\_\_  
SEAL

By: \_\_\_\_\_

\_\_\_\_\_  
\*SURETY

\_\_\_\_\_  
SEAL

By: \_\_\_\_\_

\_\_\_\_\_  
AGENCY ADDRESS

\*Surety hereby acknowledges it holds 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, Arizona Revised Statutes.

**PAYMENT BOND FORM**

(Bond Amount to Be Equal to 100% of the Contract Amount)

KNOW ALL MEN BY THESE PRESENTS:

That \_\_\_\_\_ (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), are held and firmly bound unto \_\_\_\_\_ (hereinafter called the Obligee) in the amount of \_\_\_\_\_ Dollars (\$ \_\_\_\_\_), for the payment whereof the said Principal and Surety bind themselves, and their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written Contract with the Obligee, dated the / day of /, 2014, to complete Project No. 3206061, 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 Principal promptly pays all monies due to all persons supplying labor or materials to the Principal or the Principal's subcontractors in the prosecution of the work provided for in the Contract, this obligation is void. Otherwise it remains in full force and effect.

Provided, however, that this bond is executed pursuant to the provisions of title 34, chapter 2, article 2, Arizona Revised Statutes, and all liabilities on this bond shall be determined in accordance with the provisions, conditions and limitations of title 34, chapter 2, article 2, Arizona Revised Statutes, to the same extent as if they were copied at length in this agreement.

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

DATED this \_\_\_\_\_ day of \_\_\_\_\_, 2014.

\_\_\_\_\_  
PRINCIPAL

\_\_\_\_\_  
SEAL

By: \_\_\_\_\_

\_\_\_\_\_  
\*SURETY

\_\_\_\_\_  
SEAL

By: \_\_\_\_\_

\_\_\_\_\_  
AGENCY ADDRESS

\*Surety hereby acknowledges it holds 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, Arizona Revised Statutes.

**UNCONDITIONAL WAIVER AND RELEASE  
FOR CONTRACTOR'S PAYMENT  
AND SETTLEMENT OF CLAIMS**

Upon receipt of payment from the City of Tempe, the undersigned:

Contractor's Name: \_\_\_\_\_

Contractor's Address: \_\_\_\_\_

The undersigned has been paid and acknowledges having received final payment from the City of Tempe in the amount of \$\_\_\_\_\_ [state dollar amount for final, total contract amount] for full and final payment of all work, services, equipment, labor, skill, and material furnished, delivered, and performed by the undersigned for the City or anyone in the construction [or other services] for GILBERT METERING STATION IMPROVEMENTS and PROJECT NO. 3206061 at the location of 641 E. Gilbert Road; and does hereby waive and release any and all rights to mechanic's liens, any state or federal statutory bond right, any private bond right, any claim for payment, and any and all rights under any applicable federal, state, or local laws related to claim or payment rights for persons in the undersigned's position held on the above-referenced project against the City of Tempe, for this value received. The undersigned further agrees to defend, indemnify, and hold harmless the City of Tempe against any and all liens, claims, suits, actions, damages, charges, and expenses whatsoever, which the City may incur, arising out of the failure of the undersigned to pay in full for all work, services, equipment, labor, skill, and material furnished with regard to the project.

The undersigned, in consideration of the payment acknowledged, hereby warrants that he/she has already paid or will pay using the monies received from this final payment to promptly pay in full all of his contractors, subcontractors, laborers, materialmen, and suppliers for all work, materials, equipment, or services provided to the above-referenced project.

\_\_\_\_\_  
Contractor Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
By (Print Name and Title)

Notice: This document waives rights unconditionally and states that you have been paid for giving up those rights. This document is enforceable against you if signed, even if you have not been paid. If you have not been paid in full, use a conditional release form.

[NOTARY SEAL TO FOLLOW]

STATE OF ARIZONA )  
COUNTY OF MARICOPA )

On \_\_\_\_ day of \_\_\_\_\_, 2014, \_\_\_\_\_ personally appeared before me, and proved by lawful identification documents to be the person who signed the preceding document in my presence, and who affirmed to me that the contents therein are truthful and accurate to the best of his/her knowledge and belief.

Notary Seal

\_\_\_\_\_  
Notary Public

\_\_\_\_\_  
Printed Name

My Commission Expires:

\_\_\_\_\_

**AFFIDAVIT OF GENERAL CONTRACTOR / PRIME CONSULTANT  
REGARDING  
HEALTH INSURANCE**

Phoenix, Arizona

Date March 25, 2014

**GILBERT METERING STATION IMPROVEMENTS  
PROJECT NO. 3206061**

I hereby certify that Low Mountain Construction, Inc. (name of company) currently has, and all of its major subcontractors/subconsultants, defined as doing work in excess of \$30,000, will have, during the course of this Contract, health insurance for all employees working on this project and will offer health insurance coverage to eligible dependents of such employees, as defined in the accompanying Guidelines. The company's health insurance is as follows:

Name of Insurance Company: AETNA

Type of Insurance (PPO, HMO, POS, INDEMNITY): \_\_\_\_\_

Policy No.: 64057499

Policy Effective Date (MM/DD/YY): 12/01/2013

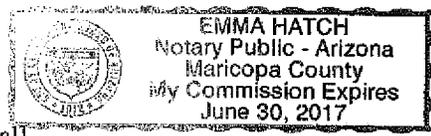
Policy Expiration Date (MM/DD/YY): 12/01/2014

Signed and dated at Phoenix, AZ, this 24 day of MARCH, 2014.

LOW MOUNTAIN CONSTRUCTION, INC.  
General Contractor/Prime Consultant  
By: [Signature]

STATE OF ARIZONA            )  
  ) ss  
COUNTY OF MARICOPA    )

SUBSCRIBED AND SWORN to before me this 24TH day of MARCH, 2014.



[Notary Seal]

Emma Hatch  
Notary Public

**CITY OF TEMPE GUIDELINES  
FOR IMPLEMENTATION OF HEALTH INSURANCE**

These Guidelines are provided for purposes of implementing Resolution No. 2000.73, which requires all employees of prime consultants, general contractors and major subconsultants and subcontractors to have health insurance and to offer health insurance to their eligible dependents, as determined at the start of each project. Questions regarding these guidelines should be directed to the City of Tempe Engineering Division at 480-350-8200.

1. All Prime Consultants who enter into a Public Works contract or General Contractors who bid on Public Works projects that are advertised for bid and enter into a contract in excess of \$30,000 with the City of Tempe ("City") after January 1, 2001, are required to sign an affidavit in the form attached hereto. The prime consultant or general contractor shall require that all major subconsultants or subcontractors, defined as entities doing work in excess of \$30,000, comply with the health insurance requirements. In signing the affidavit, prime consultants and general contractors may refer to and rely upon these Guidelines for interpretation.
2. Health insurance is required for permanent employees who work for the consultant/contractor more than one hundred and twenty (120) days in any calendar year. A "work day" consists of any time within a twenty-four hour period, regardless of number of hours, that the individual is paid. This requirement excludes students working part-time who are enrolled in a recognized educational institution. Many companies have a grace period or a qualifying period prior to commencement of insurance coverage, which is acceptable so long as the employee coverage begins by the 120th day of Contract signing. Temporary employees will be covered to the same extent as City covers temporary employees as determined at the start of each project.
3. If a contractor is a "Union" shop and withholds union dues from employees for health insurance coverage that is also offered to their eligible dependents and meets all City requirements, Contractor may so note on the required affidavit.
4. The health insurance requirements herein apply to all employees that are directly involved with City project including support and administrative personnel.
5. Health insurance coverage must be maintained during the entire time of the Contract, including any warranty periods, with the City.
6. All complaints concerning violations of the health insurance requirements shall be filed by an employee, in writing, with the Public Works Department, within thirty (30) days from discovery of the violation. An administrative hearing will be held before the Public Works Director, and a written decision of findings will be provided to the parties to the hearing within ten (10) days thereafter. Appeal from the decision of the Public Works Director may be made within ten (10) days of the date of the decision by filing a notice
7. In the event of a finding by City of a violation of the insurance provisions, the company in violation of the provision shall be barred from bidding on, or entering into, any public works Contract with City for a minimum period of three (3) years.
8. All consultants and contractors subject to the health insurance requirements shall post, in English and Spanish, notice of the health insurance requirements at their office and at the job site. Signs for posting will be provided by the City.

These "Guidelines for Implementation of Health Insurance" issued and dated this 21<sup>st</sup> day of August, 2002, hereby amend all guidelines previously issued.

7.12

**PROMPT PAYMENT REQUIREMENTS**

City adheres to the prompt payment provisions of A.R.S. § 34-221.

1. Contractor shall pay to its sub-contractors or material suppliers and each Sub-contractor shall pay to its Sub-contractors or material supplier, within seven (7) days of receipt of each progress payment, the amounts attributable to the Contractor, Sub-contractors or material supplier for work performed or materials supplied. In addition, any reduction of retainage to Contractor must also result in a like reduction to sub-contractors for their work successfully completed within fourteen (14) calendar days of the reduction of the retainage to the Contractor. No contract between Contractor and its Contractors, Sub-contractors and material suppliers may materially alter the rights of any Contractor, Sub-Contractor or material supplier to receive prompt and timely payment as provided herein. Any diversion by Contractor, or any Sub-contractor, of payments received for work performed on a contract, or failure to reasonably account for the application or use of such payments, constitutes sufficient grounds for City to take any one or more of the following actions: (1) withhold future payments including retainage until proper disbursement has been made; (2) refusal of all future bids or offers from Contractor for a period not to exceed one year; or, 3) cancellation of the contract.
2. Alternate Dispute Resolution. If entitlement to the payment is in dispute, the parties to the dispute shall submit the matter to either; a) binding arbitration; b) to some other form of binding alternative dispute resolution (ADR); or, c) a City of Tempe facilitated mediation process. The ADR process shall commence within a reasonable period of time, not to exceed fourteen (14) calendar days of receipt of a Notice to Proceed to an ADR process issued by City once an ADR determination has been made on any disputed claim, the determination shall be implemented by the disputing parties within seven (7) calendar days of that determination.

**AFFIDAVIT DEMONSTRATING LAWFUL PRESENCE IN THE UNITED STATES**

A.R.S. § 1-501 and § 1-502 require any individual person or sole proprietor who applies to the City for a local public benefit (including the award of a contract) to demonstrate his or her lawful presence in the United States. An individual person or sole proprietor who submits a bid for this contract must complete this Affidavit and submit it with the bid, along with a copy of one of the documents listed below.

**LAWFUL PRESENCE IN THE UNITED STATES CAN BE DEMONSTRATED BY PRESENTATION OF ONE (1) OF THE DOCUMENTS LISTED BELOW.**

Please present the document indicated below to the City. If mailing the document, attach a copy of the document to this Affidavit. (If the document may not be copied, present the document in person to the City for review and signing of the affidavit.)

- \_\_\_\_\_ 1. An Arizona driver license issued after 1996.  
Print first 4 numbers/letters from license: \_\_\_\_\_
- \_\_\_\_\_ 2. An Arizona non-operating identification License.  
Print first 4 numbers/letters: \_\_\_\_\_
- \_\_\_\_\_ 3. A birth certificate or delayed birth certificate issued in any state, territory or possession of the United States.  
Year of birth: \_\_\_\_\_: Place of birth: \_\_\_\_\_
- \_\_\_\_\_ 4. A United States Certificate of Birth abroad.  
Year of birth: \_\_\_\_\_: Place of birth: \_\_\_\_\_
- \_\_\_\_\_ 5. A United States passport.  
Print first 4 numbers/letters on Passport: \_\_\_\_\_
- \_\_\_\_\_ 6. A foreign passport with a United States Visa.  
Print first 4 numbers/letters on Passport \_\_\_\_\_  
Print first 4 numbers/letters on Visa \_\_\_\_\_
- \_\_\_\_\_ 7. An I-94 form with a photograph.  
Print first 4 numbers on I-94: \_\_\_\_\_
- \_\_\_\_\_ 8. **A United States Citizenship and Immigration Services Employment Authorization Document (EAD).**  
Print first 4 numbers/letters on EAD: \_\_\_\_\_
- \_\_\_\_\_ 9. **Refugee travel document.**  
Date of Issuance: \_\_\_\_\_ Refugee Country: \_\_\_\_\_
- \_\_\_\_\_ 10. **A United States Certificate of Naturalization.**  
Print first 4 digits of CIS Reg. No.: \_\_\_\_\_
- \_\_\_\_\_ 11. **A United States Certificate of Citizenship.**  
Date of Issuance: \_\_\_\_\_ Place of Issuance: \_\_\_\_\_
- \_\_\_\_\_ 12. **A tribal Certificate of Indian Blood.**  
Date of Issuance: \_\_\_\_\_ Name of Tribe: \_\_\_\_\_
- \_\_\_\_\_ 13. **A tribal or Bureau of Indian Affairs Affidavit of Birth.**  
Year of Birth: \_\_\_\_\_ Place of Birth: \_\_\_\_\_

**I DO SWEAR OR AFFIRM UNDER PENALTY OF LAW THAT I AM LAWFULLY PRESENT IN THE UNITED STATES AND THAT THE DOCUMENT I PRESENTED ABOVE AS VERIFICATION IS TRUE.**

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Business/Company (if applicable)

\_\_\_\_\_  
Print Name

\_\_\_\_\_  
Address

\_\_\_\_\_  
Date:

\_\_\_\_\_  
City, State, Zip Code

OFFICE USE ONLY: EMPLOYEE NAME: \_\_\_\_\_  
EMPLOYEE NUMBER: \_\_\_\_\_

**ALL VIOLATIONS OF FEDERAL IMMIGRATION LAW SHALL BE REPORTED TO 1-866-347-2423**

## **SPECIAL PROVISIONS**

### **MAINTAINING OPERATION OF AND ACCESS TO METERING STATION DURING CONSTRUCTION**

Temporary interruptions to normal operation of the metering station equipment including: flow measurement devices, water sampling equipment, radio communications of data, ventilation system and all other instruments and equipment shall be limited to not more than 8 hours in any given work week.

Temporary interruptions of access into the metering station by the Owner's Operations Staff shall be limited to not more than 48 hours in any given work week.

The approval and coordination of any such interruptions to operations and access to the facility shall be as described in Section 01040 of the Technical Specifications.

### **CONFIDENTIALITY OF PLANS AND SPECIFICATIONS**

Any Plans or Specifications Contractor receives regarding this project, are for official use only. Contractor may not share them with others except as required to fulfill the obligations of its contract with City.

Prepared by:

**CDM  
Smith**

4835 East Cactus Road, Suite 360  
Phoenix, Arizona 85254

**City of Tempe  
Public Works Department  
Division of Engineering**

**Gilbert Metering Station  
Improvements**

**COT Project No. 3206061**

**TECHNICAL  
SPECIFICATIONS**



Expires 3/31/2016

**NOVEMBER 2013**

CITY OF TEMPE GILBERT METERING STATION IMPROVEMENTS

PROJECT No. 3206061

TECHNICAL SPECIFICATION

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## SECTION 01040

### CONSTRUCTION COORDINATION AND SEQUENCE

#### PART 1 SCOPE OF WORK

##### 1.01 GENERAL REQUIREMENTS

- A. The Contractor shall furnish all labor, materials, equipment, tools, services and incidentals to complete all work required by Specifications and as shown on the Drawings at the City of Tempe Gilbert Metering Station Project.
- B. The Contractor shall perform the work complete, in place, and ready for continuous service, and shall include repairs, testing, permits, cleanup, replacements, and restoration required as a result of damages caused during this construction at no additional cost to the Owner.
- C. All materials, equipment, skills, tools and labor which are reasonably and properly inferable and necessary for the proper completion of the work in compliance with the requirements stated or implied by these Specifications or Drawings shall be furnished and installed by the Contractor without additional compensation, whether specifically indicated in the Contract Documents or not.
- D. The Contractor shall maintain the submittal drawing, equipment delivery schedules, and time frames of the equipment suppliers to complete this project in the allocated time as stipulated in the Agreement.
- E. The intent of construction sequencing and constraints, as specified herein and as shown on the Drawings, is to maintain Metering Station access and operation at all times throughout the construction process, and to facilitate coordination between the various parts of the project in order to bring the most critical processes on-line in a specific order over a specific time frame. All tasks of the phased construction schedule necessary to maintain the Metering Station access and operation at all times, whether described herein or not, are the responsibility of the Contractor.
- F. The work specified herein and any other work required by the Engineer, which may interrupt the normal operations, shall be accomplished at times that will be convenient to the Owner and approved by the Owner. The Contractor shall plan to work overtime if needed to complete construction of the project and shall make no claims for extra compensation for overtime work required to conform to these requirements. The Contractor shall coordinate with the Engineer and Owner's personnel at least ten (10) days prior to tying into existing piping or treatment processes, which will be out of service (shutdown) for any length of time, and at least four (4) weeks prior to construction requiring shutdown of portions of the system for extended periods of time.
- G. The Contractor shall maintain continuous access to the sites and present operations.
- H. In the event that underground piping or utilities are encountered which are not shown on the Drawings, such piping or utilities shall not be disturbed without prior approval of the Owner and Engineer.
- I. All operations of existing facilities shall be performed by City of Tempe personnel.

##### 1.02 RELATED WORK DESCRIBED ELSEWHERE

- A. Scope of Work is included in MAG Section 104.

- B. Control of Work included in MAG Section 105.
- C. Control of Materials is included in MAG Section 106.
- D. Legal Regulations and Responsibility to Public is included in MAG Section 107.
- E. Commencement, Prosecution, and Progress is included in MAG Section 108.
- F. Measurements and Payments is included in MAG Section 109.
- G. Notification of Changed Conditions and Dispute Resolutions is included in MAG Section 110.

### 1.03 COORDINATION

- A. The Metering Station is operated by the City of Tempe.
- B. Construction under this contract must be coordinated with the City of Tempe Construction Inspector and accomplished in a logical order to maintain access and operation at all times and to allow construction to be completed within the time allowed by the Contract Documents. The Contractor shall also coordinate his activities with any other contractors on site to allow orderly and timely completion of all the work.
- C. The Contractor is required to arrange with the Owner and Engineer for equipment and material storage site(s), including location of field office(s) and personnel plant access and parking area(s) prior to commencing work. Contractor shall abide by security measures in place (or as directed by the Owner) at the plant.
- D. When access through construction areas must be disrupted, the Contractor shall provide alternate acceptable access for the Metering Station operators or other Contractors at least 10 days prior to disturbance with a written request.
- E. The Contractor is required to coordinate construction activities in the interface or common areas with other Contractors, and the Metering Station operators. The Contractor must submit to the Owner and Engineer for approval a description and schedule as to how the common areas will be utilized, recognizing the required coordination with other Contractors and the plant operators.
- F. Access to all facilities shall be maintained at all times. Prior to the start of any work on the project, the Contractor shall meet with the Owner and Engineer and develop a construction schedule and a sequence of operations which will permit full, normal facility operation during construction, such schedule and sequence shall meet the written approval of the Owner.
- G. The Contractor will be required to maintain the streets and roadways used in construction operation in a reasonably clean condition. Weekly street cleaning, scraping, and sweeping will be required as directed by the Engineer.
- H. Streets shall not be utilized for storage of materials except for pipe laying operation, in which case temporary staging for excavated materials, pipe building, and embedment materials will be allowed during active pipe laying periods. One traffic lane must be kept open in these temporary staging areas. Staging areas shall be so located as to allow plant operations to be maintained. Gutters and drainage areas shall be kept clear of construction materials at all times.
- I. Street closings and lane closures shall be coordinated and approved by the Engineer. The period of time that streets are closed shall be limited to the minimum time reasonably possible.

#### 1.04 CONSTRUCTION CONSTRAINTS

- A. The following is a list of constraints, which the Contractor must incorporate in developing his overall plan of construction. This list is not intended to release the Contractor from the responsibility to coordinate the work in any manner, which will ensure project completion within the time allowed. The following areas are not necessarily listed in their required sequence of construction.
- B. Existing Metering Station Coordination
  - 1. During the course of this work, plant personnel will be operating the existing facility. The Contractor is advised of the coordination required to install the new access facility and the structural, mechanical, and electrical modifications at the existing facility. The Contractor shall coordinate and plan all work under this contract with Metering Station operating and maintenance personnel and shall not disrupt any operations at the existing facility without advance written notice and an approved schedule of events. Contractor shall provide required temporary ventilation for operations access into the confined space.
- D. Location of Existing Utilities
  - 1. Prior to commencing underground work or work requiring excavation, the Contractor shall locate the existing underground electrical conduits, including other existing utilities, sewer lines, potable and non-potable water lines, etc., located in the areas of the proposed improvements.
- E. Contractor shall be responsible for developing the schedule to meet the completion requirements and maintain the required access and ventilation of the facility.

#### 1.05 WORK SEQUENCE

- A. All work to be done under this Contract shall be done with minimum inconvenience to the existing Metering Station. Contractor shall coordinate their work with the Owner such that the facilities are maintained to the maximum extent possible.
- B. Construct Work in stages to accommodate the Owner's use of the premises during the construction period; coordinate the construction schedule and operations with the Owner's Representative.

#### 1.06 CONSTRUCTION AREAS

- A. Contractor shall limit their use of the construction areas for Work and for storage, to allow for:
  - 1. Work by other contractors, if any.
  - 2. Owner use.
  - 3. See Paragraph 1.03E this Section, for existing construction operations and coordination of the work.
- B. Coordinate use of Work under direction of the Owner and Engineer.
- C. Assume full responsibility for the protection and safekeeping of Products under this Contract stored on the site.

- D. Move any Products under Contractor's control, which interfere with operations of the Owner or separate contractor.
- E. Obtain and pay for the use of additional storage or work areas needed for operations.

#### 1.07 ADDITIONAL PROVISIONS

- A. Before commencing work on any of the existing structures or equipment, the Contractor shall notify the Engineer, in writing, at least ten (10) Calendar days in advance of the date he proposes to commence such work.
- B. Contractor shall provide at their own cost all necessary temporary facilities for access to, and for protection of, all existing structures. The treatment plant personnel must have ready access at all times to the existing structures. Contractor is responsible for all damage to existing structures, equipment, and facilities caused by their construction operations, and must repair all such damage when and as ordered by the Engineer.

#### 1.08 OWNER OCCUPANCY

- A. The Owner shall have full access to and use of all existing utilities during the entire period of construction for the conduct of their normal operations. Cooperate with the Owner's Representative in all construction operations to minimize conflict, and to facilitate Owner usage.
- B. Contractor shall at all times conduct their operations as to ensure the least inconvenience to the general public and plant operating/maintenance personnel.

#### 1.09 SUBMITTALS

- A. The Contractor shall submit to the Owner and Engineer for approval a detailed Schedule for Construction prior to initiation of site construction. The Schedule shall comply with aspects of the work described in the Contract Documents and herein.
- B. The Contractor shall update the schedule as required by the Project Specifications.

### PART 2 PRODUCTS (NOT USED)

### PART 3 EXECUTION

#### 3.01 SCHEDULE CONSIDERATIONS

- A. The construction schedule shall be developed and implemented to minimize interruptions of the Metering Station operation.
- B. The Contractor shall be responsible for developing their own schedule to meet the completion requirements and maintain the treatment capacity requirements of the plant.

#### 3.02 LIQUIDATED DAMAGES

- A. Liquidated Damages are specified in the Contract Documents.

MAINTENANCE OF PLANT OPERATIONS

<b>Construction Sequencing Plan (CSP) 01040-A: Existing Facility Partial Demolition</b>	
<b>Location:</b> Gilbert Metering Station	<b>Process Units Operating During Task:</b> All
<b>Shutdown Duration:</b> NA	<b>Process Units Out-of-Service for this Task:</b> None
<b>Related CSPs:</b> 01040-B, 01040-C& 01040 D	<b>Process Units Impacted by Task:</b> Metering Station
<b>Task Description:</b>	<p>Perform the work related to partial demolition of existing facility, but not limited to</p> <ul style="list-style-type: none"> <li>• Partial demolish the existing access facility</li> <li>• Provide temporary cover and protection to have uninterrupted access to the metering station. Temporary cover shall prevent gases leak from the tunnel.</li> <li>• Relocate antenna</li> <li>• Coordinate electrical work as required</li> </ul>
<b>Constraints</b>	<ul style="list-style-type: none"> <li>• Required access to existing facility</li> <li>• Safety requirements after partial facility demolition</li> </ul>
<b>OWNER Role &amp; Tasks:</b>	<ul style="list-style-type: none"> <li>• Coordinate site access with the Contractor</li> <li>• Coordinate antenna location with the Contractor</li> <li>• Coordinate all metering station entrance requirements with the Contractor</li> <li>• Owner inspection and approval</li> </ul>
<b>CONTRACTOR Role &amp; Tasks:</b>	<ul style="list-style-type: none"> <li>• Coordinate schedule with Owner prior to commencing work</li> <li>• Coordinate with Owner prior to performing the demolition</li> <li>• Provide uninterrupted access to the metering station</li> <li>• Monitor Metering Station air quality</li> </ul>

<b>Construction Sequencing Plan (CSP) 01040-B: Metering Station New Access</b>	
<b>Location:</b> Gilbert Metering Station	<b>Process Units Operating During Task:</b> All
<b>Shutdown Duration:</b> None	<b>Process Units Out-of-Service for this Task:</b> None
<b>Related CSPs:</b> 01040-A, 01040-C, 01040-D,	<b>Process Units Impacted by Task:</b> Metering Station Access/Operation
<b>Task Description:</b>	<p>Perform the work related to the Metering Station New Access construction, but not limited to</p> <ul style="list-style-type: none"> <li>• Excavation</li> <li>• Construct new access structure</li> <li>• Electrical work as required</li> </ul>
<b>Constraints</b>	<ul style="list-style-type: none"> <li>• Antenna relocation</li> <li>• Partial demolition of existing facility</li> </ul>
<b>OWNER Role &amp; Tasks:</b>	<ul style="list-style-type: none"> <li>• Coordinate with Contractor on temporary access requirements to the metering station</li> <li>• Owner inspection and approval</li> </ul>
<b>CONTRACTOR Role &amp; Tasks:</b>	<ul style="list-style-type: none"> <li>• Coordinate schedule with Owner prior to commencing work</li> <li>• Utilities coordination</li> <li>• Provide temporary access to metering station</li> <li>• Monitor Metering Station air quality</li> </ul>

<b>Construction Sequencing Plan (CSP) 01040-C: New HVAC System</b>	
<b>Location:</b> Gilbert Metering Station	<b>Process Units Operating During Task:</b> All
<b>Shutdown Duration:</b> None	<b>Process Units Out-of-Service for this Task:</b> None
<b>Related CSPs:</b> 01040-A, 01040-B and 01040-D	<b>Process Units Impacted by Task:</b> Metering Station Operation
<b>Task Description:</b>	<p>Perform the work related to the Chlorine Building, including, but not limited to</p> <ul style="list-style-type: none"> <li>• Install the new HVAC equipment.</li> <li>• Modifications of existing facility</li> <li>• Electrical work as required.</li> </ul>
<b>Constraints</b>	<ul style="list-style-type: none"> <li>• New facility access shall be constructed prior to existing facility modifications</li> <li>• The new HVAC equipment shall be installed prior to interior wall demolition</li> <li>• Provide uninterrupted ventilation to the Metering Station.</li> </ul>
<b>OWNER Role &amp; Tasks:</b>	<ul style="list-style-type: none"> <li>• Coordinate with Contractor to allow access to electrical and HVAC room</li> <li>• Owner inspection and approval</li> </ul>
<b>CONTRACTOR Role &amp; Tasks:</b>	<ul style="list-style-type: none"> <li>• Coordinate schedule with Owner prior to commencing work</li> <li>• Coordinate with Owner prior to performing equipment installation</li> <li>• Provide temporary ventilation as required</li> <li>• Monitor Metering Station air quality</li> </ul>

<b>Construction Sequencing Plan (CSP) 01040-D: Flume Cover</b>	
<b>Location:</b> Gilbert Metering Station	<b>Process Units Operating During Task:</b> All
<b>Shutdown Duration:</b> None	<b>Process Units Out-of-Service for this Task:</b> None
<b>Related CSPs:</b> 01040-B, 01040-C	<b>Process Units Impacted by Task:</b> Metering Station Operation
<b>Task Description:</b>	<p>Perform the work related to the Flume Cover, including, but not limited to</p> <ul style="list-style-type: none"> <li>• Remove equipment as required</li> <li>• Provide flume cover</li> </ul>
<b>Constraints</b>	<ul style="list-style-type: none"> <li>• The new HVAC system to be running</li> <li>• Louver operation to be in place</li> <li>• Flow through flume will be in operation during installation.</li> <li>• Provide access to the flume as required for Metering Station operation</li> </ul>
<b>OWNER Role &amp; Tasks:</b>	<ul style="list-style-type: none"> <li>• Coordinate with Contractor to provide access to Metering Station flume.</li> <li>• Owner inspection and approval.</li> </ul>
<b>CONTRACTOR Role &amp; Tasks:</b>	<ul style="list-style-type: none"> <li>• Coordinate schedule with Owner prior to commencing work</li> <li>• Monitor Metering Station air quality</li> </ul>

<b>Construction Sequencing Plan (CSP) 01040-E: Civil Site Work</b>	
<b>Location:</b> Gilbert Metering Station	<b>Process Units Operating During Task:</b> All
<b>Shutdown Duration:</b> None	<b>Process Units Out-of-Service for this Task:</b> None
<b>Related CSPs:</b> 01040-A & 01040-B	<b>Process Units Impacted by Task:</b> None
<b>Task Description:</b>	<p>Perform the work related with the Civil Site Work, including, but not limited to</p> <ul style="list-style-type: none"> <li>• Pavement</li> <li>• Grading</li> <li>• Landscaping</li> <li>• Concrete caps for old access</li> </ul>
<b>Constraints</b>	<ul style="list-style-type: none"> <li>• New facility access to be operating</li> </ul>
<b>OWNER Role &amp; Tasks:</b>	<ul style="list-style-type: none"> <li>• Owner inspection and approval.</li> </ul>
<b>CONTRACTOR Role &amp; Tasks:</b>	<ul style="list-style-type: none"> <li>• Coordinate schedule with Owner prior to commencing work</li> </ul>

END OF SECTION

SECTION 05500  
MISCELLANEOUS METAL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install all miscellaneous metal complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Concrete Structures MAG Section 505.

1.03 SUBMITTALS

- A. Submit, in accordance with MAG Section 105, shop drawings and product data showing materials of construction and details of installation for:
  - 1. Shop drawings, showing sizes of members, method of assembly, anchorage and connection to other members.
- B. Design Data
  - 1. Submit calculations or test data demonstrating that the railings will resist the loads specified in the OSHA at the post spacing provided. Calculations shall be stamped by a professional engineer registered in Arizona.
  - 2. Submit for review, structural calculations for the stair system, signed and sealed by a licensed professional engineer registered in the State of Arizona.
  - 3. Submit for review, structural calculations for planking system and supports, signed and sealed by a licensed professional engineer registered in the State of Arizona. Calculations to include any manufacturer's load and deflection tables for planking.
  - 4. Submit manufacturer's load and deflection tables for grating.
- C. Test Reports
  - 1. Certified copy of mill test reports on each aluminum proposed for use showing the physical properties and chemical analysis.
- D. Certificates
  - 1. Submit certification that the railing system is in compliance with OSHA requirements.

1.04 REFERENCE STANDARDS

- A. Aluminum Association (AA)
  - 1. AA M31C22A41

- a. M31: Mechanical Finish, Fine Satin
- b. C22: Finish, Medium Matte
- c. A41: Clear Anodic Coating, Class I

B. ASTM International

1. ASTM A36 - Standard Specification for Carbon Structural Steel.
2. ASTM A48 - Standard Specification for Gray Iron Castings.
3. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
4. ASTM A108 - Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.
5. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
6. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
7. ASTM A240 - Standard Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Plate, Sheet, and Strip Pressure Vessels.
8. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
9. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 Psi Tensile Strength.
10. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
11. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
12. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
13. ASTM A536 - Standard Specification for Ductile Iron Castings.
14. ASTM A570 - Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.
15. ASTM A1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
16. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.

17. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
  18. ASTM B429 - Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
  19. ASTM F1554 -Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength
  20. ASTM F2329 - Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon Screws, Washers, Nuts, and Special Threaded Fasteners
- C. American Institute of Steel Construction (AISC)
1. Specification for Structural Steel Buildings – Allowable Stress Design and Plastic Design.
- D. American Welding Society (AWS)
1. AWS D1.1 - Structural Welding Code - Steel.
  2. AWS D1.2 - Structural Welding Code - Aluminum.
  3. AWS D1.6 - Structural Welding Code - Stainless Steel
- E. Federal Specifications
1. FS-FF-B-575C - Bolts, Hexagonal and Square
- F. Occupational Safety and Health Administration (OSHA)
- G. International Code Council (ICC)
1. International Building Code (IBC)
- H. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

#### 1.05 QUALITY ASSURANCE

- A. The work of this Section shall be completely coordinated with the work of other Sections. Verify, at the site, both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.
- B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.
- C. All welding shall be performed by qualified welders and shall conform to the applicable AWS welding code. Welding of steel shall conform to AWS D1.1 and welding of aluminum shall conform to AWS D1.2 and welding of stainless steel shall conform to AWS D1.6.

## 1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.
- B. Store materials on skids and not on the ground and block up so that they will not become bent or otherwise damaged. Handle materials with cranes or derricks. Do not dump material off cars or trucks nor handle in any other way that will cause damage.
- C. Repair items that have become damaged or corroded to the satisfaction of the Engineer prior to incorporating them into the work.

## 1.07 PROJECT/SITE REQUIREMENTS

- A. Field measurements shall be taken at the site, prior to fabrication of items, to verify or supplement indicated dimensions and to ensure proper fitting of all items.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance and manufacturer's service.

### 2.02 MATERIALS

- A. Unless otherwise noted, materials for miscellaneous metals shall conform to the following standards:
  - 1. Aluminum Extruded Pipe           ASTM B429, Alloy 6063 T6 and Alloy 6061 T6 as indicated
  - 2. Aluminum Extruded Shapes       ASTM B221, Alloy 6061 T6
  - 3. Aluminum Sheet and Plate       ASTM B209, Alloy 6061 T6
  - 4. Stainless Steel Plates, Sheets, and Structural Shapes
    - a. Exterior, Submerged or Industrial Use       ASTM A240, Type 316 (Type 316L for welded)
    - b. Interior and Architectural Use       ASTM A240, Type 304
  - 5. Stainless Steel Bolts, Nuts, and Washers   ASTM A276, Type 316

### 2.03 ANCHORS, BOLTS AND FASTENING DEVICES

- A. Unless otherwise noted, anchor bolts shall be ASTM F1554, Grade 36. Provide standard headed bolts with heavy hex nuts and Grade A washers.

- B. Unless otherwise noted, bolts for the connection of carbon steel or iron shall be steel machine bolts; bolts for the connection of galvanized steel or iron shall be galvanized steel or stainless steel machine bolts; and bolts for the connection of aluminum or stainless steel shall be stainless steel machine bolts.
- C. Unless otherwise noted, expansion anchors shall be zinc plated carbon steel wedge type anchors complete with nuts and washers. Type 316 stainless steel wedge type anchors shall be used where they will be submerged or exposed to the weather or where stainless steel wedge type anchors are shown or specified. When the length or embedment of the bolt is not noted on the Drawings, provide length sufficient to place the wedge and expansion cone portion of the bolt at least 1-in behind the concrete reinforcing steel. Expansion anchors shall be Hilti, Kwik-Bolt III; Simpson Strong-Tie Wedge-All; Powers Power-Stud or equal.
- D. Adhesive anchor system, for fastening to solid concrete substrate, shall be a system manufactured for the installation of post installed studs including anchoring hardware and chemical dispenser. Injection adhesive shall be a two-component epoxy system including a hardener and a resin, furnished in pre-measured side-by-side cartridges which keep the two components separate. Side-by-side cartridges shall be designed to accept a static mixing nozzle which thoroughly blends the two components and allows injection directly into the drilled hole. Provide zinc plated carbon steel or Type 316 stainless steel stud assemblies as indicated on the Drawings consisting of an all-thread anchor rod with nut and washer. Adhesive anchor system shall be Hilti RE 500 SD; Simpson Strong Tie SET-XP; ITW Ramset Red Head Epcon G5; or equal. Unless otherwise noted, anchorage designs shown on the Drawings are based on Hilti RE 500 SD.
- E. Machine bolts and nuts shall conform to Federal Specification FF-B-575C. Bolts and nuts shall be hexagon type. Bolts, nuts, screws, washers and related appurtenances shall be Type 316 stainless steel.
- F. Toggle bolts shall be Hilti, Toggler Bolt or equal.

#### 2.04 ALUMINUM STAIR

- A. Stairs and hand railing shall conform to OSHA requirements.
- B. Design stair assembly to support a minimum concentrated live load of 1000 lbs.
- C. Design hand railing to meet OSHA Standards and to withstand 200 lbs load applied anywhere on the system and in any direction.
- D. Fabrication
  - 1. Size members as required by design calculations and job conditions.
  - 2. Stringers and Headers: Aluminum channel stringers shall be clip angled to concrete walls. Stringers shall furnish support to intermediate landing, unless otherwise indicated on the Drawings.
  - 3. Metal Risers and Treads: Form metal risers and treads of minimum 14 gauge structural sheet steel and shop weld to stringer in an approved manner.

4. Landings: Construct platforms of loose structural aluminum channels, side-supported headers and miscellaneous framing members framing into the stair stringers. Provide minimum 14 gauge landing decking complete with shop welded reinforcing rods topside and perimeter screed members.
5. Construct stairs to conform to sizes and arrangements indicated; join pieces together by welding unless otherwise indicated. Provide complete stair assemblies including metal framing, hangers, columns, struts, clips, brackets, bearing plates and other components necessary for the support of stairs and platforms and as required to anchor and contain the stairs on the supporting structure.
6. Fabricate stringers of structural steel channels, or plates, or a combination thereof, as indicated. Provide closures for exposed ends of stringers. Construct platforms of structural steel channel headers and miscellaneous framing members as indicated. Bolt or weld headers to stringers and framing members to stringers and headers. Fabricate and join so that bolts, if used, do not appear on finish surfaces.
7. Metal pan risers, subtreads and subplatforms: Shape metal pans for risers and subtreads to conform to configuration shown. Provide thicknesses of structural steel sheet for metal pans indicated but not less than that required to support total design loading.
8. Attach risers, subtreads and subplatforms to stringers by means of brackets made of steel angles or bars. Weld brackets to stringers and attach metal pins to brackets by welding, or bolting.
9. Form work true to line and level with accurate angles and surfaces and straight sharp edges. Ease exposed edges to radius of approximately 1/32-in. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
10. Weld all assemblies in accordance with recommendations of AWS. Grind all exposed welds to match and blend with adjoining surfaces.

## 2.05 ALUMINUM GRATING

- A. Grating shall have rectangular, 3/16-in thick, bearing bars spaced 1-3/16-in on center with cross bars spaced at 4-in on center. All grating panels shall be banded with a bar the same size as the bearing bars.
  1. Grating shall not exceed the fabricator's maximum recommended span, and meet or exceed the following load and deflection criteria for the maximum span length at the opening being covered by the grating.
    - a. The grating shall produce a deflection of 1/360 of the span or less under a concentrated live load of 1000 lbs applied at the mid point of the maximum span.
  2. Openings 2-in or greater in diameter/dimension and grating edges shall be banded with a bar of the same depth and thickness as the bearing bars. Cut bearing bars or cross bars shall be welded to the banding bar.
  3. Grating clamps, nuts, bolts, washers and other fastening devices for grating and grating supports shall be Type 316 stainless steel. All grating shall be anchored to the supporting system using saddle clips or welding.

- B. Aluminum grating material shall be aluminum alloy 6063-T6 with an anodized finish. Cross bars shall be attached to the bearing bars with interlocked swaged joints. The grating shall be Type BS by Harsco Industrial IKG, Houston, TX; Type 19 SG-4 by Ohio Gratings, Inc., Canton, OH; Type 19S4 by Seidelhuber Metal Products, San Carlos, CA or equal.
- C. Metal frames and supports for grating shall be of the same material as the grating unless otherwise shown on the Drawings. Where aluminum supports are used, they shall be fabricated from aluminum alloy 6061-T6.

## 2.06 ALUMINUM PLANKING

- A. Planking shall not exceed the fabricator's maximum recommended span, and meet or exceed the following load and deflection criteria for the maximum span length at the opening being covered by the grating.
  - 1. The planking shall produce a deflection of 1/240 of the span or less under a concentrated live load of 300 lbs applied at the midpoint of the maximum span.
  - 2. The planking shall produce a deflection of 1/240 of the span or less under a uniform live load of 100 lbs/sq ft on the maximum span.
  - 3. The planking shall be designed for a uniform uplift load of 180 lbs/sq ft on the maximum span.
  - 4. Openings 2-in or greater in diameter/dimension and planking edges shall be banded with a bar of the same depth and thickness as the bearing bars. Cut bearing bars or cross bars shall be welded to the banding bar.
- B. Planking shall be removable. Each removable section shall not exceed in weight 50 lbs.
- C. Aluminum planking material shall be aluminum alloy 6063-T6 with an anodized finish. The Planking shall be by Harsco Industrial IKG; Ohio Gratings, Inc.; CST Covers, Hallsten Corporation, PS Doors, Ironco or equal.
- D. Metal frames and supports for grating shall be of the same material as the grating unless otherwise shown on the Drawings. Where aluminum supports are used, they shall be fabricated from aluminum alloy 6061-T6.

## 2.07 RAILINGS

- A. Handrail and railing systems shall comply with the requirements of OSHA.
- B. Aluminum railing and handrail shall be a welded or mechanically fastened, seamless, extruded aluminum pipe system. Rails shall be 6063-T6 alloy. Posts shall be 6061-T6 alloy. Splice and reinforcing sleeves, brackets, end caps, toeboards, etc, shall be aluminum alloy 6063-T6 or 6061-T6. Railing system fastening hardware shall be Type 304 stainless steel. After welding, aluminum shall be anodized.
- C. Railings shall be 2 rail welded railing systems, fabricated with 1-1/2-in nominal diameter pipe. Posts shall be Schedule 80 pipe, minimum and rails and handrail shall be Schedule 40 pipe, minimum. Posts and top rails shall be continuous. Spacing of posts shall not exceed 5-ft on

center and shall be uniformly spaced except as otherwise shown on the Drawings. All railing posts shall be vertical.

- D. Welds shall be circumferential welds ground smooth and even to produce a railing that is neat in appearance and structurally sound. Welding methods shall be in conformity with AWS standards for the materials being joined. For welding aluminum, use a weld filler alloy that is compatible with the alloys to be joined, that will not discolor the pieces to be joined and that will not be discolored by anodizing. All rails to post connections shall be coped and fastened by continuous welds. There shall be no burrs, sharp edges or protrusions on any weld on any part of the handrail system. After fabrication, the welds and surrounding area shall be cleaned and hand buffed to blend with the adjacent finish. All mechanical fasteners shall be unobtrusively located in countersunk holes with the top flush with the surface of the rail. Bends in the railing shall be as indicated by the Drawings. No distortion of the circular railing shape will be allowed. Bends and terminal sections shall be made without the use of fittings. Corner bends shall be mitered and welded bends.
- E. Railing shall be assembled in sections as long as practical but shall not be greater than 24-ft in length. A field splice shall be used when an assembled section is to be attached to another section.
  - 1. Field splices shall use internal splice sleeves located within 8-in of railing posts. The sleeve shall be welded to the rail on one side and fastened with a set screw to the rail on other side. The field splice shall be detailed to take the differential expansion between the railing system and the supporting structure.
- F. The bases or supports for railing posts and handrail shall be the types indicated on the Drawings.
- G. Toeboards shall be provided on all railing adjacent to a drop in elevation of 4-ft or more. Toeboards are not required on the inclined portion of stairway railings or where concrete or steel curbs, 4-in or more in height, are present. Toeboards shall be 4-in high channels of the same material as the railing. The channels shall have a minimum thickness of 1/8-in and have flanges of not less than 3/4-in nor more than 1-1/2-in in width. Toeboards shall be positioned with a maximum clearance of 1/4-in from the floor and fastened to railing posts with 1/4-in stainless steel U-bolts, with J-bolts at corner posts and with clip angles and two 1/4-in stainless steel expansion bolts at walls.
- H. All railings shall be properly protected by paper, or by an approved coating or by both against scratching, splashes or mortar, paint, or other defacements during transportation and erection and until adjacent work by other trades has been completed. After protective materials are removed, the surfaces shall be made clean and free from stains, marks, or defects of any kind.

## 2.08 MISCELLANEOUS ALUMINUM

- A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

- B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Welding shall be on the unexposed side as much as possible in order to prevent pitting or discoloration of the aluminum exposed surface. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.
- C. Miscellaneous aluminum items shall include: beams, angles, closure angles, grates, hatches, floor plates, stop plates, stair nosings and any other miscellaneous aluminum called for on the Drawings and not otherwise specified.
- D. Angle frames for hatches, beams, grates, etc, shall be complete with welded strap anchors attached.
- E. Stair treads for aluminum stairs shall have abrasive non-slip nosing as approved.

### PART 3 EXECUTION

#### 3.01 INSTALLATION

- A. Install all items except those to be embedded in concrete or other masonry which shall be installed under MAG Section 505. Items to be attached to concrete after such work is completed shall be installed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted.
- B. Abrasions in the shop primer shall be touched up immediately after erection. Areas left unprimed for welding shall be painted with primer after welding.
- C. Zinc coating which has been burned by welding, abraded, or otherwise damaged shall be cleaned and repaired after installation. The damage area shall be thoroughly cleaned by wire brushing and all traces of welding flux and loose or cracked zinc coating removed prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint conforming to the requirements of Military Specifications MIL-P-15145. The paint shall be properly compounded with a suitable vehicle in the ratio of one part zinc oxide to four parts zinc dust by weight.
- D. Specialty products shall be installed in accordance with the manufacturer's recommendations.
- E. Expansion bolts shall be checked for tightness a minimum of 24 hours after initial installation.
- F. Install adhesive anchor system in strict compliance with the manufacturer's recommendations, including drill bit diameter, surface preparation, temperature, moisture conditions, injection and installation of bolts. Use oil free compressed air to blast out loose particles and dust from the drilled holes. Bolts must be clean and free of dirt, oil, grease, ice or other material which would reduce bond.
- G. Headed anchor studs shall be welded in accordance with manufacturer's recommendations.
- H. All railings shall be erected to line and plumb.

- I. All steel surfaces that come into contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with the manufacturer's instructions prior to installation.
- J. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc-chromate primer followed by two coats of aluminum metal and masonry paint to the dissimilar metal.
- K. Where aluminum contacts masonry or concrete, apply a heavy coat of approved alkali resistant paint to the masonry or concrete.
- L. Between aluminum gratings, aluminum stair treads, or aluminum handrail brackets and steel supports, insert 1/4-in thick neoprene isolator pads, 85 plus or minus 5 Shore A durometer, sized for full width and length of bracket or support.

END OF SECTION

SECTION 08110  
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install hollow metal doors and frames complete as shown on the drawings and as specified herein.

1.02 RELATED WORK

- A. Door Hardware is included are Section 08710.

1.03 SUBMITTALS

- A. Product Data: For each type of product.
  - 1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, and finishes.
- B. Shop Drawings:
  - 1. Elevations of each door type.
  - 2. Details of doors, including vertical- and horizontal-edge details and metal thicknesses.
  - 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
  - 4. Locations of reinforcement and preparations for hardware.
  - 5. Details of anchorages, joints, field splices, and connections.
  - 6. Details of accessories.
  - 7. Details of moldings, removable stops, and glazing.
- C. Schedule: Provide a schedule of hollow-metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final Door Hardware Schedule.
- D. Product Test Reports: For each type of hollow-metal door and frame assembly, for tests performed by a qualified testing agency.
- E. Oversize Construction Certification: For assemblies required to be fire rated and exceeding limitations of labeled assemblies.

1.04 REFERENCES

- A. ASTM International

1. ASTM A 153/A 153M - Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
  2. ASTM A 653/A 653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
  3. ASTM A 879/A 879M - Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface
  4. ASTM A 1008/A 1008M - Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable
  5. ASTM A 1011/A 1011M - Specification for Steel, Sheet and Strip, Hot Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength
  6. ASTM C 143/C 143M - Test Method for Slump of Hydraulic Cement Concrete
  7. ASTM C 476 - Specification for Grout for Masonry
  8. ASTM C 665 - Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
  9. ASTM C 1363 - Test Method for the Thermal Performance of Building Materials and Envelope Assemblies by Means of a Hot Box Apparatus
  10. ASTM E 136 - Test Method for Behavior of Materials in a Vertical Tube Furnace at 750 Degree C
- B. Builders Hardware Manufacturers Association
1. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames (ANSI)
- C. Hollow Metal Manufacturers Association; Division of National Association of Architectural Metal Manufacturers
1. NAAMM-HMMA 803 - Hollow Metal Manual: Steel Tables
  2. NAAMM-HMMA 840 - Installation and Storage of Hollow Metal Doors and Frames
  3. NAAMM-HMMA 860 - Guide Specifications for Hollow Metal Doors and Frames (ANSI)
  4. NAAMM-HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames (ANSI)
  5. NAAMM-HMMA 867 - Guide Specifications for Commercial Laminated Core Hollow Metal Doors and Frames (ANSI)
- D. NFPA
1. NFPA 80 - Fire Doors and Other Opening Protectives (ANSI)

2. NFPA 105 - Installation of Smoke-Control Door Assemblies (ANSI)
  3. NFPA 252 - Fire Tests of Door Assemblies (ANSI)
  4. NFPA 257 - Fire Tests for Window and Glass Block Assemblies (ANSI)
- E. Steel Door Institute
1. SDI 111C - Recommended Louver Details for Standard Steel Doors
  2. SDI A250.3 - Test Procedure and Acceptance Criteria for Factory Applied Finish Painted Steel Surfaces for Steel Doors and Frames (ANSI)
  3. SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors and Hardware Reinforcings (ANSI)
  4. SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames (ANSI)
  5. SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames (ANSI)
  6. SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames (ANSI)
  7. SDI A250.11 - Recommended Erection Instructions for Steel Frames (ANSI)
- F. Underwriters Laboratories Inc.
1. UL 9 - Fire Tests of Window Assemblies
  2. UL 10C - Positive Pressure Fire Tests of Door Assemblies
  3. UL 1784 - Air Leakage Tests for Door Assemblies
- G. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

#### 1.05 DEFINITIONS

- A. Minimum Thickness: Minimum thickness of base metal without coatings according to NAAMM-HMMA 803 or SDI A250.8.
- B. Manufacturers Standard Gage (MSG): The minimum steel thickness derived from the published figures of Underwriters Laboratories, Inc. and used for reference purposes only.

#### 1.06 COORDINATION

- A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow-metal work palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.
  - 1. Provide additional protection to prevent damage to factory-finished units.
- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow-metal work vertically under cover at Project site with head up. Place on minimum 4-inch- (102-mm-) high wood blocking. Provide minimum 1/4-inch (6-mm) space between each stacked door to permit air circulation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Provide products by one of the following:
  - 1. Apex Industries, Inc.
  - 2. Ceco Door Products; an Assa Abloy Group company.
  - 3. Commercial Door & Hardware Inc.
  - 4. Curries Company; an Assa Abloy Group company.
  - 5. .
  - 6. .
  - 7. .
  - 8. .
  - 9. Hollow Metal Xpress.
  - 10. Steelcraft; an Ingersoll-Rand company.
  - 11. Or equal.
- B. Source Limitations: Obtain hollow-metal work from single source from single manufacturer.

2.02 EXTERIOR HOLLOW-METAL DOORS AND FRAMES

- A. Construct exterior doors and frames to comply with the standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.
- B. Hollow-Metal Doors and Frames: NAAMM-HMMA 860..

1. Physical Performance: Level A according to SDI A250.4.
2. Doors:
  - a. Type: As indicated in the Door and Frame Schedule.
  - b. Thickness: 1-3/4 inches (44.5 mm.)
  - c. Face: Metallic-coated steel sheet, minimum thickness of (MSG 18 gage) 0.042 inch (1.0 mm), with minimum G60 (Z180 or)A60 (ZF180) coating.
  - d. Edge Construction: Continuously welded with no visible seam.
  - e. Core: Steel stiffened.
    - 1) Thermal-Rated Doors: Provide doors fabricated with thermal-resistance value (R-value) of not less than {R-15} when tested according to ASTM C 1363.
3. Frames:
  - a. Materials: Metallic-coated steel sheet, minimum thickness of (MSG 16 gage) 0.053 inch (1.3 mm), with minimum G60 (Z180 or)A60 (ZF180) coating.
  - b. Construction: Face welded
4. Exposed Finish: Prime.

## 2.03 FRAME ANCHORS

### A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 inch (1.0 mm) thick, with corrugated or perforated straps not less than 2 inches (51 mm) wide by 10 inches (254 mm) long; or wire anchors not less than 0.177 inch (4.5 mm) thick.

### B. Floor Anchors: Formed from same material as frames, minimum thickness of 0.042 inch (1.0 mm), and as follows:

1. Monolithic Concrete Slabs: Clip-type anchors, with two holes to receive fasteners.

## 2.04 MATERIALS

- A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- B. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- C. Hot-Rolled Steel Sheet: ASTM A 1011/A 1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.
- D. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B.
- E. Frame Anchors: ASTM A 879/A 879M, Commercial Steel (CS), 04Z (12G) coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A 1008/A 1008M or ASTM A 1011/A 1011M, hot-dip galvanized according to ASTM A 153/A 153M, Class B.
- F. Inserts, Bolts, and Fasteners: Hot-dip galvanized according to ASTM A 153/A 153M.
- G. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.
- H. Grout: ASTM C 476, except with a maximum slump of 4 inches (102 mm), as measured according to ASTM C 143/C 143M.
- I. Mineral-Fiber Insulation: ASTM C 665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E 136 for combustion characteristics.

## 2.05 FABRICATION

- A. Fabricate hollow-metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for metal thickness. Where practical, fit and assemble units in manufacturer's plant. To ensure proper assembly at Project site, clearly identify work that cannot be permanently factory assembled before shipment.
- B. Hollow-Metal Doors:
  1. Steel-Stiffened Door Cores: Provide minimum thickness 0.026 inch (0.66 mm), steel vertical stiffeners of same material as face sheets extending full-door height, with vertical webs spaced not more than 6 inches (152 mm) apart. Spot weld to face sheets no more than 5 inches (127 mm) o.c. Fill spaces between stiffeners with glass- or mineral-fiber insulation.
  2. Vertical Edges for Single-Acting Doors: Provide beveled or square edges at manufacturer's discretion.
  3. Top Edge Closures: Close top edges of doors with flush closures of same material as face sheets.
  4. Bottom Edge Closures: Close bottom edges of doors where required for attachment of weather stripping with end closures or channels of same material as face sheets.
  5. Exterior Doors: Provide weep-hole openings in bottoms of exterior doors to permit moisture to escape. Seal joints in top edges of doors against water penetration.
- C. Hollow-Metal Frames: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.

1. Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
  2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
  3. Grout Guards: Weld guards to frame at back of hardware mortises in frames to be grouted.
  4. Floor Anchors: Weld anchors to bottoms of jambs with at least four spot welds per anchor; however, for slip-on drywall frames, provide anchor clips or countersunk holes at bottoms of jambs.
  5. Jamb Anchors: Provide number and spacing of anchors as follows:
    - a. Masonry Type: Locate anchors not more than 16 inches (406 mm) from top and bottom of frame. Space anchors not more than 32 inches (813 mm) o.c., to match coursing, and as follows:
      - 1) Two anchors per jamb up to 60 inches (1524 mm) high.
      - 2) Three anchors per jamb from 60 to 90 inches (1524 to 2286 mm) high.
      - 3) Four anchors per jamb from 90 to 120 inches (2286 to 3048 mm) high.
      - 4) Four anchors per jamb plus one additional anchor per jamb for each 24 inches (610 mm) or fraction thereof above 120 inches (3048 mm) high.
  6. Head Anchors: Two anchors per head for frames more than 42 inches (1067 mm) wide and mounted in metal-stud partitions.
  7. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.
    - a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.
  8. Terminated Stops: Terminate stops 6 inches (152 mm) above finish floor with a 90-degree angle cut, and close open end of stop with steel sheet closure. Cover opening in extension of frame with welded-steel filler plate, with welds ground smooth and flush with frame.
- D. Fabricate concealed stiffeners and edge channels from either cold- or hot-rolled steel sheet.
- E. Hardware Preparation: Factory prepare hollow-metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to SDI A250.6, the Door Hardware Schedule, and templates.
1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
  2. Comply with applicable requirements in SDI A250.6 and BHMA A156.115 for preparation of hollow-metal work for hardware.
- F. Stops and Moldings: Provide stops and moldings around glazed lites and louvers where indicated. Form corners of stops and moldings with butted or mitered hairline joints.
1. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames.

2. Provide loose stops and moldings on inside of hollow-metal work.
3. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.

## 2.06 STEEL FINISHES

- A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer compatible with field painting materials included in Section 09902.
  1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.
- B. Factory Finish: Clean, pretreat, and apply manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat, complying with SDI A250.3.
  1. Color and Gloss: As selected by Engineer from manufacturer's full range.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for embedded and built-in anchors to verify actual locations before frame installation.
- C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

### 3.03 INSTALLATION

- A. General: Install hollow-metal work plumb, rigid, properly aligned, and securely fastened in place. Comply with Drawings and manufacturer's written instructions.
- B. Hollow-Metal Frames: Install hollow-metal frames of size and profile indicated. Comply with SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces, leaving surfaces smooth and undamaged.
    - a. At fire-rated openings, install frames according to NFPA 80.
    - b. Where frames are fabricated in sections because of shipping or handling limitations, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces.
    - c. Install frames with removable stops located on secure side of opening.
    - d. Install door silencers in frames before grouting.
    - e. Remove temporary braces necessary for installation only after frames have been properly set and secured.
    - f. Check plumb, square, and twist of frames as walls are constructed. Shim as necessary to comply with installation tolerances.
    - g. Field apply bituminous coating to backs of frames that will be filled with grout containing antifreezing agents.
  2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with postinstalled expansion anchors.
    - a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.
  3. Metal-Stud Partitions: Solidly pack mineral-fiber insulation inside frames.
  4. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with grout.
  5. Concrete Walls: Solidly fill space between frames and concrete with mineral-fiber insulation.
  6. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
  7. In-Place Metal or Wood-Stud Partitions: Secure slip-on drywall frames in place according to manufacturer's written instructions.
  8. Installation Tolerances: Adjust hollow-metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
    - a. Squareness: Plus or minus 1/16 inch (1.6 mm), measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
    - b. Alignment: Plus or minus 1/16 inch (1.6 mm), measured at jambs on a horizontal line parallel to plane of wall.
    - c. Twist: Plus or minus 1/16 inch (1.6 mm), measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
    - d. Plumbness: Plus or minus 1/16 inch (1.6 mm), measured at jambs at floor.
- C. Hollow-Metal Doors: Fit hollow-metal doors accurately in frames, within clearances specified below. Shim as necessary.
1. Non-Fire-Rated Steel Doors:

- a. Between Door and Frame Jambs and Head: 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
  - b. Between Edges of Pairs of Doors: 1/8 inch (3.2 mm) to 1/4 inch (6.3 mm) plus or minus 1/32 inch (0.8 mm).
  - c. At Bottom of Door: [3/4 inch (19.1 mm)] [5/8 inch (15.8 mm)] plus or minus 1/32 inch (0.8 mm).
  - d. Between Door Face and Stop: 1/16 inch (1.6 mm) to 1/8 inch (3.2 mm) plus or minus 1/32 inch (0.8 mm).
- D. Secure stops with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches (230 mm) o.c. and not more than 2 inches (51 mm) o.c. from each corner.

### 3.04 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow-metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow-metal work immediately after installation.
- C. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.
- D. Metallic-Coated Surface Touchup: Clean abraded areas and repair with galvanizing repair paint according to manufacturer's written instructions.
- E. Factory-Finish Touchup: Clean abraded areas and repair with same material used for factory finish according to manufacturer's written instructions.
- F. Touchup Painting: Cleaning and touchup painting of abraded areas of paint are specified in painting Sections.

END OF SECTION

SECTION 08710  
DOOR HARDWARE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and design and deliver door hardware for the Project as shown on the Drawings and as specified herein.
- B. Types of products required include the following:
  - 1. Heavy-duty Mortise hinges
  - 2. Electric panic exit device
  - 3. Overhead, surface-mounted, door closer.
  - 4. Heavy-duty, concealed, adjustable, overhead holders and stops.
  - 5. Stripping and seals.
  - 6. Thresholds.
  - 7. Silencers.
  - 8. Miscellaneous items and accessories for a complete installation functioning in compliance with the requirements of governing authorities having jurisdiction at the site.

1.02 RELATED WORK

- A. Metal doors and frames are included in Section 08110

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300.
- B. Product Data: Include construction and installation details, material descriptions, dimensions of individual components and profiles, and finishes.
- C. Qualification Data: For Architectural Hardware Consultant.
- D. Maintenance Data: For each type of door hardware to include in maintenance manuals. Include final hardware and keying schedule.
- E. Warranty: Special warranty specified in this Section.
- F. Other Action Submittals:
  - 1. Door Hardware Sets: Prepared by or under the supervision of an Architectural Hardware Consultant, detailing fabrication and assembly of door hardware, as well as procedures and

diagrams. Coordinate the final door hardware sets with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

- a. Format: Comply with scheduling sequence and vertical format in DHF's "Sequence and Format for the Hardware Schedule." Double space entries, and number and date each page and use same door numbers as indicated.
  - b. Content: Include the following information:
    - 1) Identification number, location, hand, fire rating, and material of each door and frame.
    - 2) Type, style, function, size, quantity, and finish of each door hardware item. Include description and function of each lockset and exit device.
    - 3) Complete designations of every item required for each door or opening including name and manufacturer.
    - 4) Fastenings and other pertinent information.
    - 5) Location of each door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
    - 6) Explanation of abbreviations, symbols, and codes contained in schedule.
    - 7) Mounting locations for door hardware.
    - 8) Door and frame sizes and materials.
    - 9) List of related door devices specified in other Sections for each door and frame.
  - c. Submittal Sequence: Submit the final door hardware sets at earliest possible date, particularly where approval of the door hardware sets must precede fabrication of other work that is critical in Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the door hardware sets.
2. Keying Schedule: Prepared by or under the supervision of Architectural Hardware Consultant, detailing Owner's final keying instructions for locks. Include schematic keying diagram and index each key set to unique door designations.

#### 1.04 REFERENCE STANDARDS

##### A. American Architectural Manufacturers Association

1. AAMA 701/702 - Voluntary Specifications for Pile Weatherstripping and Replaceable Fenestration Weatherseals

##### B. American National Standards Institute

1. ANSI A250.6 - Hardware for Standard Steel Doors (Reinforcement - Application)

##### C. ASTM International

1. ASTM D 2000 - Classification System for Rubber Products in Automotive Applications
2. ASTM E 283 - Test Method for Determining the Rate of Air Leakage through Exterior Windows, Curtain Walls, and Doors under Specified Pressure Differences across the Specimen

##### D. Builders Hardware Manufacturers Association

1. BHMA A156.1 - Butts and Hinges (ANSI)

2. BHMA A156.4 - Door Controls - Closers (ANSI)
3. BHMA A156.5 - Auxiliary Locks and Associated Products (ANSI)
4. BHMA A156.6 - Architectural Door Trim (ANSI)
5. BHMA A156.7 - Template Hinge Dimensions (ANSI)
6. BHMA A156.13 - Mortise Locks & Latches Series 1000 (ANSI)
7. BHMA A156.16 - Auxiliary Hardware (ANSI)
8. BHMA A156.18 - Materials and Finishes (ANSI)
9. BHMA A156.21 - Thresholds (ANSI)
10. BHMA A156.22 - Door Gasketing and Edge Seal Systems (ANSI)
11. BHMA A156.30 - High Security Cylinders (ANSI)
12. Certified Product Directory.

E. Door and Hardware Institute

1. DHI A115 Series - Specifications for Steel Door and Frame Preparation for Hardware (ANSI)
2. Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames.
3. Sequence and Format for the Hardware Schedule.

F. NFPA

1. NFPA 80 - Fire Doors and Fire Windows
2. NFPA 101 - Life Safety Code
3. NFPA 252 - Methods of Fire Tests of Door Assemblies

- G. Where reference is made to one of the above or other referenced standards, the revisions in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by lock manufacturer.
1. Installer's responsibilities include supplying and installing door hardware and providing a qualified Architectural Hardware Consultant available during the course of the Work to consult with Contractor, Engineer, and Owner about door hardware and keying.
  2. Installer shall have warehousing facilities in Project's vicinity.

3. Scheduling Responsibility: Preparation of door hardware and keying schedules.

- B. Architectural Hardware Consultant Qualifications: A person who is currently certified by DHI as an Architectural Hardware Consultant and who is experienced in providing consulting services for door hardware installations that are comparable in material, design, and extent to that indicated for this Project.
- C. Source Limitations: Obtain each type and variety of door hardware from a single manufacturer, unless otherwise indicated.
- D. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
  - 1. Test Pressure: Test at atmospheric pressure.
- E. Keying Conference: Conduct conference at Project site. In addition to Owner, Contractor, and Engineer, conference participants shall also include Installer's Architectural Hardware Consultant. Incorporate keying conference decisions into final keying schedule after reviewing door hardware keying system including, but not limited to, the following:
  - 1. Function of building, flow of traffic, purpose of each area, degree of security required, and plans for future expansion.
  - 2. Preliminary key system schematic diagram.
  - 3. Requirements for key control system.
  - 4. Address for delivery of keys.

#### 1.06 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up for door hardware delivered to Project site.
- B. Tag each item or package separately with identification related to the final door hardware sets, and include basic installation instructions, templates, and necessary fasteners with each item or package.
- C. Deliver keys to manufacturer of key control system for subsequent delivery to Owner.
- D. Deliver keys and permanent cores to Owner by registered mail or overnight package service.

#### 1.07 COORDINATION

- A. Templates: Distribute door hardware templates for doors, frames, and other work specified to be factory prepared for installing door hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing door hardware to comply with indicated requirements.

- B. Existing Openings: Where new hardware components are scheduled for application to existing construction or where modifications to existing door hardware are required, field verify existing conditions and coordinate installation of door hardware to suit opening conditions and to provide for proper operation.

#### 1.08 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including excessive deflection, cracking, or breakage.
    - b. Faulty operation of operators and door hardware.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.
  - 2. Warranty Period: Three years, except 10 years for manual closers.

#### 1.09 MAINTENANCE SERVICE

- A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.
- B. Maintenance Service: Provide six months' full maintenance by skilled employees of door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door hardware operation. Provide parts and supplies same as those used in the manufacture and installation of original products.

### PART 2 PRODUCTS

#### 2.01 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in this Section.
  - 1. Door Hardware Sets: Provide quantity, item, size, finish or color indicated, and products equivalent in function and comparable in quality to named products and the BHMA standard referenced.
- B. Designations: Requirements for design, grade, function, finish, size, and other distinctive qualities of each type of door hardware are indicated in Part 3 "Door Hardware Sets" Article. Products are identified by using door hardware designations, as follows:
  - 1. Named Manufacturers' Products: Manufacturer and product designation are listed for each door hardware type required for the purpose of establishing minimum requirements. Manufacturers' names are abbreviated in Part 3 "Door Hardware Sets" Article.
  - 2. References to BHMA Standards: Provide products complying with these standards and requirements for description, quality, and function.

## 2.02 HINGES, GENERAL

- A. Quantity: Provide the following, unless otherwise indicated:
  - 1. Two Hinges: For doors with heights up to 60 inches.
  - 2. Three Hinges: For doors with heights 61 to 90 inches.
  - 3. Four Hinges: For doors with heights 91 to 120 inches.
  - 4. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
- B. Template Requirements: Except for hinges and pivots to be installed entirely (both leaves) into wood doors and frames, provide only template-produced units.
- C. Hinge Weight: Provide Heavy-weight hinges.
- D. Hinge Base Metal: Stainless steel, with stainless-steel pin.
- E. Hinge Corners: Square.
- F. Fasteners: Comply with the following:
  - 1. Machine Screws: For metal doors and frames. Install into drilled and tapped holes.
  - 2. Screws: Phillips flat-head; machine screws (drilled and tapped holes) for metal doors. Finish screw heads to match surface of hinges.

## 2.03 HINGES

- A. Butts and Hinges: BHMA A156.1. Listed under Category A in BHMA's "Certified Product Directory."
- B. Template Hinge Dimensions: BHMA A156.7.
- C. Manufacturers: Provide products by one of the following:
  - 1. FBB 199 by Stanley Commercial Hardware; Div. of The Stanley Works (STH).
  - 2. Or equal.

## 2.04 LOCKS AND LATCHES, GENERAL

- A. Latches and Locks for Means of Egress Doors: Comply with NFPA 101. Latches shall not require more than 15 lbf to release the latch. Locks shall not require use of a key, tool, or special knowledge for operation.
- B. Lock Trim:
  - 1. Levers: Match to the following:

- a. "P Lever Design," by SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
  - b. "17 (D Sparta)," by Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
  - c. "JEFFERSON - JNE," by Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).
2. Lockset Designs: Provide designs that match those scheduled.
- C. Lock Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
- 1. Mortise Locks: Minimum 3/4-inch latchbolt throw.
  - 2. Deadbolts: Minimum 1-inch bolt throw.
- D. Backset: 2-3/4 inches, unless otherwise indicated.
- E. Strikes: Manufacturer's standard strike with strike box for each latchbolt or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, and as follows:
- 1. Strikes for Mortise Locks and Latches: BHMA A156.13.

## 2.05 MECHANICAL LOCKS AND LATCHES

- A. Lock Functions: Function numbers and descriptions indicated in door hardware sets comply with the following:
- 1. Mortise Locks: BHMA A156.13.
- B. Mortise Locks: Stamped steel case with steel or brass parts; BHMA A156.13, Grade 1; Series 1000. Listed under Category F in BHMA's "Certified Product Directory."
- 1. Manufacturers: Provide products by one of the following:
    - a. SARGENT Manufacturing Company; an ASSA ABLOY Group company (SGT).
    - b. Schlage Commercial Lock Division; an Ingersoll-Rand Company (SCH).
    - c. Yale Commercial Locks and Hardware; an ASSA ABLOY Group company (YAL).
    - d. Or equal.

## 2.06 DOOR BOLTS

- A. Bolt Throw: Comply with testing requirements for length of bolts required for labeled fire doors, and as follows:
- 1. Fire-Rated Surface Bolts: Minimum 1-inch throw; listed and labeled for fire-rated doors.
  - 2. Mortise Flush Bolts: Minimum 3/4-inch throw.
- B. Dustproof Strikes: BHMA A156.16, Grade 1.
- C. Manual Flush Bolts: BHMA A156.16, Grade 1; designed for mortising into door edge.

1. Manufacturers: Provide products by one of the following:
  - a. Hager Companies (HAG).
  - b. IVES Hardware; an Ingersoll-Rand Company (IVS).
  - c. Rockwood Manufacturing Company (RM).
  - d. Or equal.

## 2.07 LOCK CYLINDERS

- A. Standard Lock Cylinders: BHMA A156.5, Grade 1.
- B. Cylinders: Manufacturer's standard tumbler type, constructed from brass or bronze, stainless steel, or nickel silver, and complying with the following:
  1. Number of Pins: Seven.
  2. Mortise Type: Threaded cylinders with rings and straight- or clover-type cam.
- C. Permanent Cores: Manufacturer's standard; finish face to match lockset; complying with the following:
  1. Interchangeable Cores: Core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- D. Construction Keying: Do not provide construction keying. Contractor shall provide access to all areas during construction, so not to interrupt the Owners unhindered use of all areas.
- E. Manufacturer: Same manufacturer as for locks and latches.

## 2.08 KEYING

- A. Keys: 3-Nickel silver.
  1. Stamping: Permanently inscribe each key with a visual key control number and include the notation "DO NOT DUPLICATE."
  2. Quantity: In association with Owner requirements, determined at keying conference, provide up to the following maximum number of keys.
    - a. Cylinder Change Keys: Three.
    - b. Master Keys: Five.
    - c. Grand Master Keys: Five.
    - d. Great-Grand Master Keys: Five.

## 2.09 CLOSERS

- A. Door Closers for Means of Egress Doors: Comply with NFPA 101. Door closers shall not require more than 30 lbf to set door in motion and not more than 15 lbf to open door to minimum required width.
- B. Size of Units: Unless otherwise indicated, comply with manufacturer's written recommendations for size of door closers depending on size of door, exposure to weather, and

anticipated frequency of use. Provide factory-sized closers, adjustable to meet field conditions and requirements for opening force.

- C. Surface Closers: BHMA A156.4, Grade 1. Listed under Category C in BHMA's "Certified Product Directory." Provide type of arm required for closer to be located on non-public side of door, unless otherwise indicated.

- 1. Manufacturers: Provide products by one of the following:
  - a. 4040 Series by LCN Closers; an Ingersoll-Rand Company (LCN).
  - b. DC800 Series by Corbin Russwin Architectural Hardware; an ASSA ABLOY Group company (NDC).
  - c. Or equal.

- D. Heavy-Duty, Concealed Overhead Holders and Stops:

- 1. Provide heavy-duty, concealed overhead holders and stops on all exterior doors unless otherwise specified to receive an extra heavy-duty overhead holder and stop in List of Finish Hardware Items.
- 2. Provide the following features and materials:
  - a. Shock Absorber Spring: Heavy tempered steel.
  - b. Channel: Heavy-gauge brass
  - c. All other parts: Stainless Steel.
  - d. Adjustment: Degree of hold-open and stop shall be adjustable after installation.
- 3. Finish: US 32D satin
- 4. Coordinate placement of concealed overhead holder and stop with overhead closers.
- 5.

## 2.10 PROTECTIVE TRIM UNITS

- A. Size: 1-1/2 inches less than door width on push side and 1/2 inch less than door width on pull side, by height specified in door hardware sets.
- B. Fasteners: Manufacturer's standard machine or self-tapping screws.
- C. Metal Protective Trim Units: BHMA A156.6; beveled top and 2 sides; fabricated from the following material:
  - 1. Material: 0.050-inch-thick stainless steel.
  - 2. Manufacturers: Provide products by one of the following:
    - a. Hager Companies (HAG).
    - b. IVES Hardware; an Ingersoll-Rand Company (IVS).
    - c. Rockwood Manufacturing Company (RM).
    - d. Or equal.

## 2.11 STOPS AND HOLDERS

- A. Stops and Bumpers: BHMA A156.16, Grade 1.
  - 1. Provide floor stops for doors. Do not mount floor stops where they will impede traffic. Where floor or wall stops are not appropriate, provide overhead holders.
- B. Manufacturers: Provide products by one of the following:
  - 1. Heavy-Duty 100H (ADJ) Series Concealed Holders and Stops by Glynn-Johnson Part of Worldwide Ingersoll-Rand Corporation.
  - 2. Or equal.

## 2.12 DOOR GASKETING

- A. Standard: BHMA A156.22. Listed under Category J in BHMA's "Certified Product Directory."
- B. General: Provide continuous weather-strip gasketing on exterior doors. Provide noncorrosive fasteners for exterior applications and elsewhere as indicated.
  - 1. Perimeter Gasketing: Apply to head and jamb, forming seal between door and frame.
- C. Air Leakage: Not to exceed 0.50 cfm per foot of crack length for gasketing other than for smoke control, as tested according to ASTM E 283.
- D. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- E. Gasketing Materials: ASTM D 2000 and AAMA 701/702.
- F. Manufacturers: Provide products by one of the following:
  - 1. No. 350DSPK by Pemko Manufacturing Co. (PEM).
  - 2. ).
  - 3. Or equal.

## 2.13 THRESHOLDS

- A. Standard: BHMA A156.21. Listed under Category J in BHMA's "Certified Product Directory."
- B. Thresholds for Means of Egress Doors: Comply with NFPA 101. Maximum 1/2 inch high.
- C. Manufacturers: Provide products by one of the following:
  - 1. Pemko Manufacturing Co. (PEM).
  - 2. Or equal.

## 2.14 EXTERNAL DOOR LATCH COVER

- A. Auxiliary Hardware: BHMA A156.16, Grade 1.
  - 1. Manufacturers: Provide products by one of the following:
    - a. Don-Jo LP-107
    - b. Or equal.

## 2.15 FABRICATION

- A. Manufacturer's Nameplate: Do not provide products that have manufacturer's name or trade name displayed in a visible location except in conjunction with required fire-rated labels and as otherwise approved by Engineer.
  - 1. Manufacturer's identification is permitted on rim of lock cylinders only.
- B. Base Metals: Produce door hardware units of base metal, fabricated by forming method indicated, using manufacturer's standard metal alloy, composition, temper, and hardness. Furnish metals of a quality equal to or greater than that of specified door hardware units and BHMA A156.18. Do not furnish manufacturer's standard materials or forming methods if different from specified standard.
- C. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to commercially recognized industry standards for application intended, except aluminum fasteners are not permitted. Provide Phillips flat-head screws with finished heads to match surface of door hardware, unless otherwise indicated.
  - 1. Concealed Fasteners: For door hardware units that are exposed when door is closed, except for units already specified with concealed fasteners. Do not use through bolts for installation where bolt head or nut on opposite face is exposed unless it is the only means of securely attaching the door hardware. Where through bolts are used on hollow door and frame construction, provide sleeves for each through bolt.
  - 2. Steel Machine: For the following fire-rated applications:
    - a. Mortise hinges to doors.
    - b. Strike plates to frames.
    - c. Closers to doors and frames.
  - 3. Spacers or Sex Bolts: For through bolting of hollow-metal doors.

## 2.16 FINISHES

- A. Standard: BHMA A156.18, as indicated in door hardware sets.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in the same piece are not acceptable. Variations in appearance of other components are

acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Examine doors and frames, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Examine roughing-in for electrical power systems to verify actual locations of wiring connections before electrified door hardware installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

#### 3.02 PREPARATION

- A. Steel Doors and Frames: Comply with DHI A115 Series.
  - 1. Surface-Applied Door Hardware: Drill and tap doors and frames according to ANSI A250.6.

#### 3.03 INSTALLATION

- A. Mounting Heights: Mount door hardware units at heights indicated as follows unless otherwise indicated or required to comply with governing regulations.
  - 1. Custom Steel Doors and Frames: DHI's "Recommended Locations for Builders' Hardware for Custom Steel Doors and Frames."
- B. Install each door hardware item to comply with manufacturer's written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
  - 1. Set units level, plumb, and true to line and location. Adjust and reinforce attachment substrates as necessary for proper installation and operation.
  - 2. Drill and countersink units that are not factory prepared for anchorage fasteners. Space fasteners and anchors according to industry standards.
- C. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant.

#### 3.04 FIELD QUALITY CONTROL

- A. Independent Architectural Hardware Consultant: Owner will engage a qualified independent Architectural Hardware Consultant to perform inspections and to prepare inspection reports.

1. Independent Architectural Hardware Consultant will inspect door hardware and state in each report whether installed work complies with or deviates from requirements, including whether door hardware is properly installed and adjusted.

### 3.05 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.
  1. Door Closers: Unless otherwise required by authorities having jurisdiction, adjust sweep period so that, from an open position of 70 degrees, the door will take at least 3 seconds to move to a point 3 inches from the latch, measured to the leading edge of the door.
- B. Occupancy Adjustment: Approximately six months after date of Substantial Completion, Installer's Architectural Hardware Consultant shall examine and readjust, including adjusting operating forces, each item of door hardware as necessary to ensure function of doors, door hardware, and electrified door hardware.

### 3.06 CLEANING AND PROTECTION

- A. Clean adjacent surfaces soiled by door hardware installation.
- B. Clean operating items as necessary to restore proper function and finish.
- C. Provide final protection and maintain conditions that ensure that door hardware is without damage or deterioration at time of Substantial Completion.

### 3.07 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain door hardware and door hardware finishes.

B.

B. Hardware Sets

1. HW 1: Single, Exterior Man Door

Heavy-Duty Mortise Hinges

1 - Lockset

1 - Overhead, surface mounted, door closer.

1 - Overhead Stop and Holder (no holder on fire-rated doors)

1-Stripping and seals

1-Threshold

1 - Kick Plate

END OF SECTION

SECTION 09902  
PAINTING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install all painting complete as shown on the Drawings and as specified herein.
- B. It is the intent of this Section to paint all exposed new and existing CMU walls; exposed concrete; all as specified in the attached painting schedules and all other work obviously required to be painted unless otherwise specified. Minor items not mentioned in the schedule of work shall be included in the work of this Section where they come within the general intent of this Section as stated herein.
- C. The following items will not be painted:
  - 1. Concrete except where indicated on drawings..
  - 2. Stainless steel louvers, doors and frames.
  - 3. Finish hardware.
  - 4. Non-ferrous metals and stainless steel, unless specifically noted otherwise.
  - 5. Factory pre-finished architectural components.
  - 6. Packing glands and other adjustable parts and name plates of mechanical equipment.
  - 7. Parts of buildings not exposed to sight, unless specifically noted otherwise.
  - 8. Maintenance equipment
  - 9. Plumbing fixtures.
  - 10. Mechanical, HVAC, Plumbing and Electrical equipment which has been finished painted in the factory as specified in Divisions 11, 13 and 15.

1.02 RELATED WORK

- A. Shop primers associated with hollow metal doors and frames are included in Section 08110.

1.03 SUBMITTALS

- A. Submit the following in accordance with Section 01300.
- B. Product Data: For each type of product indicated.
- C. Samples: Submit the following for each type of coating system and in each color and gloss of finish coat indicated.

1. Color cards for initial color selections.
- D. Product List: For each product indicated, Cross-reference products to coating system and locations of application areas. Use same designations indicated on Drawings and in schedules.

#### 1.04 REFERENCE STANDARDS

- A. Steel Structures Painting Council (SSPC)
  1. SSPC SP-1 - Surface Preparation Specification No. 1 Solvent Cleaning.
  2. SSPC SP-2 - Surface Preparation Specification No. 2 Hand Tool Cleaning.
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

#### 1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
  1. Maintain containers in clean condition, free of foreign materials and residue.
  2. Remove rags and waste from storage areas daily.

#### 1.06 PROJECT CONDITIONS

- A. Apply coatings only when temperature of surfaces to be coated and surrounding air temperatures are between 50 and 95 deg F.
- B. Do not apply coatings in snow, rain, fog, or mist; when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURERS

- A. Manufacturers: Provide products by one of the following:
  1. The Sherwin Williams Company (SW)
  2. PPG Architectural Finishes, Inc. (PPG)
  3. PPG Architectural Finishes, Inc. Ameron (AME)
  4. Or equal.

#### 2.02 MATERIALS

- A. Material Compatibility:

1. Provide materials for use within each coating system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
  2. Provide products of same manufacturer for each coat in a coating system.
- B. All painting materials shall be delivered to the work site in unbroken packages, bearing the manufacturer's brand and name. They shall be used without adulteration and mixed, thinned and applied in strict accordance with manufacturer's directions for the applicable materials and surface and with the Engineer's approval before using.
- C. Shop priming shall be done with primers that are guaranteed by the manufacturer to be compatible with the finish paints to be used. Refer to Section 09901 for special primers.
- D. Work areas will be designated by the Engineer for storage and mixing of all painting materials. Materials shall be in full compliance with the requirements of pertinent codes and fire regulations. Proper containers outside of the buildings shall be provided and used for painting wastes and no plumbing fixture shall be used for this purpose.
- E. Colors: Match existing colors.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
1. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
    - a. Concrete: 12 percent.
    - b. Masonry (Clay and CMU): 12 percent.
    - c. Wood: 15 percent.
    - d. Gypsum Board: 12 percent.
  2. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
  3. Begin coating application only after unsatisfactory conditions have been corrected and surfaces are dry.
  4. Coating application indicates acceptance of surfaces and conditions.

#### 3.02 PREPARATION

- A. All surfaces to be painted shall be prepared as specified herein and shall be dry and clean before painting. Special care shall be given to thoroughly clean interior concrete and CMU surfaces to receive polyamide cured epoxy paint of all marks before application of finish.
- B. All metal welds, blisters, etc, shall be ground and sanded smooth. All pits and dents shall be filled and all imperfections shall be corrected so as to provide a smooth surface for painting. All

rust, loose scale, oil, tar and asphalt bearing coatings, grease and dirt shall be removed by use of approved solvents, wire brushing, grinding or sanding.

- C. Concrete surfaces shall have been finished as specified in Section 03350. Report unsatisfactory surfaces to the Engineer. Concrete shall be left for one month minimum before painting and shall be free of dust, oil, curing compounds and other foreign matter.
- D. Concrete masonry unit surfaces shall be smooth and cleaned of all dust, loose mortar and other foreign matter.
- E. Existing Surfaces to be Repainted
  - 1. Existing masonry, steel and other previously field painted surfaces so noted or as provided in Paragraph 1.01B shall be repainted.
  - 2. Preparation shall be in general as specified above for new surfaces except that all loose paint shall be removed and all edges of existing paint shall be feathered to ensure a smooth surface.
  - 3. Paint removal, capture of its residue, and its disposal shall be handled in accordance with all laws and regulations concerning disposal of hazardous materials.
  - 4. Primer (spot) and paint used for a particular surface shall, in general, be as scheduled for that type of new surface. Provide a CDM approved organic zinc-rich (min. 83% zinc in dried film) primer as specified. Confirm with the paint manufacturer that the paint proposed for a particular repaint condition will be compatible with the existing painted surface. Perform adhesion and compatibility tests on existing substrates as ordered and required. Repainted areas shall be covered by the same guaranty specified for remainder of Project.

### 3.03 WORKMANSHIP

#### A. General

- 1. At the request of the Engineer, sample areas of the finished work prepared in strict accordance with this Section shall be furnished and all painting shall be equal in quality to the approved sample areas. Finished areas shall be adequate for the purpose of determining the quality of workmanship. Experimentation with factory or paint manufacturer's warehouse mixed colors shall be furnished to the satisfaction of the Engineer where standard chart colors are not satisfactory.
- 2. Protection of furniture and other movable objects, equipment, fittings and accessories shall be provided throughout the painting operation. Canopies of lighting fixtures shall be loosened and removed from contact with surface, covered and protected and reset upon completion. Remove all electric plates, surface hardware, etc, before painting, protect and replace when completed. Mask all machinery name plates and all machined parts not receiving a paint finish. Dripped or spattered paint shall be promptly removed. Lay drop cloths in all areas where painting is being done to adequately protect flooring and other work from all damage during the operation and until the finished job is accepted.

3. On metal surfaces apply each coat of paint at the rate specified by the manufacturer to achieve the minimum dry mil thickness required. If material has thickened or must be diluted for application by spray gun, the coating shall be built up to the same film thickness achieved with undiluted material. One gallon of paint as originally furnished by the manufacturer shall not cover a greater area when applied by spray gun than when applied unthinned by brush. Deficiencies in film thickness shall be corrected by the application of an additional coat(s). On masonry, application rates will vary according to surface texture; however, in no case shall the manufacturer's stated coverage rate be exceeded. On porous surfaces, it shall be the painter's responsibility to achieve a protective and decorative finish either by decreasing the coverage rate or by applying additional coats of paint.

#### B. Field Painting

1. All painting at the site shall be under the strict inspection of the Engineer. Only skilled painters and, where dictated by special conditions or systems and so ordered, specialist painters shall be used on the work.
2. All paint shall be at room temperature before applying, and no painting shall be done when the temperature is below 60 degrees F, in dust-laden air, when rain or snow is falling, or until all traces of moisture have completely disappeared from the surface to be painted.
3. Successive coats of paint shall be different shades (from paint manufacturer's stock or shop mixed paint) of the required colors so as to make each coat easily distinguishable from each other with the final undercoat the approximate shade of the finished coat to ensure no show-through as approved.
4. Finish surfaces shall not show brush marks or other irregularities. Undercoats shall be thoroughly and uniformly sanded with the type paper appropriate for the undercoats to remove defects and provide a smooth even surface. Top and bottom edges of doors shall be painted.
5. Painting shall be continuous and shall be accomplished in an orderly manner so as to facilitate inspection. Materials subject to weather shall be primed coated as quickly as possible. Surfaces of exposed members that will be inaccessible after erection shall be cleaned and painted before erection.
6. All painting shall be performed by approved methods with number of coats modified as required to obtain the total dry film thickness specified. Spray painting shall be performed specifically by methods submitted and as approved by the Engineer.
7. All surfaces to be painted as well as the atmosphere in which painting is to be done shall be kept warm and dry by heating and ventilation, if necessary, until each coat of paint has hardened. Any defective paint shall be scraped off and repainted in accordance with the Engineer's directions.
8. Before final acceptance of the work, all damaged surfaces of paint shall be cleaned and repainted as directed by the Engineer.
9. Only the aluminum work noted on the Drawings or in the Painting Schedule shall be field painted.

### 3.04 FIELD QUALITY CONTROL

- A. Owner reserves the right to invoke the following procedure at any time and as often as Owner deems necessary during the period when coatings are being applied:
  - 1. Owner will engage the services of a qualified testing agency to sample coating material being used. Samples of material delivered to Project site will be taken, identified, sealed, and certified in presence of Contractor.
  - 2. Testing agency will perform tests for compliance with specified requirements.
  - 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with specified requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, the two coatings are incompatible.

### 3.05 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from coating operation. Correct damage by cleaning, repairing, replacing, and recoating, as approved by Engineer, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

### 3.06 PAINTING SCHEDULE

- A. All colors will be selected by the Engineer.
- B. The following types of paints by PPG Protective & Marine Coatings, (PPG PMC); and The Sherwin Williams Company (SW) have been used as a basis for the paint schedule:
  - 1. High-Build Acrylic Polyurethane Enamel:
    - a. TN: Endura-Shield III - semi-gloss (Series V73)
    - b. SW: Acrolon 218 HS
    - c. PPG: Pitthane HB Semigloss Urethane 95-8800 Series
    - d. AME: Amercoat 450H SG Polyurethane
    - e. Or equal.
  - 2. Acrylic Latex Emulsion, Eggshell Finish:
    - a. TN: Tneme-Cryl (Series 6)
    - b. SW: DTM Primer Finish
    - c. PPG: Pitt-tech Plus 90-1110 Series Satin DTM Acrylic
    - d. AME: Amercoat 220 Waterborne Acrylic

- e. Or equal.
3. Vinyl Acrylic Surface Sealer:
- a. TN: PVA Sealer (No. 51-792) -.
  - b. SW: Prep-Rite 200 Primer
  - c. PPG: Speedhide 6-2 Vinyl Acrylic Drywall Primer
  - d. AME: Amercoat 148 Acrylic Primer
  - e. Or equal.
- C. The following surfaces shall have the types of paint scheduled below applied at the dry film thickness (DFT) in mils per coat noted:
- 1. Exterior non-submerged concrete scheduled for painting.
    - a. First and Second Coats:
      - 1) TN: Series N69 (4.0-5.0 DFT)
      - 2) SW: Macropoxy 646 (5.0-10.0 DFT)
      - 3) PPG: Pitt-Guard 97-145 Series Epoxy Mastic
      - 4) AME: Amerlock 2/400 Series Epoxy
      - 5) Or equal.
  - 2. Exterior concrete masonry units
    - a. First Coat:
      - 1) TN: No. 130-6602 (80 sq ft/gal minimum scrub-in to fill voids as approved)
      - 2) SW: Cement-Plex 875 (50-100 s.f./gl.)
      - 3) PPG: Cementitious Waterproofing Block Filler 95-217 Series
      - 4) AME: Amerlock 400 BF Epoxy Block Filler
      - 5) Or equal.
    - b. Second and Third Coats:
      - 1) TN: Series N69 (5.0 DFT)
      - 2) SW: Macropoxy 646 (5.0-10.0 DFT)
      - 3) PPG: Pitt-Guard 97-145 Series Epoxy Mastic
      - 4) AME: Amerlock 2/400 Series Epoxy
      - 5) Or equal.

END OF SECTION

SECTION 09250  
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install gypsum board assemblies complete as shown on the drawings and as specified herein.
- B. This Section includes the following:
  - 1. Interior gypsum board.
  - 2. Interior framing systems (e.g., supports for partition walls, framed soffits, furring, etc.).

1.02 RELATED WORK

- A. Building insulation for insulation and vapor retarders installed in assemblies that incorporate gypsum board in included in section 07210.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, detailed information on materials proposed and installation methods.
- B. Product Data: For each type of product indicated.

1.04 REFERENCES

- A. American National Standards Institute
  - 1. ANSI A108/A118/A136- - Installation of Ceramic Tile
- B. ASTM International
  - 1. ASTM B 221 - Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
  - 2. ASTM C 423 - Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
  - 3. ASTM C 475/C 475M - Specification for Joint Compound and Joint Tape for Finishing Gypsum Board
  - 4. ASTM C 630/C 630M - Specification for Water-Resistant Gypsum Backing Board
  - 5. ASTM A 641/A 641M - Specification for Zinc-Coated (Galvanized) Carbon Steel Wire
  - 6. ASTM A 653/A 653M - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

7. ASTM C 645 - Specification for Nonstructural Steel Framing Members
8. ASTM C 665 - Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing
9. ASTM C 754 - Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products
10. ASTM C 840 - Specification for Application and Finishing of Gypsum Board
11. ASTM C 841 - Specification for Installation of Interior Lathing and Furring
12. ASTM C 844 - Specification for Application of Gypsum Base to Receive Gypsum Veneer Plaster
13. ASTM C 931/C 931M - Specification for Exterior Gypsum Soffit Board
14. ASTM C 954 - Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness
15. ASTM C 1002 - Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs
16. ASTM C 1047 - Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base
17. ASTM C 1063 - Specification for Installation of Lathing and Furring to Receive Interior and Exterior Portland Cement-Based Plaster
18. ASTM C 1177/C 1177M - Specification for Glass Mat Gypsum Substrate for Use as Sheathing
19. ASTM C 1178/C 1178M - Specification for Glass Mat Water-Resistant Gypsum Backing Panel
20. ASTM C 1278/C 1278M - Specification for Fiber-Reinforced Gypsum Panel
21. ASTM C 1288 - Specification for Discrete Non-Asbestos Fiber-Cement Interior Substrate Sheets
22. ASTM C 1325 - Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units
23. ASTM C 1396/C 1396M - Specification for Gypsum Board
24. ASTM C 1629/C 1629M - Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels
25. ASTM C 1658/C 1658M - Specification for Glass Mat Gypsum Panels

26. ASTM D 226 - Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing
  27. ASTM D 3273 - Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber
  28. ASTM D 3274 - Test Method for Evaluating Degree of Surface Disfigurement of Paint Films by Fungal or Algal Growth, or Soil and Dirt Accumulation
  29. ASTM E 84 - Test Method for Surface Burning Characteristics of Building Materials
  30. ASTM E 90 - Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements
  31. ASTM E 119 - Test Methods for Fire Tests of Building Construction and Materials
  32. ASTM E 413 - Classification for Rating Sound Insulation
  33. ASTM E 488 - Test Methods for Strength of Anchors in Concrete and Masonry Elements
  34. ASTM E 1190 - Test Methods for Strength of Power-Actuated Fasteners Installed in Structural Members
- C. Code of Federal Regulations
1. 40 CFR, Part 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings
- D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

#### 1.05 QUALITY ASSURANCE

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies [that incorporate non-load-bearing steel framing, ]provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E 413 by an independent testing agency.

#### 1.06 STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against damage from weather, condensation, direct sunlight, construction traffic, and other causes. Stack panels flat to prevent sagging.

#### 1.07 PROJECT CONDITIONS

- A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

- B. Do not install interior products until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
  - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

## PART 2 PRODUCTS

### 2.01 PANELS, GENERAL

- A. Size: Provide in maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

### 2.02 NON-LOAD-BEARING STEEL FRAMING, GENERAL

- A. Recycled Content of Steel Products: Provide products with average recycled content of steel products such that postconsumer recycled content plus one-half of preconsumer recycled content is not less than 25 percent.
- B. Framing Members, General: Comply with ASTM C 754 for conditions indicated.
  - 1. Steel Sheet Components: Comply with ASTM C 645 requirements for metal, unless otherwise indicated.
  - 2. Protective Coating: ASTM A 653/A 653M, G40, hot-dip galvanized, unless otherwise indicated.

### 2.03 INTERIOR GYPSUM BOARD

- A. Manufacturers: Provide products by one of the following:
  - 1. American Gypsum Co.
  - 2. CertainTeed Corp.
  - 3. Georgia-Pacific Gypsum LLC.
  - 4. Lafarge North America Inc.
  - 5. National Gypsum Company.
  - 6. PABCO Gypsum.
  - 7. Temple-Inland.
  - 8. USG Corporation.

9. Or equal.
- B. Gypsum Board, Type X: ASTM C 1396/C 1396M.
1. Thickness: 5/8 inch.
  2. Long Edges: Tapered.

#### 2.04 TRIM ACCESSORIES

- A. Interior Trim: ASTM C 1047.
1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized steel sheet.
  2. Shapes:
    - a. Cornerbead.
    - b. Bullnose bead.
    - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
    - d. L-Bead: L-shaped; exposed long flange receives joint compound.
    - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
    - f. Expansion (control) joint.
    - g. Curved-Edge Cornerbead: With notched or flexible flanges.

#### 2.05 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C 475/C 475M.
- B. Joint Tape:
1. Interior Gypsum Wallboard: Paper.
- C. Joint Compound for Interior Gypsum Wallboard: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.
1. Prefilling: At open joints beveled panel edges, and damaged surface areas, use setting-type taping compound.
  2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
    - a. Use setting-type compound for installing paper-faced metal trim accessories.
  3. Fill Coat: For second coat, use setting-type, sandable topping compound.
  4. Finish Coat: For third coat, use setting-type, sandable topping compound.
  5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound.

#### 2.06 STEEL FRAMING FOR FRAMED ASSEMBLIES

- A. Steel Studs and Runners: ASTM C 645.

1. Minimum Base-Metal Thickness: 0.0179 inch.
2. Depth: As indicated on Drawings.

## 2.07 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards and manufacturer's written recommendations.
  1. Fasteners for Metal Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
  1. Use adhesives that have a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
- C. Steel Drill Screws: ASTM C 1002, unless otherwise indicated.
  1. Use screws complying with ASTM C 954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
  2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.
- D. Sound Attenuation Blankets: ASTM C 665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
  1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Thermal Insulation: As specified in Section 07231.
- F. Isolation Strip at Exterior Walls: Provide one of the following:
  1. Asphalt-Saturated Organic Felt: ASTM D 226, Type I (No. 15 asphalt felt), nonperforated.
  2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames and framing, for compliance with requirements and other conditions affecting performance.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

- C. Proceed with installation only after unsatisfactory conditions have been corrected.

### 3.02 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

- 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

- B. Coordination with Sprayed Fire-Resistive Materials:

- 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling runners (tracks) to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
  - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

### 3.03 FRAMING INSTALLATION, GENERAL

- A. Installation Standard: ASTM C 754, except comply with framing sizes and spacing indicated.

- 1. Gypsum Board Assemblies: Also comply with requirements in ASTM C 840 that apply to framing installation.

- B. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

- C. Install bracing at terminations in assemblies.

- D. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

### 3.04 INSTALLING FRAMED ASSEMBLIES

- A. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

- B. Install studs so flanges within framing system point in same direction.

- 1. Space studs as follows:

- a.
    - b. Multilayer Application: 16 inches o.c., unless otherwise indicated.

- C. Install tracks (runners) at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings, except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts penetrating partitions above ceiling.
  - 1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
  - 2. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
    - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- D. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

### 3.05 APPLYING AND FINISHING PANELS, GENERAL

- A. Comply with ASTM C 840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
  - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
  - 2. Fit gypsum panels around ducts, pipes, and conduits.
  - 3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments, except floors. Provide 1/4- to 1/2-inch- wide spaces at these locations, and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.
- I. Install sound attenuation blankets before installing gypsum panels, unless blankets are readily installed after panels have been installed on one side.

### 3.06 APPLYING INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
  - 1. Regular Type: As indicated on Drawings.
- B. Multilayer Application:
  - 1. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
  - 2. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
  - 3. For double-layer construction, fasten base layer to studs with screws 16 inches o.c. Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

### 3.07 INSTALLING TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.
- B. Control Joints: Install control according to ASTM C 840 and in specific locations approved by Engineer for visual effect.
- C. Interior Trim: Install in the following locations:
  - 1. Cornerbead: Use at outside corners.

### 3.08 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C 840:

1. Level 4: At panel surfaces that will be exposed to view, unless otherwise indicated.
  - a. Primer and its application to surfaces are specified in other Division 9 Sections.

3.09 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, and mold damaged.
  1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
  2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION

SECTION 15500  
HVAC

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section and Drawings cover(s) the requirements of the HVAC Work to be performed and shall not void any of the requirements specified under the General Conditions or General Requirements.
- B. The areas where work is to be accomplished are specified and shown in the following:
  - 1. Drawing Number  
M-1 Mechanical Plan
- C. The requirements specified herein shall be modified only if specified otherwise for particular application in other Divisions.
- D. This HVAC specification is incomplete without the information contained on the Drawings and in the Schedules. Schedules are located on the drawings.
- E. Work included under the "Scope of Work" of this HVAC Section includes all labor, material, equipment, tools and services necessary to furnish, deliver, unload, install, test and place in satisfactory operation, the equipment, services and systems as called for under the HVAC Section(s) including any incidental work not shown, or not specified but which can reasonably be inferred as belonging to the various systems and necessary in good practice to provide complete and fully operational systems. Cutting and patching is included in this Section.
- F. Equipment shall consist of the following:
  - 1. Duct Fan
  - 2. Wall Mount, Single-Package Vertical Air Conditioner
  - 3. The following work descriptions are not intended to in any way limit the above broad statement, but are intended as a more specific mention of the most important items included therein.
- G. The functions of the HVAC systems are as follows:

The ventilation system serves to ventilate an electrically classified space for the purposes of operator inspection and work on the flow meter associated with a sanitary sewer.

System Description: The system comprises a supply fan that positively pressurizes and delivers ventilation air to the meter pit. The air is introduced at the base of the meter pit and exits through the exhaust louver at the top of the stairwell near the entrance. A wall mount air conditioning unit provides cooling, heating, and positive pressurization to the electrical room.

- H. This Section is incomplete without the information contained on the drawings. Provide equipment of the type, size, capacity and arrangement as shown on the Drawings and as noted. Equipment shall consist of the particular components noted on the drawings in addition to those components normally required for the type of unit. Particular attention must be paid to the remarks and notes and on the Drawings.
- I. All ductwork and equipment shown on the Drawings is intended to be approximately correct to scale, but figured dimensions and detailed drawings of the actual equipment furnished shall be followed in every case. The Drawings shall be taken in a sense as diagrammatic. Size of ductwork and piping are shown, but it is not the intent to show every offset or fitting, nor every hanger or support, or structural difficulty that may be encountered. To carry out the intent and purpose of the drawings all necessary parts to make a complete working system ready for use shall be furnished without extra charge. The Contractor shall be responsible to coordinate the system installation and routing with the work of all trades.

#### 1.02 RELATED WORK

- A. For temporary ventilation and lighting, refer to Electrical Specifications.
- B. Trenching, excavation and backfill is included in MAG Uniform Standard Specification-Part 200, except for items specified herein.
- C. Concrete work is included in MAG Uniform Standard Specification-Section 505, except for required HVAC anchor bolts, sleeves and templates which shall be furnished under this Section.
- D. Structural steel and miscellaneous metal is included in MAG Uniform Standard Specification-Section 515, except for supplementary steel required for HVAC hangers, equipment supports, anchors and guides, which shall be furnished under this Section.
- E. Painting is included in MAG Uniform Standard Specification-Section 530 & 790 except for factory finished HVAC equipment, HVAC shop painting and HVAC identification labeling.
- F. Electrical field wiring is included in Division 16, except for field wiring for automatic temperature controls as specified herein or as shown on the HVAC Drawings.

#### 1.03 SUBMITTALS

- A. Submit, in accordance with Section MAG Uniform Standard Specification - Section 105, shop drawings and product data for the following:
  - 1. Catalog cuts and data sheets for all equipment.
  - 2. All fans, submit all data on the Mechanical Drawings. In addition the submittal shall include catalog data, fan data sheets with a description of the proposed fan, fan size, type, arrangement, materials of construction, weight, motor horsepower, motor type, power supply, and frame size. Provide catalog data and selections for vibration isolators, include materials of construction. Each submittal shall include pertinent equipment dimensional data, fan performance (operating data information, and a performance curve showing the fan operating point and range. Minimum curve size shall be 8-in by 6-in. Faxed copies of curves are not acceptable. A list of accessories to be furnished shall be included on each submittal. Copies of operating and maintenance manuals shall be submitted. Significant

dimensional differences between the specified equipment and the proposed equipment shall be noted on the equipment submittal. The contractor shall provide data to show the dimensionally different equipment will fit within the space and still provide suitable clearance. Where corrosion resistance is required, provide conformation of material suitability for the specified service.

3. Detailed equipment and ductwork layout drawings; minimum scale 1/4-in = 1-ft-0-in for interior systems and equipment, dimension clear service spaces for motors and drives, and spacer section access doors, and ductwork access panels and doors.
4. Standard shop and field installation details for transitions, elbows, takeoffs, discharge nozzles, turning vanes, access panels and doors, volume control and splitter dampers and extractors.
5. Ductwork materials, joining methods, reinforcing and material gauges. Where options are allowed by SMACNA, the proposed option shall be clearly defined. Indicate proposed materials and methods for ductwork and equipment hangers.
6. Prepare dimensional comparisons between proposed equipment and scheduled equipment when the proposed equipment is dimensionally larger than that scheduled. Do not propose dimensionally larger equipment from an alternate manufacturer for installation in confined areas, or when the installation of alternate equipment will result in reduction of service access below that recommended by the manufacturer.
7. For units that will be shipped exposed, provide a description of the protective packaging that will be used during transit.
8. When special hangers, supports, anchors, or hold downs are required that are not covered by standards provide signed and sealed calculations and details for record purposes.
9. All submittals shall contain a statement that Section 15500 and all other referenced Sections have been read and complied with. The certification statement shall be made by all of the following that are applicable; the Contractor, sub-contractor and the vendor. The statement shall be an individual statement for each party involved, and shall be included with every submittal and resubmittal.
10. Submit air system testing, adjusting and balancing reports for review and approval.
11. Operation and Maintenance Data
  - a. Submit to the Engineer as provided in MAG Uniform Standard Specification - Section 105, Operating and Maintenance Manuals. The following information shall be considered a minimum. Where applicable, provide information required for specific pieces of equipment.
    - 1) Personnel familiar with the operation and maintenance of the specific information shall prepare manuals.
    - 2) Equipment shall be identified with the Engineers Equipment Numbers and Identification as shown in the Schedules and on the Drawings.
    - 3) Provide information in three ring binders. All sheets shall have reinforced punches. Tabbed dividers shall separate all sections. Drawings will be bound in the manual, or contained in envelopes bound into the manual.
  - b. Contents - Each volume shall contain the following minimum contents:

- 1) Installation including instructions for unpacking, installing, aligning, checking and testing. Foundation data, allowable piping loads, and electrical design shall be included.
  - 2) Operating Instructions to provide pre-operational checks, start up and shut down, and description of all control modes. Include emergency procedures for all fault conditions and actions to be taken for all alarms. Procedures for long term storage shall be included.
  - 3) Maintenance shall include preventive, and corrective. Schedules for test of other functions are to be included. Provide a list of tools required to service the equipment. Trouble shooting instructions to include a trouble-shooting guide shall be included.
- c. Spare Parts List
  - d. Shop Drawing Data to include performance curves, data sheets, flow diagrams, wiring diagrams, and descriptive drawings.
12. All materials deliveries must have accompanying manufacturer's certifications attesting to satisfactory results of product testing showing conformance with this Section.
  13. Provide a recommended list of spare parts to be provided
  14. In general, corrections or comments or lack thereof, made relative to submittals during review shall not relieve the Contractor from compliance with the requirements of the drawings and specifications. Submittals are for review of general conformance with the design concepts of the project and general compliance with the contract documents. The Contractor is responsible for the final design conforming and correlating all quantities and dimensions, selecting fabrication processes and techniques of construction, coordinating the work of all trades, and performing the work in a safe and satisfactory manner.

#### 1.04 REFERENCE STANDARDS

- A. These standards shall be considered as minimum requirements. This is a general list and not all standards listed are necessarily referenced elsewhere in this Section. Specific requirements of this Section and/or Drawings shall have precedence. In case of conflict between published requirements, the Engineer shall determine which is to be followed.
- B. Abbreviation and the title of Federal, State and industry standards, technical societies, associations and institutes and other organizations which may be used are as follows:
  1. Associated Air Balance Council (AABC)
  2. American Conference of Governmental Industrial Hygienists (ACGIH)
  3. Air Diffusion Council (ADC)
  4. American Bearing Manufacturers Association (ABMA)
  5. Air Movement and Control Association (AMCA)
  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. ASTM International
10. Factory Mutual (FM)
11. Institute of Electrical and Electronic Engineers (IEEE)
12. Maricopa Association of Governments (MAG)
13. National Institute of Standards and Technology (NIST)
14. National Environmental Balancing Bureau (NEBB)
15. National Electrical Code (NEC)
16. National Electrical Manufacturers Association (NEMA)
17. National Fire Protection Association (NFPA)
18. Occupational Safety and Health Administration (OSHA)
19. Sheet Metal and Air Conditioning Contractors National Association (SMACNA)
20. Underwriters Laboratories (UL)

- C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

#### 1.05 QUALITY ASSURANCE

- A. Provide single source supplier/installer responsibility for systems where specified in other related Sections.
- B. All equipment of a given type included in this section shall be furnished by or through a single manufacturer or as specified on the schedules
- C. Inspection by the Engineer's representative or failure to inspect shall not relieve the Contractor of responsibility to provide materials and perform the work in accordance with the documents.
- D. The Owner and Engineer reserve the right to sample and test any materials after delivery and to reject all components represented by a sample that fails to comply with the specified requirements.
- E. An authorized representative of the manufacturer shall perform the initial startup of the equipment. The Owner and Engineer shall witness startup. The use of local sales representatives to perform this work is not acceptable, unless the manufacturer provides documented evidence that the sales representative has been specifically trained for this work.
- F. All rotating parts of equipment shall be statically and dynamically balanced at the factory.

#### 1.06 DELIVERY, STORAGE AND HANDLING

- A. All materials shall be inspected for size, quality and quantity against approved shop drawings upon delivery.
- B. Delivery schedule of all equipment shall be coordinated with the Contractor. Equipment ready for shipment prior to the agreed on shipping date shall be stored without cost to the Owner by the manufacturer.
- C. All materials shall be suitably packed for shipment and long term storage. Each package shall be labeled to indicate the project and the contents of each package. Where applicable, equipment numbers shall be marked on the container.
- D. All equipment shipped that is exposed such as on a flatbed truck shall be protected during transit. The equipment shall be protected from moisture, road salt, dirt and stones or other materials thrown up from other vehicles. Electrical components shall be protected as above, but with special attention to moisture. The method of shipment protection shall be defined in the submittals.
- E. Instruction for the servicing and startup of equipment in long term or prolonged storage shall accompany each item.
- F. All materials shall be stored in a covered dry location off of the ground. When required to protect the materials they shall be stored in a temperature-controlled location.

#### 1.07 COORDINATION

- A. The Drawings indicate the extent and general arrangement of the systems. If any departures from the drawings or specifications are deemed necessary, details of such departures and the reasons therefore shall be submitted as soon as practical for review. No such departures shall be made without the prior written concurrence of the Engineer.
- B. The Contractor shall coordinate the location and placement of all concrete inserts and welding attachments with the structural engineer.
- C. The Contractor shall assume full responsibility for coordination of the HVAC systems, including; scheduling, and verification that all structures, ducts, piping and the mounting of equipment are compatible.

#### 1.08 ENGINEERING SERVICES

- A. When engineering services are specified to be provided by the Contractor, the Contractor shall retain a licensed professional engineer to perform the services. The engineer shall be licensed at the time the work is done and in the State in which the project is located. If the State issues discipline specific licenses, the engineer shall be licensed in the applicable discipline. In addition, the engineer shall be experienced in the type of work being provided.
- B. All work is to be done according to the applicable regulations for professional engineers, to include signing, sealing and dating documents. When submittals are required by a professional engineer, in addition to state required signing and sealing, a copy of the current wallet card or wall certificate indicating the date of expiration shall be included with the submittal.

## 1.09 MAINTENANCE

- A. Maintain and service all equipment and systems until the particular equipment or the system has been accepted by the Owner.
- B. Maintenance shall include compliance with the manufacturers operating and maintenance instructions as well as periodic cleaning or replacement of air handling system filters.
- C. Compile records of all maintenance and lubrication work performed on Owner or Contractor furnished equipment. Maintain records at the construction or installation site and make available at all times for review by the Owner or Engineer. At the request of the Owner or Engineer submit copies of these records to the Owner for information and/or review.
- D. Provide all special tools required for normal maintenance. Tools shall be packaged in a steel case, clearly and indelibly marked on the exterior to indicate equipment for which tools are intended.
- E. Provide to the Owner a list of all spare and replacement parts with individual prices and location where they are available. Prices shall remain in effect for a period of not less than 1 year after start-up and final acceptance.

## 1.10 WARRANTY

- A. In the event that the equipment or components fail to perform satisfactorily at any time within the Defects Liability Period, the Contractor shall replace it with one capable of operating as specified, and shall comply with the requirements in Division 1. The Contractor shall be responsible for all cost incurred in furnishing and installing the replacement equipment.

## 1.11 DEFINITIONS

- A. Particular terminology used under this Section is defined as follows:
  - 1. Traffic Level and Personnel Level - Areas, including process areas, equipment rooms, boiler rooms and other areas where insulation may be damaged by normal activity and local personnel traffic. Area extends to 8-ft above floor, walkways, platforms and stairs, and horizontally 3-ft beyond the edge of walkways, platforms, and stairs.
  - 2. Exposed Piping and Ductwork - Piping and ductwork visible from the floor level and includes all piping and ductwork in equipment rooms, boiler rooms, etc.
  - 3. Supply Air Ductwork - Ductwork carrying air from a fan or air handling unit to the space or spaces to which it will be introduced. This air may have been heated or cooled or in the case of ventilation system the air would be neither heated nor cooled. Supply air ductwork extends from the fan or air handling unit to the registers, grills or diffusers at the end of the ductwork.
  - 4. Exhaust Air Ductwork - Ductwork carrying air from a space to a fan and then to be discharged to the outdoors. Exhaust air ductwork extends from the registers of grills at the end of the ductwork to the fan. From the fan exhaust ductwork extends to the discharge point, exhaust air damper, or exhaust air plenum, whichever comes first.

5. Outdoor Air Ductwork - Ductwork carrying untreated air from the outside to a fan or air handling unit. Outdoor air ductwork starts at the intake point, outdoor air damper, or outdoor air plenum, whichever comes last. The outdoor air ductwork extends to the fan, air handling unit, or connection with a return air duct, whichever comes first.
6. Ventilated Spaces - Areas supplied with outdoor air on a continuous or intermittent basis. The outdoor air may be heated and/or cooled or untreated.
7. Unheated Spaces - Areas where heat is not applied and there is no minimum temperature during the heating season.
8. Non-Conditioned Spaces - Areas that are not provided with mechanical cooling.

## PART 2 PRODUCTS

### 2.01 ELECTRICAL EQUIPMENT

Process Areas: Div. 1 or 2, Explosion Proof

#### A. Electric Motors

1. Electric motors in NEMA frame sizes shall conform to the requirements in Section 01171, unless otherwise specified herein.
2. The motor manufacturer shall confirm that motors used to power equipment are provided with bearings that will provide a bearing life equal to the driven equipment or better. Confirmation shall be included with shop drawing submittal.
3. Motors will be selected to be non-overloading over the entire operating range of the equipment. A safety factor of 25 percent will be added to all motors up to and including 50 horsepower. A safety factor of 15 percent will be added to all motors over 50 horsepower. Motors indicated on the schedules are to be considered a minimum. This sizing is not to limit compliance with the above requirements

#### B. Electrical Equipment

1. Electrical equipment which is furnished under this Section shall meet the requirements specified in Division 16:
  - a. Disconnect switches, motor starters and combination motor starters (starters with disconnecting means and short circuit protection) shall be as specified in Section 16020.
  - b. Raceways, boxes, fittings and supports shall be as specified in Section 16020.
  - c. Wires and cables shall be as specified in Section 16020.

C. Electrical enclosures and panels to include automatic temperature control panels and components shall be suitable for the environment and electrical classification for the space they are located in. The type of enclosure for the various spaces shall be as specified in Division 16. Refer to the electrical drawings for the space classifications.

D. Where noted in the HVAC equipment schedules, or when shown on the Drawings, provide fan speed control switches and integral unit thermostats.

## 2.02 EQUIPMENT VIBRATION ISOLATOR AND MOUNTINGS

### A. General

1. Unless otherwise specified in this Division all machinery or vibrating mechanical equipment shall be isolated from the building structure by vibration isolators with a minimum deflection as specified. Operating equipment that can transmit objectionable vibration and noise must be installed with special types of vibration isolators such as flexible connectors to ductwork, piping and wiring. In more critical areas and under particular conditions, additional vibration isolators shall be installed as specified in other related Sections in this Division, or in specific equipment schedules.
2. All equipment shall be provided with attachment points for floor or suspended mounting that will safely transmit all loads including seismic to the supports.
3. The vibration isolator manufacturer shall be responsible for the proper selection of vibration isolators suitable for the particular application. Selection of the vibration isolator shall include the following factors.
  - a. Equipment Weight
  - b. Equipment operating frequencies
  - c. Type of building support structure
  - d. Seismic forces as required by the applicable building codes to include shear, tension and compression due to the code specified loads.
4. All floor mounted vibration isolators shall be bolted to the floor or framing on which they rest. Bolts shall be arranged to prevent transmission of vibration through the bolts.
5. All isolation devices for a single piece of equipment shall be selected for a uniform static deflection according to distribution of weight in the equipment.
6. All pieces of equipment that have a variation in weight during operation or maintenance such as, but not limited to, cooling towers and hoppers, shall have built-in vertical limit restraints to limit motion to a maximum of 1/4-in.
7. Isolators exposed to the weather, in rooms classified on electrical drawings as damp, wet, or corrosive or where called for on the Drawings shall be provided with corrosion protection. Steel parts other than springs shall be galvanized. Parts subject to wear, rubbing, shall be non-corrosive material such as rubber or stainless steel. Springs and hardware shall be cadmium plated or otherwise provided with an approved coating.
8. After installation of equipment, isolators shall be adjusted for proper loading and distribution of weight.

### B. Types - The following types of vibration isolators may be used.

1. Isolation for Suspension
  - a. Isolation hangers for suspension of equipment and piping shall have a single element of elastomer for 1/4-in deflection, a double or a single molded element of 1/2-in deflection, a single spring element with an elastomer grommet for up to 3/4-in deflection and a combination of an elastomer and spring elements in series for 1-in deflection and up contained within a structural rigid one piece steel hanger box.

Springs shall have a minimum ratio of outside diameter to operating spring height of 0.8 and an additional travel to solid equal to 50 percent of the specified deflection.

- b. The neoprene element shall have a bushing to prevent hanger rod contact with the housing box. The lower rod shall be free to swing in a 30 degree arc without touching the spring or the housing.
2. Rails and Bases - Rails and bases shall be of the following types based on the equipment and deflection required.
- a. Steel spring type shall be steel rails running the full length of the supported equipment and extending under any overhang to counteract cantilever effects. The rails shall consist of structural members supported by individual free standing springs. The rails shall be drilled to accept the supported equipment and shall serve as a template.
  - b. Fans and their driving motors shall be mounted on structural steel channel members forming a rigid base. A common member parallel to the V-belt drive shall run the full length of the fan and motor and shall be of sufficient rigidity to resist the bending stress of belt pull. The structural steel base shall incorporate single or double deflection elastomer-in-shear elements or free standing springs located for proper weight distribution. The base shall be drilled and tapped to accept the fan and motor and shall serve as a template. Integral motor slide rails shall be provided and welded in place.
  - c. Unless specifically noted in other sections of the specification or on specific equipment schedules, all equipment will be provided with vibration isolation as defined by the following table:

Type of Equipment	Vibration Isolation Type	Minimum Deflection for Slab on Grade Inches	Minimum Deflection for up to 20-ft floor span inches	Minimum Deflection for 20-ft to 30-ft Floor Span Inches	Minimum Deflection for 30-ft to 40-ft Floor Span Inches
Duct Mounted Fans (600 CFM and greater)	Spring	0.75	0.75	0.75	0.75

C. Rigidly Mounted Equipment

- 1. When equipment does not require vibration isolation, it shall be firmly attached to the building structure. Bolts and support structure shall include allowances for seismic loads as required by the applicable building codes to include shear and moment loads.

2.03 FLAME AND SMOKE RATINGS

- A. All materials, including adhesives, surface coatings, sealers, assemblies of several materials, insulation, jacketing, finish, etc, shall have flame spread ratings not over 25 (fire resistive), and smoke development ratings not over 50 and fuel contributed rating not over 50, as established

by tests conducted in accordance with the Federal Standard 00136B, National Bureau of Standards Radiant Energy Fire Test and the National Fire Code of the NFPA.

- B. These requirements apply to all circumstances whether the materials are field applied or applied by a manufacturer in his/her shop, or elsewhere, prior to delivery to the project.

#### 2.04 NOISE CRITERIA

- A. The following sound criteria shall be met for all of the following listed equipment. Data shall be the sound power level (reference 10 x-12 watts).

Equipment Identification	63	125	250	500	1000	2000	4000	8000	LwA
F-1	90	83	81	76	70	66	60	51	91

- 1. The equipment supplier shall provide actual data for the equipment submitted. If the space does not meet the required criteria, and the noise level of the equipment is found to be the cause, the equipment supplier shall be responsible for the modifications required to correct the condition.

#### 2.05 BEARINGS

- A. General - Furnish equipment bearings suitable for the intended equipment service. Furnish bearings designed to carry both thrust and radial loads for equipment designed for all angle operation.
- B. Provide extended lube lines with pressure relief equipped grease fittings for all bearings which are not readily accessible from outside the equipment.
- C. Bearings for all equipment in the schedule below shall have heavy-duty grease lubricated self aligning ball or roller bearings. Bearings shall have ample thrust provision to prevent end play during the normal life of the bearing. Unless specifically noted otherwise, all fans shall have bearings for both the equipment and motors with the following ABMA L-50 life.
  - 1. Fans over 1500 cfm - 100,000 hours.
  - 2. Fan impellers greater than 10-in diameter
  - 3. Continuous duty fans with motors over 25 horse power 200,000 hours.
  - 4. All fans with motors over 50 horse power 200,000 hours.
- D. Belt driven fans, including air handling unit fans shall be equipped with self aligning single row ball bearings, double row tapered or spherical roller bearings.
- E. For systems with bearings requiring L-50 lives of 200,000 hours or greater, the equipment supplier shall provide calculations for both the equipment bearings and the motor bearings to confirm the bearing selections. For belt drives, the calculations shall include the effect of the sheave size, number of belts, the sheave location on the shaft, and the location of the motor to the driven sheave.

- F. Provide seals for bearings installed in airstreams, exposed outdoors, and for applications in corrosive or dusty atmosphere.
- G. Provide bearings suitable for high temperature service where heat fan construction is required.

2.06 HANGERS, SUPPORTS AND ANCHORS

A. General

1. Furnish supports, hangers and other devices necessary to support and anchor firmly and substantially the piping, equipment and ductwork described in this Section. Piping and duct support systems shall include restraints as required by the applicable building codes to withstand seismic and wind loading. Design shall be provided by a professional engineer hired by the Contractor as specified in other Sections. Signed and sealed calculations shall be submitted for record purposes.
2. All equipment shall be provided with lugs or brackets to allow the equipment to be firmly fastened to the structure. The lugs and brackets shall be sized to withstand the expected seismic and wind loads for the area and type of application. Location of the attachments shall be based on the equipment being hung or base mounted as shown on the Drawings and the schedules.
3. Design of hangers, supports, anchors and hold downs shall include the effect of all loads applied to the equipment, pipe or duct as well as the load of the component. These loads include, but are not limited to wind, seismic and internal dirt or liquid buildup.
4. Provide galvanized steel hanger rods, hangers, supplementary steel, anchors and guides in areas classified as corrosive, wet, and in outdoor exposed applications.
5. Provide the following material for hanger rods, hangers, supplementary steel, anchors, hold downs and guides in specified areas.

Area	System	Material
Entire Meter Pit	Fan supports & anchors	316 SS
Entire Meter Pit	Ductwork supports & straps	Aluminum
Entire Meter Pit	Ductwork anchors	316 SS

2.07 PAINTING AND COATINGS

- A. Unless otherwise specified, all machinery and factory finished equipment such as pumps, fans, air handling units, air conditioning units, and other items of manufacture shall be hot dipped galvanized or will have a factory applied finish, color as standard with the manufacturer. Components fabricated from stainless steel do not require a coating finish unless otherwise specified. All tanks, supporting steel, hangers, rods and all other uncoated or non galvanized steel other than standard piping and fittings shall have a shop coat consisting of a suitable primer and finish coat. If not factory applied, the prime coat shall be as specified in Division 9. All items not factory or shop primed prior to installation shall be suitably cleaned of rust and mill scale by wire brushing, sanding, or other means and prime painted, immediately after installation.

- B. The Contractor shall be responsible for the repair of all defects, blemishes, and the like apparent in manufactures coatings and shall ensure that the materials used for such repair shall match and be compatible with the manufacturer's standard color, coatings and practices. Surfaces to be repaired or recoated are to be prepared as recommended by the paint or coating supplier. Care shall be taken not to paint over nameplates.
- C. Furnish touch up paint for the various types of equipment furnished and deliver unopened paint to the Owner at completion of the project. The amount of touch-up paint supplied shall be sufficient to cover 15 percent of the applicable painted surfaces or one pint, whichever is greater.

## 2.08 TESTING, ADJUSTING AND BALANCING

- A. Furnish the services of an AABC or NEBB certified agency for the testing, adjusting and balancing of all HVAC air systems installed under this Section.
- B. The testing, adjusting and balancing agency shall be independent of all suppliers, installers and contractors on the project.

## 2.09 FANS

### A. General

1. Fans shall be factory assembled, complete with fan wheel, fan housing or cabinet, bearings, drives, drive guard, motor, motor base, unit base and vibration isolators, dampers and bird screens unless otherwise specified. All fans shall be provided with lugs, brackets or field supplied devices to allow the fan to be firmly bolted to the structure or fastened to specified vibration isolators. The lugs, brackets or field supplied devices shall be sized to withstand the expected seismic loads for the area and type of application. Location of the attachments shall be based on the equipment being hung or base mounted as shown on the Drawings and the schedules.
2. All fans shall be statically and dynamically balanced before shipment.
3. All fans shall be AMCA rated for sound and air performance per AMCA 210-85 and 330-86.
4. Fans shall be assembled with OSHA shaft and motor guards. Provide access for greasing bearings, tachometer readings of fan and motor speed without removing the cover. Cover shall be properly ventilated to prevent motor overheating.
5. Where shown on the Drawings and Schedules, fans shall be of spark resistant construction. Bearings shall not be placed in the air stream. Construction shall conform to AMCA 99-0401-82 Classifications. All electrical components shall be explosion proof.  
TYPE A (only shall be accepted) - All parts in contact with the gas stream shall be non-ferrous material.
6. Inlet and/or discharge screens shall be provided for fans that are not directly duct connected.
7. Fans shall be of aluminum construction.

8. Electric motors and electrical disconnects shall be provided as specified elsewhere in this Section.
9. Fans shall be UL listed when noted in the schedules or when code required for the specific application.
10. The noise level of the equipment operating in the field shall not exceed 85 dBA overall sound pressure level (referenced to 20 micro pascals) at a distance of 3-ft from equipment surfaces. Provide octave band sound data if another noise level is specified in the schedule or if sound data submission is specified in the schedules.

#### 2.10 WALL MOUNT, SINGLE-PACKAGE VERTICAL AIR CONDITIONER

- A. General – Unit shall be certified to ANSI/ARI Standard 390 for SPVU (Single Package Vertical Units). Unit shall comply with energy efficiency requirements of ANSI/ASHRAE/IESNA 90.1-2010.
- B. Casing or cabinet shall be of substantial construction with exterior weather protective finish designed to permit external wall mounting.
- C. Refrigerant shall be R410A
- D. Filter shall be of the disposable type.
- E. Electrical components shall be easily accessible for routine inspection and maintenance.
- F. Evaporator coils shall have staggered rows of aluminum finned copper tubing.
- G. Unit shall be accompanied by a digital, programmable thermostat
- H. Unit shall have an adjustable fresh air intake damper.

#### 2.11 DUCTWORK

- A. Sheet metal ductwork shall be constructed of the materials specified using the gauges or thicknesses and reinforcing called for by SMACNA for the material specified. Unless otherwise specified, all components of duct systems shall be constructed of the same material as the ductwork. This is to include braces and turning vanes.
  1. Aluminum ductwork shall be constructed of 3003H-14 alloy B&S Gauges. Construction
- B. All ductwork shall be substantially built with joints and seams smooth on the inside and given a neat appearance on the outside. Inside surfaces and joints shall be smooth and free from pockets, burrs and projections. All joints shall be substantially air tight with laps made in the direction of air flow and no flanges projecting into the air stream. All changes in direction and duct transitions shall be shaped to permit the easiest possible air flow.
- C. Pressure Classes
  1. Pressure classes for determination of sheet metal gauge and reinforcing shall be as defined by the latest issue of the SMACNA standards for duct construction.

2. For ductwork with a static pressure higher than 2-in water gauge, pressure class shall be as shown on the Drawings. For ductwork with a static pressure 2-in water gauge or less pressure class shall be equal to the maximum pressure indicated for the fans or air handling units on the Schedules and the pressure class shall be the same for the entire length, including branches, of the specific duct system.

D. Rectangular Ductwork

1. Ductwork shall be constructed as shown on the Drawings in accordance with the specified SMACNA Construction Standard, latest edition.
2. Cross-breaking shall conform to SMACNA Standard. Cross-breaking shall be applied to the sheet metal between the standing seams or reinforcing angles. The center of the cross-break shall be of the required height to assure rigidity for each panel.
3. All square elbows for rectangular ductwork shall be provided with turning vanes unless otherwise noted on the Drawings. Turning vanes shall be as detailed in the SMACNA Manual and or as shown on the Drawings.
4. Alternate Construction (Rectangular Only) - Factory-fabricated joint systems may be offered as an alternate form of construction. The system offered shall meet all requirements of SMACNA. Alternate joint systems shall be "Ductmate System" as manufactured by Ductmate Industries, Inc., installed in accordance with the manufacturer's recommendations. The system shall be sealed for zero leakage and angle attachment to the main duct section shall be by tack welding. The use of screws is not allowed.

E. Round Ductwork

1. Ductwork shall be constructed as shown on the Drawings in accordance with the specified SMACNA Construction Standard latest edition.
2. Round Ductwork
  - a. Round ductwork shall be either lock type, welded longitudinal seam construction or spiral ductwork.
  - b. Gauges of ductwork and fittings shall be as specified in SMACNA. Draw bands will not be permitted. Slip joint shall be used on ductwork up to 36-in in diameter and the "loose flange" or Vanstone joint shall be used on ducts over 36-in in diameter.
  - c. All seams and joints shall be continuously welded.
  - d. Round ductwork shall be manufactured by United Sheet Metal; SEMCO or equal.

#### F. Round Ductwork Fittings

1. All 90 degree turns shall be made of five piece mitered welded construction made by the manufacturer of the conduit. Fittings less than 90 degrees in the riser shall be made of multiple pieced mitered welded construction.
2. All fittings in the round duct system shall be of the male and female type and in assembling these together, there shall be applied an approved synthetic rubber sealing compound on the joint. Also, on the outside of the duct apply this synthetic rubber sealing compound in order to further make these joints air tight. Mechanically fasten the conduits together using sheet metal screws not less than four per fitting 6-in on centers maximum and equally spaced around the circumference of fitting.
3. Round duct fittings shall be manufactured by United Sheet Metal; SEMCO or equal.

#### G. Volume Dampers

1. Dampers shall be standard opposed or parallel multi-blade type on 2-in channel frame, flanged connection with external damper position indicator, manual adjustment, and position locking arrangement. Damper blades shall not exceed 6-in in width. Dampers shall be constructed of the same material as the ductwork, or of a material of equal corrosion resistance. Balancing and balancing/shutoff dampers shall be opposed blades and shutoff dampers shall be parallel blade.
2. Locking quadrants shall have a positive method of holding the damper in its selected position such as a bolt through both the quadrant and the lever arm. Systems using springs or other devices that can vibrate loose are not acceptable.
3. Where manual dampers are used for shut off service, dampers shall have a replaceable butyl rubber or bulb vinyl seals provided with the damper. Install seals along the top, bottom and sides of the frame and along each blade edge.

#### H. Access Doors

1. Access doors shall be 24-in by 24-in minimum, except where the duct size is less than 26-in, where the largest door that will fit the duct will be used. Unhinged access panels are not acceptable, except where shown on the Drawings. Access doors shall be of the same material as the duct, pan type construction for metal ductwork, with smooth edges and fitted seals, constructed and installed for air-tight fit with ease of opening and closing. Doors shall be substantially butt hinged, with heavy sash locks and substantial door pulls. Door openings and door frames shall be reinforced with bar stock or angle. Where ductwork is installed with duct liner or exterior duct insulation, the access door shall be of the insulated type. Access doors may be factory fabricated. Where ductwork is constructed of aluminum or stainless steel, access door hardware shall be of similar material.

#### I. Fasteners

1. Sheet metal screws, drive cleats, cinch bands and other fasteners shall be fabricated from materials with an equal or greater corrosion resistance than the ductwork in which they are installed. Where a material other than the duct material is used, it shall be approved by the Engineer before installation.

## 2.12 DIFFUSERS, REGISTERS AND GRILLES

### A. General

1. All diffusers, registers and grilles shall be of the shape, sizes, capacity and type as shown on the Drawings.
2. On all duct openings that do not have a specific diffuser, register, grill or mesh covers, provided a wire mesh cover.
3. Finish –All diffusers, registers and grilles shall have baked aluminum enamel finish.

### B. Supply Air Grilles

1. In general, grilles shall be a factory-assembled unit consisting of a grille with double deflecting adjustable airfoil vanes to diffuse supply air in the various directional patterns as shown on the Drawings. Grilles shall be of aluminum frame and border with aluminum louver blades. All grilles shall be furnished with a sponge rubber gasket to prevent streaking. Front and rear louver blades shall be individually adjustable. Where wall mounted, front blades shall be vertical and rear blades shall be horizontal. Where ceiling mounted, front blades shall be parallel to long dimension.
2. Grilles shall be Series 300FL by Titus Manufacturing Corp.; Carnes, Model RAFA Series; Air Devices Inc. or equal.

### C. Return Air Grilles

1. Stamped Metal Return Air Grilles
  - a. Grilles shall be a factory-fabricated unit consisting of a stamped aluminum lattice face. All grilles shall be furnished with a sponge rubber gasket to prevent streaking. Minimum free area shall be 50 percent.
  - b. Acceptable manufacturers shall be as listed or equal:
    - 1) Model 300ZFL - Titus Manufacturing Corp.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. The Contractor shall start up each piece of equipment and system and shall make all adjustments so that the system is placed in proper operating condition.
- B. The Contractor shall not install any equipment or materials until the Owner and Engineer have approved all submittals. If any equipment or materials are installed prior to approval of the submittals, it shall be at the Contractor's risk.
- C. Equipment
  1. Install equipment in accordance with manufacturer's recommendation. Provide piping and ductwork connections in accordance with the requirements as specified elsewhere in this Section.

2. When units are shipped disassembled, field connect all sections together as shown on the Drawings to form single air handling unit. Seal all joints with gaskets and/or sealants.
  3. Do not operate equipment without filters. Do not run equipment with dirty filter pressure drop more than twice clean filter pressure drop. A total of three complete sets of filters shall be provided. The first set is to be installed for start-up, test and balancing. The second set shall be installed after final cleanup and acceptance by the Owner. The third set shall be turned over to the Owner as a spare.
- D. The Contractor shall start up each piece of equipment and system and shall make all adjustments so that the system is placed in proper operating condition.
- E. Installation of Ductwork
1. Fabricate and erect all ductwork where shown on the Drawings, as specified herein and in accordance with SMACNA requirements. Rigidly support and secure ductwork in an approved manner. Install hangers plumb and securely suspended from supplementary steel or inserts in concrete slabs. Sufficiently thread lower ends of hanger rods to allow for adequate vertical adjustment. Do not use building siding and metal decking to hang ductwork.
  2. Wherever ducts are divided, maintain the cross-sectional area. All such changes must be approved and installed as directed by the Engineer or as approved on shop or erection drawings.
  3. During installation, close the open ends of ducts to prevent debris and dirt from entering. Install work in accordance with the overall approved progress schedule and in cooperation with all other trades so there will be no delay to other trades.
  4. Provide the unused portion of external louvers (where it is not used as a fresh air intake or exhaust) with a blank-off constructed of 0.0625-in aluminum. Provide blank-off panels with aluminum reinforcing angles to prevent buckling and secured to the exterior wall with aluminum angles and rustproof fasteners on not more than 12-in centers. Provide caulking completely around the outside edge of the angle and the aluminum.
  5. Install automatic dampers when supplied by other trades.
  6. Cross-break sheet metal in accordance with SMACNA duct construction standard. Apply cross-breaking to the sheet metal between the standing seams or reinforcing angles. The center of the cross-break shall be of the required height to assure each panel section being rigid.
  7. Cross-break steamlined ducts on top only and adequately brace internally.
  8. Beading as specified in SMACNA will be acceptable in lieu of cross-breaking.
  9. The Drawings of the air ducts and air risers show the general location for installation of the ducts and risers. Should additional offsets or changes in direction be made, these changes must be considered in the original bid and shall be installed at no additional cost to the Owner.

10. All necessary allowances and provisions shall be made in the installation of the ducts for the structural conditions of the building. Ducts shall be transformed or divided as may be required. Wherever this is necessary, maintain the cross-sectional area. All of these changes, however, must be approved and ducts installed as directed by the Engineer or as approved on shop or erection drawings.
11. The taper of all transformations shall be not more than 15 degrees.
12. Secure casing to curbs according to SMACNA Duct Construction Standards.
13. Provide baffle plates as required to prevent stratification and to provide proper operation of controls.
14. Where ducts are constructed of materials other than galvanized steel the reinforcing members shall be of the same material as the ductwork.
15. For PVC ductwork where reinforcing members of material other than PVC are required, totally encase the reinforcing member in PVC.
16. The use of button punching or snap locks on ductwork constructed of aluminum shall not be permitted.

F. Hangers

1. The use of wire to hang flexible ductwork shall not be permitted.
2. Ductwork shall not come in contact with any of the ceiling construction or any other equipment in the ceiling cavity.

G. Sealing of Ductwork

1. General – Unless, otherwise indicated, seal all ductwork joints and seams using sealant in accordance with the instructions of the sealant manufacturer and this Section. All transverse seams, joints and fitting connections, both shop and field assembled, shall be sealed in accordance with this Section. Not more than one longitudinal seam shall be unsealed in each section of duct.
2. Application of Sealant - Thoroughly clean all seams, joints, etc, of dirt, oil, grease, or other coatings which might interfere with the adhesion of the duct sealant before the sealant is applied.
3. Uncured sealant may be forced into the slotted side of the seam or joint before shop or field assembly, and the joint or seam completed while the sealant is still uncured. Excess sealant shall be removed from both the inside and outside of the duct before it sets.
4. Duct Tape - Use of duct tape alone for sealing ductwork is prohibited. Duct tape may be used primarily for the purpose of retaining the uncured duct sealant in seams and joints until it has cured. Duct tape shall not be applied to the inside of any duct nor shall it be applied to standing type joints at any time. All duct tape used shall be compatible with the sealant.

5. Sealant shall be either in liquid form or a mastic with a maximum flame spread of 25 and a maximum rate of fuel contributed and smoke developed of 50 when tested in accordance with ASTM E84, NFPA 255 and UL 723.
6. Sealing systems shall be suitable for the environment. The following schedule is to be used to select the sealant.
  - a. Indoor, dry galvanized round and rectangular duct is to be sealed with Iron Grip 601 or equal.
  - b. Indoor, dry, stainless steel, aluminum and PVC coated is to be sealed with FTA 20 adhesive and DT-Tape gypsum or equal.
  - c. All other areas unless otherwise noted are to be sealed with FTA 50 adhesive and DT-Tape gypsum or equal.
  - d. All sealers listed or manufactured by Hardcast Inc. and are to define the type of sealer. Other equal sealants are acceptable.

#### H. Ductwork Fittings and Accessory Items

1. Duct Elbows - Rectangular ductwork where full radius elbows cannot be installed, provide abrupt elbows equipped with shop-installed hollow, air foil turning vanes.
2. Dampers
  - a. Install manual volume control dampers wherever it may be necessary to regulate air volume for system air balancing and where shown on the Drawings.
  - b. Install splitter dampers, where shown on the Drawings, to regulate air volume for system air balancing. Splitter dampers shall be single blade, end pivoted type, manual adjustment and position locking arrangement.
  - c. Factory-fabricated volume extractors shall be used at all supply air diffusers.
  - d. An access door, of ample size to permit maintenance and resetting of damper blades, shall be installed at each opposed blade damper, splitter damper and volume extractor so located for easy access to the damper blades.

#### I. Grilles, Registers and Diffusers

1. The location of diffusers, registers and grilles shall be as shown on the Reflected Ceiling Plans. Where diffusers, registers and grilles are not located in the ceiling, there are no Reflected Ceiling Plans provided, the location shall be as shown on the ductwork drawings. The exact location of these devices shall be determined in the field in cooperation with the other trades.
2. Install all devices in an approved manner in accordance with the manufacturer's recommendation.

#### J. Duct Supports Through Floors

1. Where vertical ducts pass through floor openings, rigidly attach supporting angles to the ducts and anchor with expansion bolts to the floor or curb. Angles shall be of the same material as the duct for metal duct and stainless steel for non metallic ducts, placed on the two long sides of the duct extending 3-in over edge of opening, and shall not be less than the sizes recommended by SMACNA. Remaining open areas shall be filled in with a plate of the same material as the angles.

#### K. Ductwork at Masonry

1. Where ducts connect to, or terminate at masonry openings, or along the edges of floors where concrete curbs are not being provided, place a continuous 2-1/2-in by 2-1/2-in by 3/16-in aluminum angle of the same material as the duct around the ductwork. Then bolt the angle to the construction and make airtight to same by applying caulking compound on the angle before it is drawn down tight to construction.

#### L. Quality of Ductwork Installation

1. All ductwork shall be free from pulsation, chatter, vibration or objectionable noise. After system is in operation, should these defects appear, correct by removing, replacing or reinforcing the work. Sound levels shall not exceed the minimum requirement as specified in ASHRAE 1980 Systems Volume, page 35.16, Table 23. No discreet tones will be allowed.
2. The maximum allowable leakage of low pressure system shall be 5 percent of air volume.

#### M. Test Ports

1. Where shown on the Drawings and where required for testing and balancing, provide instrument insertion ports. Size and location of ports shall be coordinated with the Contractor performing air balancing. Seal ports with plastic snap lock plugs. When the ductwork will be insulated, extend the port to the face of the insulation and seal the vapor barrier to the port. When the ductwork is lined, extend the port into the duct to the inner surface of the duct liner.
2. In round ductwork provide 2 ports 90 degrees on centers. In rectangular ductwork provide ports as required by AABC or NEBB for a full traverse measurement.
3. As a minimum, ports shall be provided in the following connections:
  - a. All duct mains.
  - b. All duct branches unless all connections are diffusers, registers, or grilles and the total can be calculated by summing the readings for all of the connections.
  - c. All connections to tanks or hoods where there is no other access for taking a measurement.
4. A main duct is defined as one of the following:
  - a. A duct serving five or more outlets.
  - b. A duct serving two or more branch ducts.
  - c. A duct emanating from a fan or plenum.
  - d. All remaining ducts are considered branch ducts.

### 3.02 FIELD TESTING

#### A. Testing

1. General - If required by the Engineer, tests shall be made during the progress of the work to demonstrate the strength, durability and fitness of the installation. Furnish all instruments, ladders, lubricants, test equipment and personnel required for the tests; including manufacturer's representatives for testing and start-up of all Contractor supplied

equipment. Before testing, all systems shall be cleaned as specified. Submit four printed copies and one electronic copy of records of all tests, measurements, settings of throttling devices and nameplate data to the Engineer. Information shall be in Excel spread sheet format.

2. Final Tests - Perform tests of all systems as required by the Engineer prior to final acceptance of the systems for the purpose of demonstrating satisfactory functional and operating efficiency as well as adjustment. During this period, check the setting of all automatic controls and take sufficient measurements to ensure that conditions are correct and that capacities are adequate to meet the specified requirements. Systems will not be considered complete until all tests have been concluded to the satisfaction of the Engineer and all other parties having jurisdiction. In event of leakage or defects, repeat tests until all faults are corrected. Perform the general operating tests under as near design conditions as possible.
3. Coordination of the test shall be the responsibility of the balancing sub-contractor. Access to the site, availability of service representatives, and tenant acquiescence will be considered in the determination of both the testing schedule and the witnessed recheck of the balancing.

### 3.03 BALANCING

- A. Furnish the necessary labor, materials, instruments, transportation and devices required and test, adjust and balance the total heating-ventilating-cooling systems. Each as specified and detailed herein, or as required to cause the systems to perform in accordance with the intent of the Drawings and this Section. Systems to be tested, adjusted and balanced include air and all other systems installed by the HVAC Contractor.
- B. Testing, balancing and operation of the systems shall be performed by competent and experienced personnel, having formerly done similar work and whose qualifications and performance shall be subject to the approval of the Engineer. Test and balance air system and submit testing and balancing reports to the Engineer for review and approval. Re-balance when required by the Engineer, incorporating all changes and certify the systems have been tested and balanced to meet specified requirements.
- C. The tests shall demonstrate the specified capacities and operation of equipment and materials comprising the systems. Such tests other than as described herein, which are deemed necessary by the Engineer to indicate the fulfillment of the Contract, shall be made.
- D. When the work includes modifications to existing systems, the entire system including existing portions shall be rebalanced. Where capacities of existing components are not shown as changed, the original capacities shall be used for balancing.
- E. Systems serving odorous areas shall be balanced for both flow and pressure as defined herein.
- F. Data required by this Section shall receive complete approval before final payment is made.
- G. If, in the opinion of the Engineer, the Contractor has not, will not, or cannot comply with the testing, balancing and adjusting requirements of this Section, he may advise the Owner to employ a qualified firm to perform such work at Contractor's sole expense.

- H. Membership in the AABC or NEBB for air and water testing is required. The testing balancing contractor shall not be affiliated with the on-site contractors.
- I. The balancing contractor shall be prepared to submit credentials and other evidence of qualifications, and work experience, following receipt of, but prior to award of filed sub-bids.
- J. To perform required professional services, the balancing agency shall have a minimum of two test-and-balance engineers certified by the AABC or NEBB.
- K. This certified test-and-balance engineer shall be responsible for supervision and certification for the total work specified herein.
- L. The balancing agency shall furnish all necessary calibrated instrumentation to adequately perform the specified services. An inventory of all instruments and devices in possession of the balancing agency may be required by the Engineer to determine the balancing agency's performance capability.
- M. A complete schedule of balancing procedures for each of the buildings or systems shall be submitted in sufficient time in advance so that the Engineer might arrange to observe these procedures as they progress. Before commencing with the balancing of the systems, submit the methods and instruments proposed to be used to adjust and balance the air and water systems.
- N. Fan Characteristics Charts: The HVAC and General Contractors shall provide to the Balancing Organization any required characteristic curve charts for all fans to include air conditioning units and air handling units. Characteristic curve charts shall be not less than 8-1/2-in by 11-in and shall show the static pressure, capacity horsepower and overall efficiency for operating conditions from no load to 130 percent of specified load. The minimum size of the actual fan curve shall be no less than 6-in by 8-in. The use of faxed copies of curves is not acceptable.
- O. The balancing work shall be guaranteed to be accurate and factual data, based on readings in the field. All typewritten data shall be submitted within 14 working days of the performance of the test. Test data shall not be held until final completion, but shall be submitted on an interim basis as soon as the test or appropriate groups of tests are finished.
- P. Furnish gaskets, lubricants and other expendable materials required to be replaced during the execution of this work.
- Q. Fixed-pitched pulleys required for fan adjustments shall be furnished on an exchange basis by the party responsible for the fan installation.
- R. Where test results indicate that air quantities at any system fan are below or in excess of the specified amount, the HVAC and General Contractors, at their own expense, shall change driving pulley ratio or shall make approved changes to obtain the specified or scheduled air quantities.
- S. Testing apparatus: Furnish plugs, caps, stops, valves, pumps, compressors, blowers and similar devices required to perform this work.
  - 1. Furnish anemometers, thermometers, gauges, voltmeters, ammeters, tachometers and similar instruments, not part of the permanent installation, but required to record the performance of the equipment and systems.

2. Testing apparatus, not part of the permanent installation, shall remain the property of the Contractor, but made available to the Engineer.
3. Instruments used for testing shall be certified accurate to within plus or minus 0.10 degrees F for temperature or plus or minus 0.10-in wc for pressure. Calibration of the instruments shall be done within 7 days of testing for this project and henceforth every 30 days thereafter for the duration of the testing period. Certification of calibration shall be submitted to the engineer prior to starting the work.

#### T. Testing Reports

1. Forms: Furnish both printed and electronic format test report data on 8-1/2-in by 11-in AABC or NEBB form in accordance with Section (01 30 00) ( 01300). Submit format for recording data and receive approval prior to use.
2. The report shall contain the following general data in a format selected by the balancing agency:
  - a. Project number
  - b. Contract number
  - c. Project title
  - d. Project location
  - e. Project architect
  - f. Project mechanical engineer
  - g. Test and balance agency
  - h. Test and balance engineer
  - i. General contractor
  - j. Mechanical subcontractor
  - k. Dates tests were performed
  - l. Certification
3. At a minimum, the report shall include:
  - a. Preface. A general discussion of the systems, any abnormalities and problems encountered.
  - b. Instrumentation list. The list of instruments including type, model, manufacturer, serial number and calibration dates.
  - c. System Identification. In each report, the VAV boxes, zones, supply, return and exhaust openings and traverse points shall be numbered and/or lettered to correspond to the numbers and letters used on the report data sheets and on the report diagrams.
4. Furnish both printed and electronic format 11-in by 17-in single line diagrams or 12-in by 18-in half size drawings showing all duct systems indicating all terminal air outlets including diffusers, grilles and registers, perforated plates, nozzles and other types of air supply, exhaust or return outlets. The minimum scale for diagrams showing the measurement points shall be 1/8-in=1-ft-0-in in the final form as submitted. The use of faxed copies of diagrams is not acceptable. Location of test points shown on the diagrams shall be clear and easy to locate on the diagram. The identification mark of the test points shall be the same as is shown on the test report showing the test data. The identification for test points shall include indication of the units served, and shall not have a duplicate in the project. All supply outlets shall be adjusted so that there are no drafts. Grille and register readings may be made by a vane anemometer, but diffuser readings shall be made by a

flow hood or a velometer, using the tip recommended by the diffuser manufacturer. Each test sheet shall include the following data:

- a. Job name and address.
  - b. Name of HVAC Contractor.
  - c. Name of balancing organization.
  - d. Instruments used to perform the test.
  - e. Name of test technician or test engineer.
  - f. Fan system and/or zone number.
  - g. Room number or area name.
  - h. Size of outlet.
  - i. Type outlet.
  - j. Manufacturer of outlet.
  - k. The cfm at each outlet on system and corresponding cfm at each outlet as noted on the plans.
  - l. Percent deviation of the measured flow versus the design flow.
  - m. Indication of the branch and terminal that are the open/low that are the basis for balancing the remainder of the system
5. Final balancing shall not begin until system has been installed complete and is capable of normal operation. Provide personnel to assist in rough balance and calibration.
  6. All grilles, dampers, fans, and linkages shall be verified to be installed and operating.
  7. System shall be capable of operating under control as specified on Drawings and/or contained herein.
  8. Verify with straight edge that fan/pump and motor shafts are parallel and that sheaves are in proper alignment.
  9. Verify that belts are properly tensioned when unit is operating with no excessive squeal at startup. If not correct, adjust sheaves or motor base accordingly.
  10. Start fans, verify that rotation is correct. If rotation is incorrect, coordinate with electrical contractor to switch power leads such that the motor rotates correctly.
  11. Check nameplate voltage on motor, compare to scheduled voltage. Notify the Engineer immediately of any discrepancies. Measure and record actual voltage across all power leads. Notify the Engineer of discrepancies immediately.
  12. Check motor nameplates full load amps, measure and record amperage across all power leads. If there are marked discrepancies in amperage draws between legs, notify the Engineer immediately.
  13. Measure and record fan and motor rpm. Check, that motor rpm agrees with nameplate and scheduled rpm.
  14. If, upon commencing the work, the balancing contractor finds that the systems are not ready, or if a dispute occurs as to the readiness of the systems, the balancing agency shall request an inspection to be made by the Engineer. This inspection shall establish to the satisfaction of the represented parties whether or not the systems meet the basic requirements for testing and balancing. Should the inspection reveal the notification to

have been premature, all costs for the inspection and work previously accomplished by the balancing agency shall be paid for by the General Contractor. Furthermore, such items that are not ready for testing and balancing shall be completed and placed in operational readiness before testing and balancing services shall be recommenced.

15. Leaks, damage and defects discovered or resulting from startup, testing and balancing shall be repaired or replaced to like-new condition with acceptable materials. Tests shall be continued until system operates without adjustments or repairs.
16. Systems shall be balanced to be within the following limits of the capacity shown on the Drawings. Limits shall be applied to both individual components and to the system totals.
  - a. Odorous Exhaust Systems (plus/minus 5 percent)

#### U. HVAC Air Systems

1. Balance the supply return and exhaust air systems in accordance with AABC or NEBB Standards by the use of direct reading instruments such as an "anemotherm" or velometer, which has been properly calibrated.
2. Temporarily add static pressure to the system, to simulate the effect of dirty filters, by blanking off portions of the filter section, covering filter section with cheesecloth or other suitable means. Confirm static has been added with new static pressure reading across fan. Remove cheesecloth, etc, after traverses are complete.
3. The sequence of air balancing shall be as follows:
  - a. First, establish airflow quantity at supply fan by main duct traverse.
  - b. Next, establish airflow quantities in main ducts and branches.
  - c. Finally, establish airflow quantities at outlets, using proportional balancing among branch outlets. All multiple opening systems shall be left with at least one "open low" inlet or outlet, to which all other system openings shall be proportionally balanced. The "open low(s)" on each system shall be indicated in the report.
  - d. After all outlets are adjusted to within the tolerances specified elsewhere in this Section, re-measure all system outlets, and re-traverse all branch and main ducts to establish final "as balanced" flows.
  - e. All main air ducts shall be traversed, using a Pitot tube and manometer. The manometer shall be calibrated to read two significant figures in all velocity pressure ranges. The static pressure reading at the traverse point shall be recorded for each successive traverse.
    - 1) A main duct is defined as either of the following:
      - a) A duct serving five or more outlets.
      - b) A duct serving two or more branch ducts.
      - c) A duct emanating from a fan or plenum.
    - 2) All other ducts are branch ducts.
    - 3) The intent of this operation is to measure by traverse, the total air quantity handled by the fan and to verify the distribution of air to zones and to adjust system pressure to minimum level required to satisfy the farthest air outlet.
  - f. Adjust fan speeds if results of system capacity tests are not within tolerances specified and repeat Paragraphs 3.04A4c, d and e above, as required.
  - g. Mark all final balancing damper positions with a permanent marker.
  - h. For systems which modulate between different flow modes (e.g., minimum outside air to 100 percent outdoor air or 100 percent return air to 100 percent exhaust) measure

and report system flow under both extremes of modulation and check for excessive system flow deviation above design, when system is modulating between its end points.

- i. Furnish both printed and electronic format data tabulating the following:
  - 1) Opening number, type, size and design flow rate.
  - 2) Quantity of air in cfm at each air outlet and inlet.
  - 3) Dry bulb temperature in each room.
  - 4) Dry bulb temperature of the supply air.
  - 5) Outdoor dry and wet bulb temperature at the time the above tests are conducted. (Wet bulb temperature only required for AC systems)
- j. Furnish both printed and electronic format data taken at each air moving device, to include fans, packaged units and air handling units, tabulating the following:
  - 1) Manufacturers, model number and serial number of units.
  - 2) All design and manufacturer's rated data.
  - 3) Total quantity of supply air in cfm.
  - 4) Total quantity of return air in cfm.
  - 5) Total quantity of exhaust or relief air in cfm.
  - 6) Total quantity of outside air in cfm.
  - 7) Outlet velocity - fpm.
  - 8) The rpm of each fan or blower.
  - 9) Maximum tip speed - fpm.
  - 10) The rpm of each motor.
  - 11) Voltage and ampere input of each motor (one reading for each phase leg on 3 phase motors).
  - 12) Pressure in inches w.g. at inlet of each fan or blower.
  - 13) Pressure in inches w.g. at discharge of each fan or blower.
  - 14) Pressure drops across system components such as louvers,
  - 15) Submit the actual fan operating point on a copy of the fan shop drawing showing operating curve. List the following data from all fan motors installed.
  - 16) Manufacturer model and size.
  - 17) Motor horsepower, service factor and rpm.
  - 18) Volts, phases, cycles and full load amps.
  - 19) Equipment locations.

#### 4. Metering Station

- a. Balance the ventilation system to the flows shown on the Drawings. Balance the space to maintain a 0.10 in. w.g. positive pressure relative to the surrounding areas by adjusting the supply air to the space. If the final supply air quantity is below the flow specified, use this flow and pro-rate it for the various supply air devices, on an equal percentage basis.
- b. Balancing shall be done with all doors to the area closed and all interrelated systems operating.
- c. After completion of the system balancing the space positive pressures shall be rechecked. If the positive pressures have been reduced, the systems shall be rebalanced to provide the specified positive pressures. This process shall be repeated until the positive pressures are maintained.

- V. Where systems are provided with standby equipment, the system shall be balanced for operation in standby as well as normal operation.

#### W. Final Acceptance

1. At the time of final inspection, the balancing agency shall recheck, in the presence of the Engineer, specific and random selections of data recorded in the certified test-and-balance report.
2. Points and areas for recheck shall be selected by the Engineer.
3. Measurements and test procedures shall be the same as the original test and balance.
4. Selections for recheck, specific plus random, shall not normally exceed 15 percent of the total number tabulated in the report, except where special air systems require a complete recheck for safety reasons.
5. If the specific rechecks are more than 5 percent deviation from the report or specified flows, all of the systems, that require specific recheck, shall be rebalanced. If 5 percent or 5 of the random checks, whichever is less, exceeds a 10 percent deviation from the specified flows, the report shall be rejected. In the event the report is rejected, all systems shall be readjusted and tested, new data recorded, a new certified test-and-balance report submitted, and a new inspection test made, all at no additional cost to the Owner.

#### 3.04 START-UP AND TEMPORARY OPERATION

- A. Properly maintain and service all equipment and systems until the particular equipment or the system has been accepted by the Owner.

#### 3.05 BALANCING OF ROTATING EQUIPMENT

- A. All machines shall be balanced both statically and dynamically by the manufacturer within the limits of best commercial practices. The term machine, as used above, is to be considered as any piece of equipment, which contains rotating components. All machines furnished shall have operating speed not exceeding 80 percent of the first critical speed.

#### 3.06 CLEANING

- A. Leave all ductwork and equipment in a thoroughly cleaned condition.
- B. Maintain all ductwork, fans, coils, air filters, outlets and other parts of the ductwork systems in a clean condition during installation.
- C. Clean complete ductwork systems prior to testing and air balancing. Secure cheese cloth over all openings of the ductwork system for entrapment of dirt during the cleaning operation.

END OF SECTION

SECTION 16020  
ELECTRICAL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and equipment required to install complete and make operational, electrical and process instrumentation systems as specified, as shown on the Drawings.
- B. The work shall include furnishing and installing the following:
  - 1. Conduit, wire and field connections for all motors, motor controllers, control devices, control panels and electrical equipment furnished under other Divisions of these Specifications.
  - 2. Conduit, wiring and terminations for all field-mounted instruments furnished and mounted under other Divisions of these Specifications, including process instrumentation primary elements, transmitters, local indicators and control panels. Lightning and surge protection equipment wiring at process instrumentation transmitters. Install vendor furnished cables specified under other Divisions of these Specifications.
  - 3. Power wiring for all ventilating and air conditioning equipment furnished under other Divisions of these Specifications, including power wiring for 24 Volt thermostats. Refer to HVAC Drawings for the locations of 24 Volt thermostats and provide a 3/4-in C, 2 #12 and 1 #12 GRD between air conditioning unit and its respective control thermostat.
- C. Each bidder or their authorized representatives shall, before preparing their proposal, visit all areas of the existing buildings and structures in which work under this bid is to be performed and inspect carefully the present installation. The submission of the proposal by this bidder shall be considered evidence that they have visited the site, buildings and structures and noted the locations and conditions under which the work will be performed and that they takes full responsibility for a complete knowledge of all factors governing his/her work.

1.02 RELATED WORK

- A. Excavation and backfilling, including gravel or sand bedding for underground electrical work is included in Division 2.
- B. Cast in place concrete work, including concrete encasements for electrical duct banks, equipment pads, light pole bases, antenna pole bases and reinforcing steel, is included in Division 3.
- C. All automatic temperature control wiring for ventilating and air conditioning equipment (thermostats, duct switches, P-E switches, dampers, automatic temperature control panels, etc) will be furnished and installed under Division 15, unless otherwise indicated on the Drawings.
- D. Refer to the Structural plans for room and building dimensions.
- E. Refer to HVAC Drawings for the exact location of mechanical and instrumentation equipment.

- F. Refer to ELECTRICAL Drawings for exact location of security door intrusion switches and electrical equipment.

#### 1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, shop drawings for equipment, materials and other items furnished under Division 16.
- B. Check shop drawings for accuracy and contract requirements prior to submittal. Shop drawings shall be stamped with the date checked and a statement indicating that the shop drawings conform to Specifications and Drawings. This statement shall also list all exceptions to the Specifications and Drawings. Shop drawings not so checked and noted shall be returned.
- C. The Engineer's check shall be for conformance with the design concept of the project and compliance with the Specifications and Drawings. Errors and omissions on approved shop drawings shall not relieve the Contractor from the responsibility of providing materials and workmanship required by the Specifications and Drawings.
- D. All dimensions shall be field verified at the job site and coordinated with the work of all other trades.
- E. Material shall not be ordered or shipped until the shop drawings have been approved. No material shall be ordered or shop work started if shop drawings are marked "APPROVED AS NOTED - CONFIRM," "APPROVED AS NOTED - RESUBMIT" or "NOT APPROVED."
- F. Operation and Maintenance Data
  - 1. Submit operations and maintenance data for equipment furnished under this Division, in accordance with Section 01730. The manuals shall be prepared specifically for this installation and shall include catalog data sheets, drawings, equipment lists, descriptions, parts lists, etc., to instruct operating and maintenance personnel unfamiliar with such equipment.

#### 1.04 CONTRACT PERFORMANCE REQUIREMENTS

- A. Electric equipment, materials and installation shall comply with the latest edition of the National Electrical Code (NEC) and with the latest edition of the following codes and standards:
  - 1. National Electrical Safety Code (NESC)
  - 2. Occupational Safety and Health Administration (OSHA)
  - 3. National Fire Protection Association (NFPA)
  - 4. National Electrical Manufacturers Association (NEMA)
  - 5. American National Standards Institute (ANSI)
  - 6. Insulated Cable Engineers Association (ICEA)
  - 7. Instrument Society of America (ISA)

8. Underwriters Laboratories (UL)
  9. Factory Mutual (FM)
  10. National Electrical Testing Association (NETA)
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

#### 1.05 PRIORITY OF THE CONTRACT DOCUMENTS

- A. If, during the performance of the work, the Contractor finds a conflict, error or discrepancy between or among one or more of the Sections or between or among one or more Sections and the Drawings, furnish the higher performance requirements. The higher performance requirement shall be considered the equipment, material, device or installation method which represents the most stringent option, the highest quality or the largest quantity.
- B. In all cases, figured dimensions shall govern over scaled dimensions, but work not dimensioned shall be as directed by the Engineer and work not particularly shown, identified, sized, or located shall be the same as similar work that is shown or specified.
- C. Detailed Drawings shall govern over general drawings, larger scale Drawings take precedence over smaller scale Drawings, Change Order Drawings shall govern over Contract Drawings and Contract Drawings shall govern over Shop Drawings.
- D. If the issue of priority is due to a conflict or discrepancy between the provisions of the Contract Documents and any referenced standard, or code of any technical society, organization or association, the provisions of the Contract Documents will take precedence if they are more stringent or presumptively cause a higher level of performance. If there is any conflict or discrepancy between standard specifications, or codes of any technical society, organization or association, or between Laws and Regulations, the higher performance requirement shall be binding on the Contractor, unless otherwise directed by the Engineer.
- E. In accordance with the intent of the Contract Documents, the Contractor accepts the fact that compliance with the priority order specified shall not justify an increase in Contract Price or an extension in Contract Time nor limit in any way, the Contractor's responsibility to comply with all Laws and Regulations at all times

#### 1.06 ENCLOSURE TYPES

- A. Unless otherwise specified electrical enclosures shall have the following ratings:
  1. NEMA 1 for dry, non-process indoor above grade locations.
  2. NEMA 3R for outdoor non-corrosive or hazardous areas.
  3. NEMA 12 for Electrical Room.
  4. NEMA 4X for outdoor locations outside of hazardous zones. NEMA 4X enclosures may be used within a hazardous location if no energized (powered) equipment is contained within the enclosure.

5. NEMA 7 for Meter Station Vault (entire enclosed space) and Inlet Fan Room (entire enclosed space) NEMA 7 areas shall be rated "Class I Div. 1 Group D."

#### 1.07 HAZARDOUS AREAS

- A. Equipment, materials and installation in areas designated as hazardous shall comply with National Electrical Code Articles 500, 501, 502 and 503.
- B. Equipment and materials installed in hazardous areas shall be UL listed for the appropriate hazardous area classification.

#### 1.08 CODES, INSPECTION AND FEES

- A. Equipment, materials and installation shall comply with the requirements of the local authority having jurisdiction.
- B. Obtain all necessary permits and pay all fees required for permits and inspections.

#### 1.09 TESTS AND SETTINGS

- A. Test systems and equipment furnished under Division 16 and repair or replace all defective work and equipment. Refer to the individual equipment sections for additional specific testing requirements.
- B. Make adjustments to the systems and instruct the Owner's personnel in the proper operation of the systems.
- C. In addition to the specific testing requirements listed in the individual sections, the following minimum tests and settings shall be performed.
  1. Mechanical inspection, testing and settings of circuit breakers, disconnect switches, protection relays, motor starters, overload relays, control circuits and equipment for proper operation.
  2. Check the full load current draw of each motor. Where power factor correction capacitors are provided the capacitor shall be in the circuit at the time of the measurement. Check ampere rating of thermal overloads for motors and submit a typed record to the Engineer of the same, including motor service factor, horsepower, and Code letter. If incorrect thermal overloads are installed replace same with the correct size overload.
  3. Check power and control power fuse ratings. Replace fuses if they are found to be of the incorrect size.
  4. Check settings of the motor circuit protectors. Adjust settings to lowest setting that will allow the motor to be started when under load conditions.
  5. Check motor nameplates for correct phase and voltage. Check bearings for proper lubrication.
  6. Check rotation of motors prior to testing the driven load. Disconnect the driven equipment if damage could occur due to wrong rotation. If the rotation is for the driven equipment is

not correct, disconnect the motor lead connections at the motor terminal box and reconnect for proper rotation.

7. Check interlocking, control and instrument wiring for each system and/or part of a system to prove that the system will function properly as indicated by control schematic and wiring diagrams.
  8. Inspect each piece of equipment in areas designated as HAZARDOUS to insure that equipment of proper rating is installed.
  9. Verify all terminations at equipment, panels and enclosures by producing a 1, 2, 3 rotation on a phase sequenced motor when connected to "A," "B" and "C" phases.
  10. Test the grounding system using the three point fall in potential method.
  11. Test all 600 Volt wire insulation with a meg-ohm meter after installation. Make tests at not less than 500V. Submit a written test report of the results to the Engineer.
- D. Testing shall be scheduled and coordinated with the Owner at least two weeks in advance. Provide qualified test personnel, instruments and test equipment.

#### 1.10 SIZE OF EQUIPMENT

- A. Investigate each space in the structure through which equipment must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.
- B. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to insure that the tilting does not impair the functional integrity of the equipment.

#### 1.11 RECORD DRAWINGS

- A. As the work progresses, legibly record all field changes on a set of project contract drawings, hereinafter called the "record drawings."
- B. Record drawings shall accurately show the installed condition of the following items:
  1. One-line Diagram(s).
  2. Raceways and pullboxes.
  3. Conductor sizes and conduit fills.
  4. Panel Schedule(s).
  5. Control Wiring Diagram(s).
  6. Lighting Fixture Schedule(s).
  7. Lighting fixture, receptacle and switch outlet locations.

8. Underground raceway and duct bank routing.
  9. Plan view, sizes and locations of panelboards, motor starters and control cabinets.
- C. Submit a schedule of control wiring raceways and wire numbers, including the following information:
1. Circuit origin, destination and wire numbers.
  2. Field wiring terminal strip names and numbers.
- D. As an alternate, point-to-point connection diagrams showing the same information may be submitted in place of the schedule of control wiring raceways and wire numbers.
- E. Submit the record drawings and the schedule of control wiring raceways and wire numbers (or the point-to-point connection diagram) to the Owner.

#### 1.12 EQUIPMENT INTERCONNECTIONS

- A. Review shop drawings of equipment furnished under other Divisions of this Specification and prepare coordinated wiring interconnection diagrams or wiring tables. Submit copies of wiring diagrams or tables with Record Drawings.
- B. Furnish and install all equipment interconnections.

#### 1.13 MATERIALS AND EQUIPMENT

- A. Materials and equipment shall be new.
- B. Material and equipment of the same type shall be the product of one manufacturer and shall be UL listed.
- C. Provide Quality Control in accordance with Section 01400.
- D. Warrant all equipment furnished under Division 16 in accordance with Section 01650 and 01740. Refer to individual equipment sections for additional warranty items.

#### 1.14 EQUIPMENT IDENTIFICATION

- A. Identify equipment (disconnect switches, separately mounted motor starters, control stations, etc.) furnished under Division 16 with the name of the equipment it serves. Control panels, panelboards, junction or terminal boxes, etc., shall have nameplate designations as shown on the Drawings.
- B. Nameplates shall be engraved, laminated plastic, not less than 1/16-in thick by 3/4-in by 2-1/2-in with 3/16-in high white letters on a black background.
- C. Nameplates shall be screw mounted to NEMA 1 enclosures. Nameplates shall be bonded to all other enclosure types using an epoxy or similar permanent waterproof adhesive. Two sided foam adhesive tape is not acceptable. Where the equipment size does not have space for mounting a nameplate the nameplate shall be permanently fastened to the adjacent mounting surface.

## 1.15 DEMOLITION

- A. Survey the existing electrical systems and equipment identified for removal with Owner and representatives from the other trades prior to performing any demolition work. Identify all conduit and equipment to be removed with tags or paint.
- B. Where a piece of equipment is to be removed all associated ancillary components (e.g., solenoid valves, pressure switches, etc) and associated wiring and conduit shall also be removed.
- C. Equipment, building or structures scheduled for complete demolition shall be made safe from electrical shock hazard prior to demolition. Disconnect all electrical power, communications, alarm and signal system.
- D. Coordinate with Owner for disposition of all major electrical equipment scheduled for demolition on Electrical Drawings. Equipment scheduled to be turned over to the Owner shall be carefully disconnected, removed and delivered to the Owner at a location within 25 miles of the existing site. Provide labor, hoisting and transportation of the equipment. All other miscellaneous electrical materials, devices, etc, associated with the equipment being turned over shall be demolished and removed from the site.
- E. Remove electrical work associated with equipment scheduled for demolition except those portions indicated to remain or be reused.
- F. Unless otherwise specifically noted, remove unused exposed conduit and support systems back to point of concealment including abandoned conduit above accessible ceiling finishes. Remove unused wiring back to source (or nearest point of usage). Identify locations where conduit scheduled for demolition penetrates demarcations between classified and unclassified spaces. Provide a fire-stop rated seal for remaining openings to maintain hazardous classification envelopes as designated on the Electrical Drawings.
- G. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned or being removed. Provide blank covers for abandoned outlets which are not removed.
- H. Disconnect and remove abandoned panelboards, disconnect switches, motor starters, control stations, distribution equipment, etc.
- I. Disconnect and remove abandoned luminaries. Remove brackets, stems, hangers and other accessories.
- J. Repair adjacent construction and finishes damaged during demolition and extension work.
- K. Where electrical systems pass through the demolition areas to serve other portions of the premises, they shall remain or be suitably relocated and the system restored to normal operation.
- L. Coordinate electrical power outages to the electrical systems and equipment with the Owner. Where duration of proposed outage cannot be allowed by the Owner, phase the retrofit work to allow the system or equipment to be re-connected to the electrical power system within the time frame allowed by the Owner or provide temporary power connections as required to maintain service to the systems or equipment. The temporary power can be from a generator or another part of the facility not affected by the outage provided there is sufficient spare capacity.

- M. Continuous service is required on all circuits and outlets affected by these changes, except where the Owner will permit an outage for a specific time. Obtain Owner's consent before removing any circuit from continuous service.
- N. The electrical and process equipment to be removed or relocated under this contract has been identified on the Drawings. The removal and or relocation of existing conduit, wire and equipment have not been detailed on the Drawings. Survey the affected equipment and building areas before submitting bid proposal.
- O. Trace out existing wiring that is to be relocated, or removed and perform the relocation or removal work as required for a complete operating and safe system.
- P. Remove exposed conduits, wireways, outlet boxes, pull boxes and hangers made obsolete by the alterations, unless specifically designated to remain. Patch surfaces and provide blank covers for abandoned outlets which are removed.
- Q. All equipment, materials, controls, motor starters, branch and feeder breakers, panelboards, transformers, wiring, raceways, etc, furnished and installed to temporarily keep circuits energized shall be removed when the permanent installation is fully operational.

#### 1.16 DISPOSITION OF REMOVED MATERIALS AND EQUIPMENT

- A. It is intended that material and equipment indicated to be removed and disposed of by the Contractor shall, upon removal, become the Contractor's property and shall be disposed of off the site by the Contractor, unless otherwise directed by the Owner. A receipt showing acceptable disposal of any legally regulated materials or equipment shall be given to the Owner.
- B. Ballasts in each existing lighting fixture shall be assumed to contain PCB's unless specifically marked with a label indicating "No PCBs." Remove ballasts from each lighting fixture and pack them in accordance with EPA PCB regulations. Ship ballasts in approved containers to an EPA approved recycling facility and pay all shipping, packaging and recycle costs..
- C. PCBs, mercury and PCB/mercury contaminated equipment shall be removed, packaged, shipped and disposed of in accordance with all State and Federal regulations. Obtain the services of a firm licensed and regularly engaged in the removal of PCBs and PCB contaminated equipment. The firm shall be licensed in the State or States in which the contaminated material is handled, shipped and disposed. Pay all fees associated with the removal of the contaminated material and equipment and provide documentation showing acceptable disposal.
- D. Should the Contractor discover PCB or mercury contaminated equipment that was not identified; they shall cease work on or about the equipment and notify the Engineer immediately. The Contractor shall then proceed with the work as directed by the Engineer.

#### 1.17 INTERPRETATION OF DRAWINGS

- A. Unless specifically stated to the contrary, the Drawings are not intended to show exact locations of conduit runs. Coordinate the conduit installation with other trades and the actual supplied equipment.

- B. Unless otherwise approved by the Engineer, conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.
- C. Where circuits are shown as "home-runs" all necessary fittings and boxes shall be provided for a complete raceway installation. Where home-runs indicate conduit is to be installed concealed or exposed the entire branch circuit shall be installed in the same manner. Unless otherwise indicated install branch circuit conduits exposed in process/industrial type spaces and concealed in finished spaces.
- D. Verify the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.
- E. Except where dimensions are shown, the locations of equipment, fixtures, outlets and similar devices shown on the Drawings are approximate only. Exact locations shall be determined by the Contractor and approved by the Engineer during construction. Obtain information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.
- F. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting and other electrical systems shown.
- G. Redesign of electrical or mechanical work, which is required due to the Contractor's use of an alternate item, arrangement of equipment and/or layout other than specified herein, shall be done by the Contractor at his/her own expense. Redesign and detailed plans shall be submitted to the Engineer for approval. No additional compensation will be provided for changes in the work, either his/her own or others, caused by such redesign.
- H. Raceways and conductors for low voltage (120 Volts) thermostats controlling HVAC unit heaters, exhaust fans and similar equipment are not shown on the Drawings. Provide raceways and conductors between the thermostats, the HVAC equipment and the motor starters for a complete and operating system. Raceways shall be installed concealed in all finished space and may be installed concealed or exposed in process spaces. Refer to the HVAC drawings for the locations of the thermostats.
- I. It is the intent of these Specifications that the Electrical Systems shall be suitable in every way for the service required. All materials and all work that may be implied as being incidental to the work of this Section shall be furnished at no additional cost to the Owner.
- J. For those raceways and conductors for lighting, switches, receptacles and other miscellaneous low voltage power and signal systems as specified not shown on the Drawings, raceways and conductors shall be provided as required for a complete and operating system. Homeruns, as shown on the Drawings, are to assist the Contractor in identifying raceways to be run exposed and raceways to be run concealed. Raceways shall be installed concealed in all finished spaces and may be installed exposed or concealed in all process spaces. Raceways installed exposed shall be near the ceiling or along walls of the areas through which they pass and shall be routed to avoid conflicts with HVAC ducts, cranes hoists, monorails, equipment hatches, doors, windows, etc. Raceways installed concealed shall be run in the center of concrete floor slabs, above suspended ceilings, or in partitions as required.

## PART 2 PRODUCTS

### 2.01 CONDUITS AND FITTING

#### A. Rigid Steel Conduit

1. Rigid steel conduit interior and exterior shall be hot-dipped galvanized and be as manufactured by the Allied Tube and Conduit Corp.; Wheatland Tube Co.; Western Tube & Conduit Corporation, or equal.

#### B. PVC Coated Rigid Steel Conduit

1. PVC coated rigid steel conduit shall have a minimum 0.040-in thick, polyvinyl chloride coating permanently bonded to hot-dipped galvanized steel conduit and an internal chemically cured urethane or enamel coating. The ends of all couplings, fittings, etc., shall have a minimum of one pipe diameter in length of PVC overlap. PVC conduit and fittings shall be manufactured by Occidental Coating Company; "Plasti-Bond Red" as manufactured by Robroy Industries; "Ocal" by Thomas & Betts Inc., Perma-Cote, or equal.

#### C. Rigid Nonmetallic Conduit

1. PVC conduit shall be rigid polyvinyl chloride schedule 40 and 80 as manufactured by Carlon; An Indian Head Co.; Kraloy Products Co., Inc.; Highland Plastics Inc. or equal.

#### D. Liquidtight Flexible Metal Conduit, Couplings and Fittings

1. Liquidtight flexible metal conduit shall be Sealtite, Type UA, manufactured by the Anaconda Metal Hose Div.; Anaconda American Brass Co.; American Flexible Conduit Co., Inc.; Universal Metal Hose Co. or equal.
2. Fittings used with liquidtight flexible metal conduit shall be of the screw-in type as manufactured by the Thomas & Betts Co.; Crouse-Hinds Co. or equal.

#### E. Flexible Couplings

1. Flexible couplings shall be type ECGJH as manufactured by the Crouse-Hinds Co.; Appleton Electric Co.; Killark Electric Manufacturing Co. or equal.

#### F. Boxes and Fittings

1. Pressed steel switch and outlet boxes shall be hot-dipped galvanized as manufactured by the Raco Manufacturing Co.; Adalet Co.; O.Z. Manufacturing Co. or equal.
2. For use in NEMA 1 areas, terminal boxes, junction boxes, pull boxes etc, shall be galvanized sheet steel with continuously welded seams. Box bodies shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Covers shall be gasketed and fastened with stainless steel screws. Terminal boxes shall be furnished with hinged doors, terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20

Amps, 600 Volt. Boxes shall be as manufactured by Hoffman Engineering Co.; Lee Products Co.; Keystone/Rees, Inc. or equal.

3. NEMA 4 terminal boxes, junction boxes, pull boxes, etc, shall be sheet stainless steel unless otherwise shown on the Drawings. Boxes shall have continuously welded seams and mounting feet. Welds shall be ground smooth. Boxes shall be flanged and shall not have holes or knockouts. Box bodies shall not be less than 14 gauge metal and covers shall not be less than 12 gauge metal. Covers shall have a continuous gasket on all four sides and be fastened with stainless steel clamps. Terminal boxes shall be furnished with hinged doors, terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20 Amp, 600 Volt. Boxes shall be as manufactured by Hoffman Engineering Co.; Lee Products Co.; Keystone/Rees, Inc. or equal.
4. NEMA 4X terminal boxes, junction boxes and pull boxes shall be fiberglass reinforced plastic with stainless steel hardware and covers having a continuous gasket on all four sides. Terminal boxes shall be furnished with hinged doors, terminal mounting straps and brackets. Terminal blocks shall be NEMA type, not less than 20 Amps, 600 Volt. Boxes shall be as manufactured by Hoffman Engineering Co.; Lee Products Co.; Keystone/Rees, Inc. or equal.
5. Explosion-proof boxes shall be designed for Class 1, Group D, Division 1 hazardous locations. They shall be cast iron with cadmium-zinc or hot-dipped galvanized finish, stainless steel or hot-dipped galvanized bolts; Type EJB as manufactured by the Crouse-Hinds Company; Appleton Electric Co.; The Pyle-National Co. or equal.
6. All boxes and fittings used with PVC coated conduit shall be furnished with a PVC coating bonded to the metal, the same thickness as used on the coated steel conduit. The ends of couplings and fittings shall have a minimum of one pipe diameter PVC overlap to cover threads and provide a seal.
7. Cast or malleable iron device boxes shall be Type FD. All cast or malleable iron boxes and fittings shall have cadmium-zinc finish with cast covers and stainless steel screws as manufactured by the Crouse-Hinds Co. or equal.
8. Cast aluminum device boxes shall be Type FD. All cast aluminum boxes and fittings shall be copper-free aluminum with cast aluminum covers and stainless steel screws as manufactured by the Killark Electric Co.; Crouse-Hinds Co.; L. E. Mason Co. or equal.
9. Steel elbows and couplings shall be hot-dipped galvanized. Elbows and couplings used with PVC coated conduit shall be furnished with a PVC coating bonded to the steel, the same thickness as used on the coated steel conduit.
10. Conduit hubs shall be as manufactured by Myers Electric Products, Inc. or equal.
11. Conduit wall and floor seals for sleeved openings shall be type CSMI as manufactured by the O.Z./Gedney Co. or equal.
12. Explosion proof fittings shall be as manufactured by the Crouse-Hinds Co.; Appleton Electric Co.; O.Z./Gedney Co. or equal.
13. Conduit sealing bushings shall be O.Z./Gedney Type CSB or equal.

14. Combination expansion-deflection fittings embedded in concrete shall be Type XD as manufactured by Crouse-Hinds Co.; Type AXDX as manufactured by O.Z./Gedney Co. Type DF as manufactured by Appleton Electric Co. or equal.
15. Combination expansion-deflection fittings installed exposed shall be Type XD as manufactured by Crouse-Hinds Co.; Type AXDX as manufactured by O.Z./Gedney Co. Type DF as manufactured by Appleton Electric Co. or equal.

G. Conduit Mounting Equipment

1. In dry indoor areas, hangers, rods, backplates, beam clamps, channel, etc. shall be galvanized iron or steel.
2. PVC coated steel channel with stainless steel hardware shall be used in outdoor locations. Fiberglass channel shall be resistant to the chemicals present in the area in which it is used.

H. Wall and Floor Slab Opening Seals

1. Wall and floor slab openings shall be sealed with "FLAME-SAFE" as manufactured by the Thomas & Betts Corp.; Pro Set Systems; Neer Mfg. Co.; Specified Technologies, Inc. or equal.

I. Cold Galvanizing Compound

1. Cold galvanizing compound shall be as manufactured by ZRC Products Company, a division of Norfolk Corp. or equal.

2.02 WIRE, CABLE AND ACCESSORIES

- A. Wires and cables shall be of annealed, 98 percent conductivity, soft drawn copper.
- B. All conductors shall be stranded, except that lighting and receptacle wiring may be solid.
- C. Except for control, signal and instrumentation circuits, wire smaller than No. 12 AWG shall not be used.
- D. Wire for lighting, receptacles and other circuits not exceeding 150 Volts to ground shall be NEC Type THHN/THWN as manufactured by Okonite Co.; Southwire Co.; Pirelli Corp., or equal.
- E. Wire for circuits over 150 Volts to ground shall be NEC type XHHW-2 for sizes up to No. 4/0 AWG and Type RHW-2 for sizes greater than No. 4/0 AWG as manufactured by Okonite Co.; Southwire Co., or equal.
- F. Wire for control, status and alarm circuits shall be No.14 AWG NEC type THHN/THWN, stranded as manufactured by the Okonite Co.; Carol Cable Co. Inc. West; Pirelli Cable Corp. or equal.
- G. Multi-conductor control and power cables shall have stranded conductors with type THHN/THWN insulated, nylon conductor covering, and an overall PVC jacket covering the individual wires. Cable shall be TC rated meeting UL 1277 and IEEE 383 Standards. Cable shall be flame resistant, non-propagating and suitable for installation in a Class I, Division II hazardous location and for direct burial in earth. Power and control cables shall be furnished

with a green ground conductor. Power cables shall be furnished with a white neutral conductor where required to serve phase to neutral loads. Cable shall be as manufactured by the Okonite Co.; Southwire Co.; General Cable Co., or equal.

- H. Wire for process instrumentation signals (i.e., 1-5 VDC, 4-20 mA), R.T.D., potentiometer and similar signals shall be:
1. Single pair cable:
    - a. Conductors: 2- No.16 stranded and twisted on 2-in lay
    - b. Insulation: PVC with 300 Volt, 105 degrees C rating
    - c. Shield: 100 percent mylar tape with drain wire
    - d. Jacket: PVC with UL Subject 13, UL 1581, and manufacturer's identification
    - e. Max overall diameter: 0.262-in
    - f. Miscellaneous: UL listed for underground wet location use
    - g. Manufacturers: Belden No. 1030 or equal
  2. Three conductor (triad) cable:
    - a. Conductors: 3- No.16 stranded and twisted on 2-in lay
    - b. Insulation: PVC with 300 Volt, 105 degrees C rating
    - c. Shield: 100 percent mylar tape with drain wire
    - d. Jacket: PVC with UL Subject 13, UL 1581 and manufacturer's identification
    - e. Max overall diameter: 0.276-in
    - f. Miscellaneous: UL listed for underground wet location use
    - g. Manufacturers: Belden No. 1031 or equal
  3. Multiple pair cables (where shown on the Drawings):
    - a. Conductor: multiple 2- No.22 stranded and twisted on a 2-in lay
    - b. Insulation: PVC with 300 Volt, 105 degrees C rating
    - c. Shield: Individual pairs shielded with 100 percent mylar tape and drain wire
    - d. Jacket: PVC with UL Subject 13, UL 1581 manufacturer's identification
    - e. Miscellaneous: UL listed for underground wet location use
    - f. Manufacturers: Belden No. 9330, 9331, 9332, 9333, 9334, 9335, 9336, 9337 or equal
- L. Splices for power wiring shall be compression type connectors insulated with a heat shrink boot or outer covering and epoxy filling. Splice kits shall be as manufactured by Raychem; Ideal Industries; 3M Co. or equal.
- J. Motor connections shall be ring type mechanical compression terminations installed on the branch circuit wires and the motor leads and secured with bolt, nut and springwasher. Connections shall be insulated with a Raychem Type RVC, roll-on stub insulator or equal.
- K. Termination connectors for control wiring shall be of the locking fork-end (upturned leg ends) type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.

- L. Splices for control wiring shall be insulated compression type connectors of the expanded vinyl insulated parallel or pigtail type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.
- M. Termination connectors for shielded instrumentation wiring shall be of the locking fork-end (upturned leg ends) type as manufactured by Ideal Industries; 3M Co.; Panduit Corp. or equal.
- N. Wire markers shall be "Omni-Grip" as manufactured by the W.H. Brady Co.; Thomas & Betts Co.; 3M Co. or equal.
- O. Wire and cables with diameters exceeding the capacity of the "Omni-Grip" shall be marked with pre-printed, self-adhesive vinyl tapes as manufactured by the W.H. Brady Co.; Panduit Corp. or equal.

### 2.03 WIRING DEVICES

- A. Wall switches shall be heavy duty, specification grade, toggle action, flush mounting quiet type. All switches shall conform to the latest revision of Federal Specification WS 896. Wall switches shall be of the following types and manufacturer:
  1. Single pole, 20 Amp, 120/277 Volt - Arrow-Hart, Catalog No. 1991, or equal by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.
  2. Explosion-proof single pole factory sealed switches shall be for 20 Amps, 120/277 Volts, mounted in copper free aluminum or malleable iron cast boxes and be similar and equal to Crouse-Hinds EDS Series, or equal by Appleton Electric Co. or Killark.
- B. Receptacles shall be heavy duty, specification grade of the following types and manufacturer or equal. Receptacles shall conform to Federal Specification WC596-F.
  1. Duplex, 20 Amp, 125 Volt, 2P, 3W; Arrow-Hart, Catalog No. 5362, or equal by Harvey Hubbell, Inc.; Pass & Seymour, Inc.
  2. Weatherproof/corrosion resistant single, 20 Amp, 125 Volt, 2P, 3W, with cover; Crouse-Hinds Co., Catalog No. WLRS-5-20, or equal by Appleton Electric.
  3. Weatherproof/corrosion resistant duplex, 20 Amp, 125 Volt, 2P, 3W, with cover; Crouse-Hinds Co., Catalog No. WLRD-5-20 or equal by Appleton Electric.
  4. Ground fault interrupter, duplex, 20 Amp, 125 Volt, 2P, 3W, GFCI feed thru type with "test" and "reset" buttons. Arrow-Hart, Catalog No. GF5342 or equal by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.
  5. Single, "power lock," 20 Amp, 125 Volt, 2P, 3W; Arrow-Hart, Catalog No. 23030 and plug Arrow-Hart, Catalog No. 23035N or equal by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.
  6. Single, 20 Amp, 250 Volts, 2P, 3W; Arrow-Hart, Catalog No. 5861 or equal by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

7. Single twist-lock, 20 Amp, 250 Volts, 2P, 3W; Arrow-Hart, Catalog No. 6210; plug: Arrow-Hart, Catalog No. 6212 or equal by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.
8. Single twist-lock, 30 Amp, 250 Volts, 2P, 3W; Arrow-Hart, Catalog No. 6340; plug: Arrow-Hart, Catalog No. 6342 or equal by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.
9. Explosion-proof single, 20 Amp, 125 Amp, 2P, 3W; Appleton Electric, Catalog No. CPC1-2350 and plug, Appleton Electric, Catalog No. CPP-2033 or equal by Crouse-Hinds; Harvey Hubbell Inc.
10. Explosion-proof duplex, 20 Amp, 125 Volt, 2P, 3W; Appleton Electric, Catalog No. CPC2-2350 and plug, Appleton Electric, Catalog No. CPP-2023 or equal by Crouse-Hinds; Harvey Hubbell, Inc.

#### C. Device Plates

1. Plates for indoor flush mounted devices shall be of the required number of gangs for the application involved and shall be as follows:
  - a. Administration type buildings: Smooth, high impact nylon of the same manufacturer and color as the device. Final color to be as selected by the Architect.
  - b. Where permitted in other areas of the plant, flush mounted devices in cement block construction shall be Type 302 high nickel (18-8) stainless steel of the same manufacturer as the devices.
2. Plates for indoor surface mounted device boxes shall be cast metal of the same material as the box, Crouse-Hinds, No. DS23G and DS32G, or equal.
3. Oversized plates shall be installed where standard plates do not fully cover the wall opening.
4. Device plates for switches mounted outdoors or indicated as weatherproof shall be gasketed, cast aluminum with provisions for padlocking switches "On" and "Off," Crouse Hinds, No. DS185, or equal.
5. Multiple surface mounted devices shall be ganged in a single, common box and provided with an adapter, if necessary, to allow mounting of single gang device plates on multigang cast boxes.
6. Engraved device plates shall be provided where required.
7. Weatherproof, gasketed cover for GFI receptacle mounted in a FS/FD box shall be Arrow-Hart, Catalog No. 4501-FS or equal by Harvey Hubbell, Inc.; Pass & Seymour, Inc. or equal.

#### 2.04 MISCELLANEOUS EQUIPMENT

##### A. Intrusion Switches

1. Intrusion switches shall be heavy-duty, with biased reed contacts wired in a SPDT configuration and include a plunger type tamper switch actuated on removal of cover. Connection to switch shall be made by screw terminals. Intrusion switches shall be rated for 30VAC/VDC and hazardous locations.
2. NEMA 7 enclosures shall be cast aluminum.
3. Switches shall be as manufactured by the General Electric Company; Sentrol; Edwards Signaling or equal.

## 2.05 THERMAL DISPERSION FLOW SWITCH

### A. Type:

1. Thermal dispersion flow switch with integral electronics enclosure.
2. Inline with flow body or insertion type as indicated on the Drawings or in the Instrument Device Schedule.

### B. Function/Performance

1. Range: 1 to 125 ft/s (0.3 to 38 m/s) in air.
2. Process Operating Temperature: -40 to 250 degrees F.
3. Operating Temperature for Electronics: 0 to 140 degrees F.
4. Accuracy: Plus or minus 5 percent of reading.
5. Repeatability: Plus or minus 0.5 percent of reading.
6. Output: DPDT contacts rated 6 A at 120 VAC adjustable over the range of the instrument.

### C. Physical:

1. Wetted parts to be 316 stainless steel.
2. Electronics head to be NEMA 4X (IP65) for non-hazardous process gases and explosion proof approved for Class 1, Division 1, Groups C and D (EEx d IIC) for hazardous process gases or where located in a hazardous area.

### D. Power Requirements:

1. Transmitter shall be 120 VAC powered instrument

### E. Accessories Required:

1. For insertion type flow elements a hot tap assembly including a ball valve and packing gland that will allow removal of the sensor without shutdown of the process, shall be provided. The hot tap assembly shall be installed in a welded fitting on the pipe.

### F. Manufacturer(s):

1. Fluid Components International FLT93-F.
2. Equal.

G. Manual Motor Starters

1. Manual starters shall be suitable for the voltage and number of phase shown on the Drawings and shall be non-reversing, reversing or two speed type as shown on the Drawings. NEMA sizes shall be as required for the horse-powers shown on the Drawings. Manual starters shall have motor overload protection in each phase.
2. NEMA 4X enclosures shall be stainless steel.
3. NEMA 7 enclosures shall be cast aluminum.
4. Manual motor starters shall be as manufactured by the Square D Co; Cutler Hammer Co.; General Electric Company; Siemens Company or equal.

H. Circuit Breakers

1. Provide thermal magnetic circuit breaker in NEMA Type 12 Enclosure with externally operated handle. Circuit breakers shall be fully rated for 22,000 Amps RMS symmetrical.
2. Circuit breakers shall be manufactured by Cutler Hammer Co.; General Electric Company; Siemens Company or equal.

I. Control Relays

1. Control relays shall be heavy duty machine tool type, with 10 Amps, 300 Volt convertible contacts. Number of contacts and coil voltage shall be as shown on the Drawings. General use relays shall be General Electric Co., Catalog No. CR120B or equal by Square D Co. or Allen-Bradley Co. Latching relays shall be General Electric Co., CR120BL, equal by Square D Co. or Allen-Bradley Co.
2. Time delay relays shall be pneumatic, 600 Volt, 20 Amp contacts, with calibrated knob operated adjustment. On delay and off delay types and timing ranges shall be as shown on the Drawings. Relays shall be Agastat, Model 7012 or 7022 or equal.

J. Polyethylene Warning Tape

1. Warning tape shall be red polyethylene film, 6-in minimum width.
2. Warning tape shall be W.H. Brady Co., Catalog No. 91296 or equal.

K. Photocells

1. The photocells shall be suitable for power duty with individual fixtures or for pilot duty with contactors as detailed on the Drawings. Enclosure shall be NEMA 3R or 4. Contacts shall be rated for 2,000 Watts continuous at 120 Volts. The unit shall turn on at 1.5 footcandles and off at 5.5 footcandles.
2. Photocells shall be TORK, Model 2101 or factory installed with the fixture or equal.

#### L. Equipment Mounting Stands

1. Equipment mounting stands shall be custom fabricated from 1/4-in steel plate and 4-in steel channel, as shown on the Drawings.
2. Hot dip galvanizing shall conform to the requirements of Division 5.

#### 2.06 UNDERGROUND SYSTEM

- A. Excavation and backfilling, including gravel and sand bedding, are included in Division 2.
- B. Concrete and reinforcing steel are included in Division 3.
- C. All concrete and reinforcing steel shall be as specified in Division 3, but the responsibility of furnishing and installing the material shall be that of this Section.
- D. All trenching and surface restoration shall be as specified in Division 2, but the responsibility of furnishing and installing the material shall be that of this Section.
- E. Raceways shall be polyvinyl chloride conduit encased in concrete except that rigid steel conduit shall be used for 600 Volt shielded wire and data highway wiring.

#### 2.07 GROUNDING

- A. Ground rods shall be 3/4-in by 10-ft copper clad steel and constructed in accordance with UL 467. The minimum copper thickness shall be 0.25 mm. Ground rods shall be Copperweld or equal.
- B. Grounding conduit hubs shall be malleable iron type similar to Thomas & Betts Co.; Cat No. 3940 (3/4-in conduit size) by Burndy; O.Z./Gedney Co. or equal, and of the correct size for the conduit.
- C. Waterpipe ground clamps shall be cast bronze saddle type, similar to Thomas & Betts Co. Cat. No. 2 (1/2-in, 3/4-in, or 1-in size) or equal by Burndy; O.Z./Gedney Co. or equal, and of the correct size for the pipe.
- D. Buried grounding connections shall be by Cadweld process, or equal exothermic welding system.

### PART 3 EXECUTION

#### 3.01 SLEEVES AND FORMS FOR OPENINGS

- A. Provide and place all sleeves for conduits penetrating floors, walls, partitions, etc. Locate all necessary slots for electrical work and form before concrete is poured.
- B. Exact locations are required for stubbing-up and terminating concealed conduit. Obtain shop drawings and templates from equipment vendors or other subcontractors and locate the concealed conduit before the floor slab is poured.
- C. Where setting drawings are not available in time to avoid delay in scheduled floor slab pours, the Engineer may allow the installations of such conduit to be exposed. Requests for this

deviation must be submitted in writing. No additional compensation for such change will be allowed.

- D. Seal all openings, sleeves, penetration and slots.

### 3.02 CUTTING AND PATCHING

- A. Cutting and patching shall be done in a thoroughly workmanlike manner. Sawcut concrete and masonry prior to breaking out sections.
- B. Core drill holes in concrete floors and walls as required.
- C. Install work at such time as to require the minimum amount of cutting and patching.
- D. Do not cut joists, beams, girders, columns or any other structural members.
- E. Cut opening only large enough to allow easy installation of the conduit.
- F. Patching to be of the same kind and quality of material as was removed.
- G. The completed patching work shall restore the surface to its original appearance or better.
- H. Patching of waterproofed surfaces shall render the area of the patching completely waterproofed.
- I. Remove rubble and excess patching materials from the premises.
- J. When existing conduits are cut at the floor line of wall line, they shall be filled with grout of suitable patching material.

### 3.03 INSTALLATION

- A. Any work not installed according to the Specifications shall be subject to change as directed by the Engineer. No extra compensation will be allowed for making these changes.
- B. Electrical equipment shall be protected at all times against mechanical injury or damage by water. Electrical equipment shall not be stored outdoors. Electrical equipment shall be stored in dry permanent shelters. Do not install electrical equipment in its permanent location until structures are weather-tight. If any apparatus has been subject to possible injury by water, it shall be thoroughly dried out and tested as directed by the Engineer, or shall be replaced at no additional cost at the Engineer's discretion.
- C. Equipment that has been damaged shall be replaced or repaired by the equipment manufacturer, at the Engineer's discretion.
- D. Repaint any damage to factory applied paint finish using touch-up paint furnished by the equipment manufacturer. The entire damaged panel or section shall be repainted at no additional cost to the Owner.
- E. Coordinate the conduit installation with other trades and the actual supplied equipment.

- F. Unless otherwise approved by the Engineer, conduit installed interior to the building shall be installed exposed; conduit installed exterior to the building shall be concealed.
- G. Verify the exact locations and mounting heights of lighting fixtures, switches and receptacles prior to installation.
- H. Exact locations of electrical equipment shall be determined by the Contractor and approved by the Engineer during construction. Obtain information relevant to the placing of electrical work and in case of any interference with other work, proceed as directed by the Engineer and furnish all labor and materials necessary to complete the work in an approved manner.

#### 3.04 BOXES AND FITTINGS

- A. Except where otherwise specified, all wiring shall be in rigid steel conduit.
- B. Rigid steel conduit shall be used at all locations (underground and within structures) as raceways for shielded process instrumentation wiring, shielded control wiring, and I/O wiring.
- C. PVC conduit shall be used for concrete encased underground duct banks except as specified in Paragraph 3.04B above.
- D. All boxes shall be metal.
- E. Exposed switch, receptacle and lighting outlet boxes and conduit fittings shall be cast or malleable iron, except that cast aluminum shall be used with aluminum conduit.
- F. Terminal boxes, junction boxes and pull boxes shall have NEMA ratings suitable for the location in which they are installed.
- G. Conduit wall seals shall be used where underground conduits penetrate walls.
- H. Conduit sealing bushings shall be used to seal conduit ends exposed to the weather.
- I. No conduit smaller than 3/4-in electrical trade size shall be used, nor shall any have more than the equivalent of three 90 degree bends in any one run. Pull boxes shall be provided as required or directed.
- J. No wire shall be pulled until the conduit system is complete in all details.
- K. The ends of all conduits shall be tightly plugged to exclude dust and moisture during construction.
- L. Conduit supports, other than for underground raceways, shall be spaced at intervals of 8-ft or less.
- M. Conduit hangers shall be attached to structural steel by means of beam or channel clamps. Where attached to concrete surfaces, concrete inserts of the spot type shall be provided.
- N. All conduits shall be run at right angles to and parallel with the surrounding wall and shall conform to the form of the ceiling. No diagonal runs will be allowed. Bends in parallel conduit runs shall be concentric. All conduits shall be run perfectly straight and true.

- O. Conduit terminating in pressed steel boxes shall have double locknuts and insulated bushings.
- P. Conduits terminating in NEMA 4X and 12 enclosures shall be terminated with Myers type conduit hubs.
- Q. Conduits containing equipment grounding conductors and terminating in sheet steel boxes shall have insulated throat grounding bushings.
- R. Conduits shall be installed using threaded fittings.
- S. Liquidtight flexible metal conduit shall be used for all motor terminations, the primary and secondary of transformers, generator terminations and other equipment where vibration is present.
- T. Flexible couplings shall be used in hazardous locations for all motor terminations and other equipment where vibration is present.
- U. Aluminum fittings and boxes shall be used with aluminum conduit. Aluminum conduit shall not be imbedded in concrete. Aluminum conduit shall be isolated from other metals with plastic sleeves or plastic-coated hangers. Strap wrenches shall be used for tightening aluminum conduit.
- V. Where conduits pass through openings in walls or floor slabs, the remaining openings shall be sealed against the passage of flame and smoke.
- W. PVC conduit to non-metallic box connections shall be made with PVC socket to male thread terminal adapters with neoprene O-ring and PVC round edge bushings.
- X. Conduit ends exposed to the weather shall be sealed with conduit sealing bushings.
- Y. PVC conduit shall be supported with non-metallic clamps, PVC coated steelracks and stainless steel hardware.
- Z. PVC boxes, conduit fittings, etc. with integral hubs shall be solvent welded directly to the PVC conduit system.
- AA. Non-metallic boxes with field drilled or punched holes shall be connected to the PVC conduit system with threaded and gasketed PVC Terminal Adapters.
- BB. All conduit entering or leaving a motor control center, switchboard or other multiple compartment enclosure shall be stubbed up into the bottom horizontal wireway or other manufacturer designated area, directly below the vertical section in which the conductors are to be terminated.
- CC. Conduit sealing and drain fittings shall be installed in areas designated as NEMA 7.
- DD. All conduit which may under any circumstance contain liquids such as water, condensation, liquid chemicals, etc, shall be arranged to drain away from the equipment served. If conduit drainage is not possible, conduit seals shall be used to plug the conduits.
- EE. Where no type or size is indicated for junction boxes, pull boxes or terminal cabinets, they shall be sized in accordance with the requirements of N.E.C. Article 370.

- FF. Miscellaneous steel for the support of fixtures, boxes, transformers, starters, contactors, panels and conduit shall be furnished and installed.
- GG. Steel channels, flat iron and channel iron shall be furnished and installed for the support of all electrical equipment and devices, where required, including all anchors, inserts, bolts, nuts, washers, etc. for a rigid installation.
- HH. Conduits passing from heated to unheated spaces, exterior spaces, refrigerated spaces, cold air plenums, etc., shall be sealed with "Duxseal" as manufactured by Manville or seal fitting to prevent the accumulation of condensation.
- II. Rigid galvanized steel conduits which have been field cut and threaded shall be painted with cold galvanizing compounds.
- JJ. Conduit expansion and deflection fittings shall be installed on all conduits crossing building expansion joint. Where conduits are installed outdoors provide expansion and deflection fittings on all conduits crossing expansion joints or at 200 foot intervals whichever is the least dimension.

3.05 WIRE, CABLE AND ACCESSORIES

- A. Uniquely identify all wires, cables and each conductor of multi-conductor cables (except lighting and receptacle wiring) at each end with wire and cable markers.
- B. Use lubrications to facilitate wire pulling. Lubricants shall be UL approved for use with the insulation specified.
- C. All wire shall be color coded or coded using electrical tape in sizes where colored insulation is not available. Where tape is used as the identification system, it shall be applied in all junction boxes, and other accessible intermediate locations as well as at each termination.
- D. The following coding shall be used:
 

System	Wire	Color
240/120 Volts	Neutral	White
1-Phase, 3-Wire	Line 1	Black
Line 2	Red	
- E. Power conductors: Terminations shall be die type or set screw type pressure connectors as specified. Splices (where allowed) shall be die type compression connector and waterproof with heat shrink boot or epoxy filling. Aluminum conductors (where specified) shall employ terminations and splices specifically designed for aluminum conductors.
- F. Control Conductors: Termination on saddle-type terminals shall be wired directly with a maximum of two conductors. Termination on screw type terminals shall be made with a maximum of two spade connectors. Splices (where allowed) shall be made with insulated compression type connectors.
- G. Instrumentation Signal Conductors (including graphic panel, alarm, low and high level signals): terminations same as for control conductors. Splices allowed at instrumentation terminal boxes only.

- H. Except where permitted by the Engineer no splices will be allowed in manholes, handholes or other below grade located boxes.
- I. Splices shall not be made in push button control stations, control devices (i.e., pressure switches, flow switches, etc.), conduit bodies, etc.
- J. Instrumentation cables shall be installed in rigid steel raceways as specified. All circuits shall be installed as twisted pairs or triads. In no case shall a circuit be made up using conductors from different pairs or triads. Triads shall be used wherever three wire circuits are required.
- K. Terminal blocks shall be provided at all instrument cable junction and all circuits shall be identified at such junctions.
- L. Shielded instrumentation wire, shall be run without splices between instruments, terminal boxes, or panels.
- M. Shields shall be grounded as recommended by the instrument manufacturer and isolated at all other locations. Terminal blocks shall be provided for inter-connecting shield drain wires at all junction boxes. Where individual circuit shielding is required, each shield circuit shall be provided with its own block.

### 3.06 WIRING DEVICES

- A. Switch and receptacles outlets shall be installed flush with the finished wall surfaces in areas with stud frame and gypboard construction, in dry areas with cement block construction or when raceways are concealed.
- B. Do not install flush mounted devices in areas designated DAMP, WET or WET/CORROSIVE. Provide surface mounted devices in these areas.
- C. Provide weatherproof devices covers in areas designated WET or WET/CORROSIVE.

### 3.07 UNDERGROUND SYSTEM

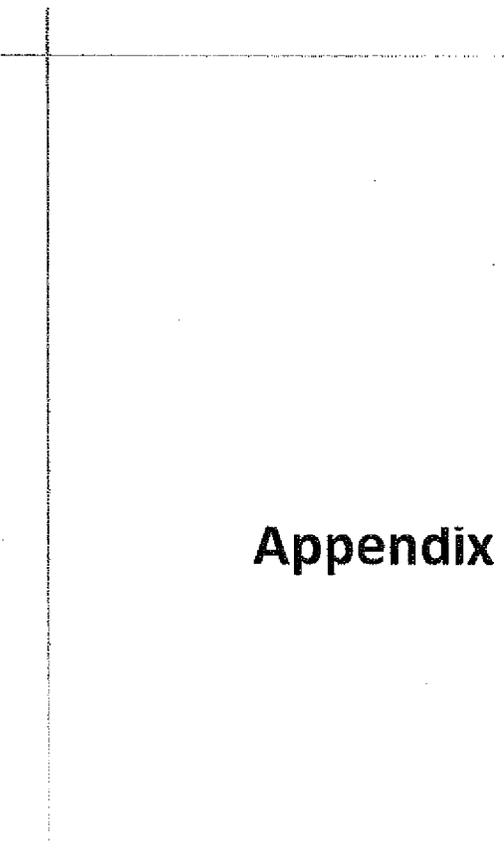
- A. Install raceways to drain away from buildings.
- B. Reinforce raceway banks when conduits pass over newly excavated pipes.
- C. The minimum cover for raceway banks shall be 24-in unless otherwise permitted by the Engineer.
- D. Swab all raceways clean before installing cable.
- E. Plug spare raceways and seal them watertight at all manholes, buildings and structures.
- F. Seal the ends of raceways and make watertight at all handholes, buildings and structures.

### 3.08 GROUNDING

- A. Run grounding electrode conductors in rigid steel conduits. Bond the protecting conduits to the grounding electrode conductors at both ends. Do not allow water pipe connections to be painted. If the connections are painted, disassemble them and re-make them with new fittings.

- B. Install equipment grounding conductors with all feeders and branch circuits.
- C. Bond all steel building columns in new structures together with ground wire in rigid conduit and connect to the distribution equipment ground bus.
- D. Ground wire connections to structural steel columns shall be made with long barrel type one-hole heavy duty copper compression lugs, bolted through 1/2-in maximum diameter holes drilled in the column web, with stainless steel hex head cap screws and nuts.
- E. Metal conduits stubbed into a motor control center shall be terminated with insulated grounding bushings and connect to the motor control center ground bus. Bond boxes mounted below motor control centers to the motor control center ground bus. Size the grounding wire in accordance with NEC Table 250-95, except that a minimum No. 12 AWG shall be used.
- F. Liquid tight flexible metal conduit in sizes 1-1/2-in and larger shall have bonding jumpers. Bonding jumpers shall be external, run parallel (not spiraled) and fastened with plastic tie wraps.
- G. Ground transformer neutrals to the nearest available grounding electrode with a conductor sized in accordance with NEC Article 250-94.
- H. Seal exposed connections between different metals with No-Oxide Paint Grade A or equal.
- I. Lay all underground grounding conductors slack and, where exposed to mechanical injury, protect by pipes or other substantial guards. If guards are iron pipe, or other magnetic material, electrically connect conductors to both ends of the guard. Make connections as specified herein.
- J. Care shall be taken to ensure good ground continuity, in particular between the conduit system and equipment frames and enclosures. Where necessary, jumper wires shall be installed.
- K. All grounding type receptacles shall be grounded to the outlet boxes with a No. 12 THW green conductor connected to the ground terminal of the receptacle and fastened to the outlet box by means of a grounding screw.
- L. Test the grounding system. Resistance to ground testing shall be performed during dry season. Submit test results in the form of a graph showing the number of points measured (12 minimum) and the numerical resistance to ground.
- M. Testing shall be performed before energizing the distribution system.
- N. Notify the Engineer immediately if the resistance to ground for any building or system is greater than five ohms.

END OF SECTION



## **Appendix A – Geotechnical Report**



**GEOTECHNICAL EVALUATION  
GILBERT METERING STATION IMPROVEMENTS  
639 EAST GILBERT DRIVE  
TEMPE, ARIZONA  
CITY OF TEMPE PROJECT NO. 3206061**

**PREPARED FOR:**  
City of Tempe  
31 East 5<sup>th</sup> Street  
Tempe, Arizona 85281

**PREPARED BY:**  
Ninyo & Moore  
Geotechnical and Environmental Sciences Consultants  
3202 East Harbour Drive  
Phoenix, Arizona 85034

October 17, 2011  
Project No. 602128029

October 17, 2011  
Project No. 602128029

Mr. Philip C. Brown, PE  
City of Tempe  
31 East 5th Street  
Tempe, Arizona 85281

Subject: Geotechnical Evaluation  
Gilbert Metering Station Improvements  
639 East Gilbert Drive  
Tempe, Arizona  
City of Tempe Project No. 3206061

Dear Mr. Brown:

In accordance with your agreement and our proposal dated July 14, 2011, Ninyo & Moore has performed a geotechnical evaluation for the above-referenced site. The attached report describes our evaluation methodology and presents our findings, conclusions, and recommendations regarding the geotechnical conditions at the project site.

We appreciate the opportunity to be of service to you during this phase of the project.

Sincerely,  
**NINYO & MOORE**

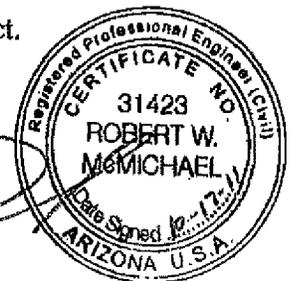


Tafwachi Chamunda, PE  
Project Engineer

TLC/HAH/RM/clj

Distribution: (1) Addressee – via electronic mail

Robert W. McMichael, PE  
Principal Engineer



EXPIRES 06/30/12

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## 1. INTRODUCTION

In accordance with your agreement and our proposal dated July 14, 2011, we have performed a geotechnical evaluation for the proposed improvements at the existing Gilbert Metering Station located at 639 East Gilbert Drive in Tempe, Arizona. The purpose of our evaluation was to assess the subsurface conditions at the project site in order to formulate geotechnical recommendations for design and construction. This report presents the results of our evaluation and our geotechnical conclusions and recommendations regarding the proposed construction.

## 2. SCOPE OF SERVICES

The scope of our services for the project generally included:

- Conducting a visual geologic reconnaissance of the project area and reviewing available geologic literature, topographic information, and aerial photographs of the project site.
- Establishing the test locations in the field based on information obtained from Kennedy/Jenks Consultants and arranging for the mark out of underground utilities through Arizona Blue Stake, prior to drilling.
- Assessing underground utilities at the boring location using geophysical equipment.
- Drilling, logging, and sampling one small-diameter exploratory borings to a depth of approximately 40 feet below ground surface (bgs). The boring log is presented in Appendix A.
- Performing laboratory tests of selected samples obtained from the boring to evaluate in-situ moisture content and dry density, particle size gradation, Atterberg limits, consolidation (response-to-wetting), and corrosivity characteristics (including pH, minimum electrical resistivity, and soluble sulfate and chloride contents). The results of the laboratory testing are presented on the boring logs and/or in Appendix B.
- Preparing this report presenting our findings, conclusions, and recommendations regarding design and construction considerations.

## 3. SITE DESCRIPTION

The project site is located within Section 15 in Township 1 North, Range 4 East. The site is located at 639 East Gilbert Drive, which is just north of the Loop 202 and west of Scottsdale

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Road in Tempe, Arizona. The approximate location of the site is depicted on Figure 1. The Tempe Town Lakes (along the Salt River) are situated within one-quarter mile to the south of the project site. The Papago Buttes are situated approximately one mile to the northwest of the project. There was an existing at-grade structure and a below-grade tunnel at the site. The structure is currently used to access the below-grade tunnel housing sewer pipes beneath East Gilbert Drive. The structure was surrounded by asphalt concrete (AC) pavement to the north and west, flatwork and landscaping to the east, and the Loop 202 freeway on-ramp to the south. East Gilbert Drive is a two-lane roadway situated to the north of the site. Based on our observation of utility marks on the ground, as well as our assessment using geophysical equipment, there are numerous underground utilities at, and around, the project site. According to the project plans prepared by Kennedy/Jenks Consultants, the site elevation is roughly 1,160 feet.

Several aerial photographs were reviewed for this project. Available Flood Control District of Maricopa County (FCDMC) aerial photographs dating from 1930 to 1949 indicated that the site was previously within a meander in the main channel of the Salt River. The 1959 and 1962 aerial photographs depicted the site as being part of undeveloped land outside the river channel. The 1969 and 1979 aerial photographs also depicted the site as being part of undeveloped land with development to the south. The 1979 aerial photograph also showed the Salt River as being channelized to the south of the site. Available aerial photographs dating from 1997 depicted the site as being similar to its current conditions.

#### **4. PROPOSED CONSTRUCTION**

The project consists of the design and construction of a new access stairway on the west side of the existing utility tunnel at 639 East Gilbert Drive in Tempe, Arizona. Based on the plans prepared by Kennedy/Jenks Consultants, the new access will consist of a series of concrete steps, with tied-in retaining walls on each side, that will extend from the existing ground surface to the existing tunnel invert situated approximately 18 feet bgs. The foundations associated with the retaining walls will consist of stepped footings constructed at a 1.5:1 (H:V) slope. A new entrance structure will be constructed to the west of the existing entrance building.

## 5. FIELD EXPLORATION AND LABORATORY TESTING

On August 31, 2011, Ninyo & Moore conducted a subsurface exploration at the site in order to evaluate the existing subsurface conditions and to collect soil samples for laboratory testing. Our evaluation consisted of the drilling, logging, and sampling of one, small-diameter boring. The boring was drilled within the footprint of the planned stairway. The boring was advanced using a Diedrich D-120 truck-mounted drill rig equipped with hollow-stem augers to a depth of about 9 feet bgs. The boring was planned to extend to about 40 feet bgs; however, auger refusal on dense material and gravel and cobbles was encountered and the boring was terminated at the shallower depth.

On September 28, 2011, Ninyo & Moore remobilized to the site to drill the boring using percussion equipment. The boring was advanced using a CME-75 truck-mounted drill rig to a depth of 40 feet bgs. Bulk and relatively undisturbed soil samples were collected at selected intervals. Descriptions of the soils encountered are presented on the boring log in Appendix A. The general location of the boring is depicted on Figure 2.

The soil samples collected from our drilling activities were transported to the Ninyo & Moore laboratory in Phoenix, Arizona for geotechnical laboratory analyses. The analyses included in-situ moisture content and dry density, sieve analyses, Atterberg limits, consolidation (response-to-wetting) test, and corrosivity characteristics (including pH, minimum electrical resistivity, and soluble sulfate and chloride contents). The results of the in-situ moisture content and dry density tests are presented on the boring log in Appendix A. A description of each laboratory test method and the remainder of the test results are presented in Appendix B.

## 6. GEOLOGY AND SUBSURFACE CONDITIONS

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

### **6.1. Geologic Setting**

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

The basins and surrounding mountains were formed approximately 10 to 18 million years ago during the mid- to late-Tertiary age. Extensional tectonics resulted in the formation of horsts (mountains) and grabens (basins) with vertical displacement along high-angle normal faults. Intermittent volcanic activity also occurred during this time. The surrounding basins filled with alluvium from the erosion of the surrounding mountains, as well as from deposition from rivers. Coarser-grained alluvial material was deposited at the margins of the basins near the mountains. The surficial geology of the site is primarily described as Holocene age terrace deposits. These deposits contain both channel and overbank sediments consisting of coarse sand, gravel, cobbles, and interlayered clay, silt, and fine sand. Soil development within these deposits is generally weak, ranging from slight organic accumulation to calcium carbonate accumulation. These deposits are typically subject to flood hazards (Pearthree and Huckleberry, 1994).

### **6.2. Subsurface Conditions**

Our knowledge of the subsurface conditions at the project site is based on the results of our field exploration, laboratory testing, and our understanding of the general geology of the area. The following sections provide a generalized description of the materials encountered. More detailed descriptions are presented on the boring log in Appendix A.

### **6.2.1. Asphalt Concrete**

Asphalt concrete (AC) was encountered at the surface of the boring and was measured to be approximately 2.5 inches thick. Aggregate base was not observed beneath the AC in our boring.

### **6.2.2. Fill**

Fill soils were encountered beneath the AC and extended to a depth of approximately 7 feet bgs. The fill generally consisted of silty sand with varying amounts of gravel in our boring.

### **6.2.3. Alluvium**

Native alluvium was encountered beneath the fill material in our boring. The alluvium extended to the total depths explored. The alluvium generally consisted of a very dense unit of sand, gravel, and cobbles, commonly referred to as SGC material. Boulders are possibly present in this unit. As mentioned previously, the unit caused auger refusal at about 9 feet below the ground surface in our borings.

## **6.3. Groundwater**

Groundwater was encountered at a depth of about 24 feet bgs in our boring. Based on well data from the Arizona Department of Water Resources (ADWR), the approximate depth to groundwater levels have been measured as shallow as 10 feet bgs near the site. Seasonal variations, irrigation, groundwater withdrawal or injection, and other factors can cause groundwater levels to fluctuate. Groundwater could be a constraint to the project design and construction. However, based on correspondence with the owner, no seepage has been observed at the basement floor elevation of the existing facility.

## **6.4. Surface Water**

Based on the information presented on the Federal Emergency Management Agency (FEMA) Online Map Viewer, the project site lies within Flood Zone X, which is described

as an area with 0.2 percent or more chance of flooding each year, in the form of sheet flow, with average depths less than 1 foot. As such, surface water flows may be encountered within the project limits during rain events.

## 7. GEOLOGIC HAZARDS

The following sections describe potential geologic hazards at the site, including land subsidence and earth fissures, faulting and seismicity, and liquefaction.

### 7.1. Land Subsidence and Earth Fissures

Groundwater depletion due to groundwater pumping has caused land subsidence and earth fissures in numerous alluvial basins in Arizona. It has been estimated that subsidence has affected more than 3,000 square miles and has caused damage to a variety of engineered structures and agricultural land (Schumann and Genualdi, 1986). From 1948 to 1983, excessive groundwater withdrawal has been documented in several alluvial valleys where groundwater levels have been reportedly lowered by up to 500 feet. With such large depletions of groundwater, the alluvium has undergone consolidation, resulting in large areas of land subsidence.

In Arizona, earth fissures are generally associated with land subsidence and pose an ongoing geologic hazard. Earth fissures generally form near the margins of geomorphic basins where significant amounts of groundwater depletion have occurred. Reportedly, earth fissures have also formed due to tensional stress caused by differential subsidence of the unconsolidated alluvial materials over buried bedrock ridges and irregular bedrock surfaces (Schumann and Genualdi, 1986).

Based on our field reconnaissance and review of the referenced material, there are no known earth fissures underlying the subject site. Based on our research, the closest earth fissure to the site is located approximately 10 miles to the northwest of the project site (Shipman, 2007). Continued groundwater withdrawal in the area may result in subsidence and the

formation of new fissures or the extension of existing fissures. While the future occurrence of land subsidence and earth fissures cannot accurately be predicted, these phenomena are not expected to be a constraint to the construction of this project.

### **7.2. Faulting**

The site lies within the Sonoran Zone, which is a relatively stable tectonic region located in southwestern Arizona, southeastern California, southern Nevada, and northern Mexico (Euge et al., 1992). This zone is characterized by sparse seismicity and few Quaternary faults. Based on our field observations, review of pertinent geologic data and analysis of aerial photographs, faults are not located on or adjacent to the property. The closest fault to the site is the Carefree fault zone, located approximately 20 miles to the north of the site (Pearthree, 1998). Approximately 2 meters of displacement has occurred along this fault within middle Pleistocene deposits (<750,000 years), but the upper Pleistocene and Holocene deposits (<250,000 years) are not displaced. Seismic parameter recommended for the design of the proposed improvements are presented in Section 9.4 of this report.

### **7.3. Liquefaction Potential**

Based on the Standard Penetration Test (SPT) values recorded at various depths in our exploratory borings, the density and consistency of the soils, and the low ground motion hazard (relatively low peak ground accelerations), the likelihood or potential for liquefaction is considered to be negligible and, therefore, liquefaction is not a design consideration.

## **8. CONCLUSIONS**

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

planned construction will progress up from the bottom. Geotechnical considerations include the following:

- The shallow on-site soils encountered in our boring should generally be excavatable with earthmoving or excavating equipment in good working condition to depths of about 9 feet bgs. However, the underlying, very dense, SGC material will be more difficult to excavate and will call for the use of heavy duty equipment.
- The trench sidewalls may be difficult to stabilize due to the presence of low to no cohesion granular soils onsite, which could have a potential to cave and slough during excavation, especially if the soils are wet or saturated. Additionally, vibrations caused by nearby traffic or construction equipment could accelerate sloughing. Shoring, as opposed to laying back excavation sides, may be more appropriate at this site due to the soil conditions and limited space.
- Retaining wall foundations should bear on a zone of moisture-conditioned, engineered fill that extends 2 feet or more below the bearing surface. Following footing excavations, the exposed subgrade should be evaluated by a geotechnical engineer. Any remaining loose soils and/or debris should be removed.
- Concrete slabs on grade should bear on a zone of moisture-conditioned, engineered fill that extends 12 inches or more below the base of the leveling course.
- Imported soils and soils generated from on-site excavation activities that exhibit low plasticity and very low to low swell potential should be used as engineered fill.
- Groundwater was encountered at approximately 24 feet in our boring. The planned construction extends about 18 feet bgs; therefore, groundwater may not be encountered. However, available well records indicated groundwater being as shallow as about 10 feet bgs in the area. As such, groundwater could be a constraint to the project, if it rose to these historic levels.
- No known or reported geologic hazards are present underlying, or adjacent to, the site.
- Corrosivity test results indicate that some of the subgrade soils at the site may be corrosive to ferrous metals and the sulfate content of the soils present a negligible sulfate exposure to concrete.

## **9. RECOMMENDATIONS**

The following sections present our geotechnical recommendations for the proposed construction. If the proposed construction is changed from that discussed in this report, Ninyo & Moore should be contacted for additional recommendations.

### **9.1. Earthwork**

The following sections provide our earthwork recommendations. The earthwork specifications contained in Maricopa Association of Governments (MAG), Uniform Standard Specifications and Details for Public Works Construction, as amended by the City of Tempe, are expected to apply except as noted.

#### **9.1.1. Site Preparation**

Construction areas should be cleared of deleterious materials, including grass and weeds (if present), asphalt pavement, construction debris, and any other material that might interfere with the performance or progress of the work. These materials, if found anywhere within the footprint of the planned improvements, should be disposed of at a legal dumpsite.

It may be desirable to document utilities and underground structures, such as the existing utility tunnel or other features that are near the planned construction, and to survey or document (e.g., photographs, video, official documentation, etc.) their pre-construction condition. The findings of the survey could be used to document any damage that might result from this project. It may also be necessary to abandon or relocate some of the existing utilities at the site.

#### **9.1.2. Excavation**

Our evaluation of the excavation characteristics of the on-site materials is based on the results of one exploratory boring, our site observations, and our experience on similar projects. In our opinion, excavation of many of the shallow on-site materials (up to

about 8 feet) encountered near the proposed stairway can be accomplished to the anticipated depths with earthmoving or excavating equipment in good operating condition. Auger refusal on SGC material with probable boulders was encountered in our hollow-stem auger boring that was advanced at a depth of about 9 feet below the ground surface. These materials will call for the use of heavy duty equipment. Difficult excavation conditions should be anticipated.

#### **9.1.3. Temporary Slope Stability**

The sides of the excavation for the planned stairwell should be stabilized in order to minimize damage to adjacent structures resulting from vertical or lateral movement of the soil. The sides of the trenches may be stabilized by sloping back the sides and/or by using bracing. Due to the limited space at the site (because of the proximity of roadways that bound the site to the north and south, and the existing structure to the east), sloping back the sides of the excavation may not be appropriate. In addition, the excavation sidewalls may be difficult to stabilize because of the loose, low cohesion, granular soils existing onsite. These soils could have a potential to cave and slough during excavation, especially if the soils are wet or saturated or are disturbed. Additionally, vibrations caused by nearby traffic or construction equipment could accelerate sloughing. Based on the preliminary project plans received from your office, the base of the stairwell will be approximately 18 feet deep.

If laying back the side slopes is feasible, the excavation for this project should be designed in accordance with current applicable, state, and federal trenching regulations, including the Occupational Safety and Health Administration (OSHA) requirements for excavations presented in 29 CFR Part 1926, Subpart P, *Excavations*. For planning purposes and according to OSHA soil classifications, a "Type C" soil should be considered for this project due to the predominantly cohesionless (e.g., sandy and gravelly) nature of the site soils along the proposed water main alignment. In general,

temporary slopes above the water table and excavations in competent "Type C" alluvium should be inclined no steeper than 1.5:1 (Horizontal:Vertical).

Groundwater was encountered at about 24 feet bgs during our drilling operations. However, available well data from ADWR indicates groundwater being recorded as shallow as 10 feet bgs in the area. Temporary excavations that encounter groundwater seepage, if any, or surface runoff, may need shoring or may be stabilized by placing sandbags or gravel along the base of the seepage zone. Excavations encountering groundwater seepage should be evaluated on a case-by-case basis. Flatter slopes or bracing should be used if excessive sloughing or raveling is observed. If material is stored or equipment is operated near an excavation, stronger shoring should be used to resist the extra pressure due to superimposed loads.

Details for open-cut slopes and shoring based on soil type and groundwater conditions are provided in the latest amended OSHA regulations. These details apply to temporary open-trench excavations up to 20 feet deep. Excavations over 20 feet deep or in areas where seepage is encountered should be designed by the contractor's engineer based on site-specific geotechnical analyses. Upon excavation, soil and/or rock classifications and excavation performance should be evaluated in the field by the geotechnical consultant in accordance with the OSHA regulations.

#### **9.1.4. Shoring**

Given the observed soil conditions, the proposed depths of the planned stairwell, and presence of existing utilities and structures (e.g., the existing building, below-grade tunnel, utilities, and adjacent roadways), it may be preferable to shore or brace the excavation than to utilize open cuts. Temporary earth retaining systems will be subject to lateral loads resulting from earth pressures. For preliminary purposes, shored or braced excavations in the on-site soils may be planned using the parameters on Figure 3. The design of the shoring system will be the responsibility of others.

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

#### **9.1.5. Bottom Stability**

The proposed excavations are not anticipated to encounter significant groundwater (with the possible exception of surface run-off or perched zones) or soft materials at their base. However, if groundwater is higher than the depth it was encountered in our boring (about 24 feet), bottom stability problems may exist during construction at this site.

#### **9.1.6. Construction Dewatering**

Based on the depth of the planned stairwell and the information from our boring, no significant seepage from the groundwater table is anticipated on site during construction. However, should the groundwater level be higher than that encountered in our boring, dewatering measures may need to be implemented during construction. In addition, surface run-off will vary seasonally depending on rainfall.

Heavily saturated units or perched groundwater zones, if encountered, may call for consultation with a qualified dewatering expert. Discharge of water from the excavations to natural drainage channels, if needed, may entail securing a special permit.

### **9.2. Engineered Fill/Backfill Material**

On-site and imported soils that exhibit relatively low plasticity indices and very low to low expansive potential are generally suitable for re-use as backfill. Relatively low plasticity indices are defined as a Plasticity Index ([PI] by the American Society for Testing and Materials [ASTM] D 4318) value of 20 or less. Very low to low expansive potential soils are defined as having an EI (by ASTM D 4829) of 50 or less. The Atterberg limits test performed for this project indicated that the soil sample tested was non-plastic, demonstrating low plasticity. It is our opinion that many of the onsite soils will be suitable for re-use as engineered fill. We recommend that additional observation, soil sampling, and/or laboratory testing be conducted during construction to check that unsuitable onsite soils, not encountered in our boring, are not used as engineered fill.

In addition, suitable fill should not include organic material, clay lumps, construction debris, rock particles, and other non-soil fill materials larger than 4 inches in dimension. These materials should be disposed of offsite or in non-structural areas. If on-site material is deemed suitable for re-use, we estimate an earthwork (shrinkage) factor of 10 to 20 percent for these soils.

Imported fill, if utilized, should consist of granular material with a very low to low expansion potential. Import material in contact with ferrous metals should also have low corrosion potential (minimum resistivity more than 2,000 ohm-cm, chloride content less than 25 parts per million [ppm]). Import material in contact with concrete should have a soluble sulfate content of less than 0.1 percent. Ninyo & Moore should evaluate such materials and details of their placement prior to importation.

### **9.3. Excavation Backfill**

The backfill material should be compacted to a relative compaction of 95 percent at a moisture content generally above its optimum moisture as evaluated by ASTM D 698. Lift thickness for backfill will be dependent upon the type of compaction equipment utilized, but should generally be placed in lifts not exceeding 8 inches in loose thickness. Special care

should be exercised to avoid damaging the stairwell or other structures during the compaction of the backfill.

As discussed in Section 9.2, high plasticity soils should not be used as backfill material. In the upper 2-foot zone, located below existing pavement sections, the material should be mechanically compacted to a relative compaction of 98 percent at a moisture content generally near its optimum moisture as evaluated by ASTM D 698.

Backfilling should generally be accomplished in a manner consistent with the standards provided by MAG (2011). The content of gravel in this backfill zone that is more than 1-1/2 inches in diameter should not exceed 40 percent of the backfill volume. Generated excavation materials that contain this oversize fraction shall not be used as backfill unless otherwise the material meets the criteria given above and/or the oversize fraction has been processed and removed from the material. Imported backfill material, if utilized, should meet the criteria for imported fill as presented in Section 9.2 of this report.

#### **9.4. Seismic Design Considerations**

Based on a Probabilistic Seismic Hazard Assessment for the conterminous United States, issued by the USGS (2002 data), the site is located in a zone where the peak ground accelerations having 10, 5, and 2 percent probability of being exceeded in 50 years are 0.04g, 0.05g, and 0.08g, respectively. These ground motion values are calculated for "firm rock" sites, which correspond to a shear-wave velocity of approximately 2,500 feet per second in approximately the top 100 feet bgs. Different soil or rock types may amplify or de-amplify these values. The proposed improvements should be designed in accordance with the requirements of governing jurisdictions and applicable building codes. Table 1 presents the seismic design parameters for the site in accordance with International Building Code (IBC, 2009) guidelines and mapped spectral acceleration parameters (USGS, 2011).

**Table 1 – 2009 International Building Code Seismic Design Criteria**

Seismic Design Factors	Value
Site Class	C
Site Coefficient, $F_a$	1.2
Site Coefficient, $F_v$	1.7
Mapped Spectral Acceleration at 0.2-second Period, $S_s$	0.186 g
Mapped Spectral Acceleration at 1.0-second Period, $S_1$	0.062 g
Spectral Acceleration at 0.2-second Period Adjusted for Site Class, $S_{MS}$	0.224 g
Spectral Acceleration at 1.0-second Period Adjusted for Site Class, $S_{M1}$	0.106 g
Design Spectral Response Acceleration at 0.2-second Period, $S_{DS}$	0.149 g
Design Spectral Response Acceleration at 1.0-second Period, $S_{D1}$	0.071 g

### 9.5. Wall Foundations

Based on the preliminary plans prepared by Structural Concepts, Inc., the walls associated with the planned stairwell will be supported on continuous stepped footings. We recommend that the footings bear on a zone of moisture-conditioned and compacted engineered fill that extends 2 feet below the base of the footing. This new fill should be placed in horizontal lifts approximately 8 inches in loose thickness and compacted by appropriate mechanical methods to a relative compaction of 95 percent as evaluated by ASTM D 698 and at a moisture content generally above its laboratory optimum moisture.

The footings should be reinforced in accordance with the recommendations of the structural engineer. Footings may be designed using a net allowable bearing capacity of up to 3,000 psf for static conditions. Total and differential settlement of up to about 1 inch and ½-inch, respectively, may occur.

Foundations bearing on moisture-conditioned and recompacted material and subject to lateral loadings may be designed using an ultimate coefficient of friction of 0.35 (total frictional resistance is the coefficient of friction multiplied by the dead load). A passive resistance value of 250 psf of depth can be used. The lateral resistance can be taken as the sum of the frictional resistance and passive resistance, provided that the passive resistance

does not exceed two-thirds of the total allowable resistance. The passive resistance may be increased by one-third when considering loads of short duration such as wind or seismic forces. The foundations should preferably be proportioned such that the resultant force from lateral loadings falls within the kern (i.e., middle one-third).

Following the overexcavation, we recommend that the exposed surface be evaluated by Ninyo & Moore prior to placement of concrete or engineered fill. If unsuitable material is encountered, additional remediation, which could include more overexcavation, may be needed.

#### **9.6. Concrete Slabs**

The design of the concrete slabs is the responsibility of the structural engineer. We recommend that the concrete slabs be reinforced with steel as designed by a structural engineer. Placement of the reinforcement in the slab is vital for satisfactory performance.

We recommend that new grade slabs be supported on 12 inches of moisture-conditioned and compacted engineered fill. The slabs should be underlain by 4 or more inches of moist, clean sand, and/or gravel. Fill soils under slabs should be maintained in a moist condition until the overlying slab is constructed.

#### **9.7. Lateral Earth Pressures against Below-Grade Walls**

Retaining wall foundations should be founded in the manner described in Section 9.5. Retaining walls that are not restrained from movement at the top and have a level backfill behind the wall may be designed using an "active" equivalent fluid unit weight of 35 pounds per cubic foot (pcf). This value assumes compaction within about 5 feet of the wall will be accomplished with relatively light compaction equipment, and that very low to low expansive backfill will be placed behind the wall. Retaining walls should also be designed to resist a horizontal earth pressure of  $0.30q$ . The value for "q" represents the vertical surcharge

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pressure induced by adjacent light loads, uniform slab, or traffic loads plus any adjacent footing loads.

At-rest conditions exist when there is no movement, such as for a restrained wall. Retaining/below-grade walls that are restrained from movement at the top and have a level backfill behind the wall may be designed using an "at-rest" equivalent fluid unit weight of 55 pounds per cubic foot (pcf).

Passive pressures are assumed to develop when the wall moves into the soil. For passive resistance to lateral loads, we recommend that an equivalent fluid weight of 250 pcf be used up to a value of 3,000 psf. This value assumes that the ground is horizontal for a distance of 10 feet or more behind the wall or three times the height generating the passive pressure, whichever is greater. We recommend that the upper 12 inches of soil not protected by pavement or a concrete slab be neglected when calculating passive resistance. For frictional resistance to lateral loads, we recommend that a coefficient of friction of 0.35 be used between soil and concrete. If passive and frictional resistances are to be used in combination, we recommend that the friction coefficient be reduced by two-thirds. The passive resistance values may be increased by one-third when considering loads of short duration, such as wind or seismic forces.

Measures should be taken so that moisture does not build up behind below-grade retaining walls. Retaining walls should be provided with a drain behind the wall. Back drainage measures should include free draining backfill material, filter fabric to hinder particle migration, and perforated drainpipes. The drain pipe may be placed at the elevation of the bottom of the stairwell and extend horizontally below the new construction. Drainpipes should outlet away from structures, to any existing sumps (associated with the below-grade utility tunnel) and the below-grade retaining walls should be waterproofed in accordance with the recommendations of the project civil engineer or architect. In lieu of the wrapped open-graded gravel, a geocomposite drainage mat attached to the wall and discharging into the drain pipe may be considered. The earth pressure values provided above assume no

hydrostatic pressure buildup behind the walls. To reduce the potential for water- and sulfate/salt-related damage to the retaining walls, particular care should be taken in the selection of the appropriate type of waterproofing material to be utilized and in the application of this material.

### **9.8. Corrosion**

The corrosion potential of the on-site materials was analyzed to evaluate its potential effect on the underground utilities and structures. Corrosion potential was evaluated using the results of laboratory testing of a sample obtained during our subsurface evaluation that was considered representative of soils at the subject site.

Laboratory testing consisted of pH, minimum electrical resistivity, and chloride and soluble sulfate contents. The pH and minimum electrical resistivity tests were performed in general accordance with Arizona Test 236b, while sulfate and chloride tests were performed in accordance with Arizona Tests 733 and 736, respectively. The results of the corrosivity tests are presented in Appendix B.

The soil pH value of the sample tested from our boring was 7.8, which is considered to represent an alkaline environment. The electrical resistivity value measured in the laboratory was 1,163 ohm-cm. The chloride content value was 38 ppm. The results of the sample tested from our boring indicated a corrosive environment to ferrous metals. The soluble sulfate content of the soil samples were measured to be 0.007 percent, which represents a negligible sulfate exposure for concrete. The results of the laboratory testing indicate that the on-site soils could be corrosive to ferrous metals. A corrosion specialist should be consulted for further recommendations.

**9.9. Concrete**

As previously mentioned, the site soils generally present a negligible exposure to soluble sulfates. Table 2 presents the American Concrete Institute (ACI) guidelines for concrete exposed to sulfate-containing soils.

**Table 2 – ACI Requirements for Concrete Exposed to Sulfate-Containing Soil**

Sulfate Exposure	Water-Soluble Sulfate (SO <sub>4</sub> ) in Soil, Percentage by Weight	Sulfate (SO <sub>4</sub> ) In Water (ppm)	Cement Type	Maximum Water-Cementitious Materials Ratio, by Weight, Normal-Weight Aggregate Concrete <sup>1</sup>	Minimum $f'_c$ , Normal-Weight and Lightweight Aggregate Concrete, psi
					x 0.00689 for MPa
Negligible	0.00 - 0.10	0 - 150	--	--	--
Moderate <sup>2</sup>	0.10 - 0.20	150 - 1,500	II, IP(MS), IS(MS), P(MS), I(PM)(MS), I(SM)(MS)	0.50	4,000
Severe	0.20 - 2.00	1,500 - 10,000	V	0.45	4,500
Very severe	Over 2.00	Over 10,000	V plus pozzolan <sup>3</sup>	0.45	4,500
Notes:					
<sup>1</sup> A lower water-cementitious materials ratio or higher strength may be required for low permeability or for protection against corrosion of embedded items or freezing and thawing (Table 19-A-2).					
<sup>2</sup> Seawater.					
<sup>3</sup> Pozzolan that has been determined by test or service record to improve sulfate resistance when used in concrete containing Type V cement.					

Notwithstanding the sulfate test results, and due to the limited number of chemical tests performed, as well as our experience with similar soil conditions and local practice, we recommend that "Type II" cement be used for the construction of concrete structures at this site. Due to potential uncertainties as to the use of reclaimed irrigation water, or topsoil that may contain higher sulfate contents, pozzolan or admixtures designed to increase sulfate resistance may be considered.

The concrete should have a water-cementitious materials ratio no more than 0.45 by weight for normal weight aggregate concrete. The structural engineer should ultimately select the concrete design strength based on the project specific loading conditions. However, higher strength concrete may be selected for increased durability and resistance to shrinkage cracking.

#### **9.10. Site Drainage**

Surface drainage should be provided to divert water away from the new stairway excavation and the at-grade structure. Positive drainage is defined as a slope of 2 percent or more over a distance of 5 feet or more away from the excavation and/or structure.

#### **9.11. Pre-Construction Conference**

We recommend that a pre-construction conference be held. Representatives of the owner, the civil engineer, Ninyo & Moore, and the contractor should be in attendance to discuss the project plans and schedule. Our office should be notified if the project description included herein is incorrect, or if the project characteristics are significantly changed.

#### **9.12. Construction Observation and Testing**

During construction operations, we recommend that Ninyo & Moore perform observation and testing services for the project. These services should be performed to evaluate exposed subgrade conditions, including the extent and depth of overexcavation, to evaluate the suitability of proposed borrow materials for use as fill, and to observe and test placement of compacted fill soils. If another geotechnical consultant is selected to perform observation and testing services for the project, we request that the selected consultant provide a letter to the owner, with a copy to Ninyo & Moore, indicating that they fully understand our recommendations and that they are in full agreement with the recommendations contained in this report. Qualified subcontractors utilizing appropriate techniques and construction materials should perform construction of the proposed improvements.

## 10. LIMITATIONS

The field evaluation, laboratory testing, and geotechnical analyses presented in this geotechnical report have been conducted in general accordance with current practice and the standard of care exercised by geotechnical consultants performing similar tasks in the project area. No warranty, expressed or implied, is made regarding the conclusions, recommendations, and opinions presented in this report. There is no evaluation detailed enough to reveal every subsurface condition. Variations may exist and conditions not observed or described in this report may be encountered during construction. Uncertainties relative to subsurface conditions can be reduced through additional subsurface exploration. Additional subsurface evaluation will be performed upon request. Please also note that our evaluation was limited to assessment of the geotechnical aspects of the project, and did not include evaluation of structural issues, environmental concerns, or the presence of hazardous materials.

This document is intended to be used only in its entirety. No portion of the document, by itself, is designed to completely represent any aspect of the project described herein. Ninyo & Moore should be contacted if the reader requires additional information or has questions regarding the content, interpretations presented, or completeness of this document.

This report is intended for design purposes only. It does not provide sufficient data to prepare an accurate bid by contractors. It is suggested that the bidders and their geotechnical consultant perform an independent evaluation of the subsurface conditions in the project areas. The independent evaluations may include, but not be limited to, review of other geotechnical reports prepared for the adjacent areas, site reconnaissance, and additional exploration and laboratory testing.

Our conclusions, recommendations, and opinions are based on an analysis of the observed site conditions. If geotechnical conditions different from those described in this report are encountered, our office should be notified and additional recommendations, if warranted, will be provided upon request. It should be understood that the conditions of a site could change with time as a result of natural processes or the activities of man at the subject site or nearby sites. In

addition, changes to the applicable laws, regulations, codes, and standards of practice may occur due to government action or the broadening of knowledge. The findings of this report may, therefore, be invalidated over time, in part or in whole, by changes over which Ninyo & Moore has no control.

This report is intended exclusively for use by the client. Any use or reuse of the findings, conclusions, and/or recommendations of this report by parties other than the client is undertaken at said parties' sole risk.

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## 11. REFERENCES

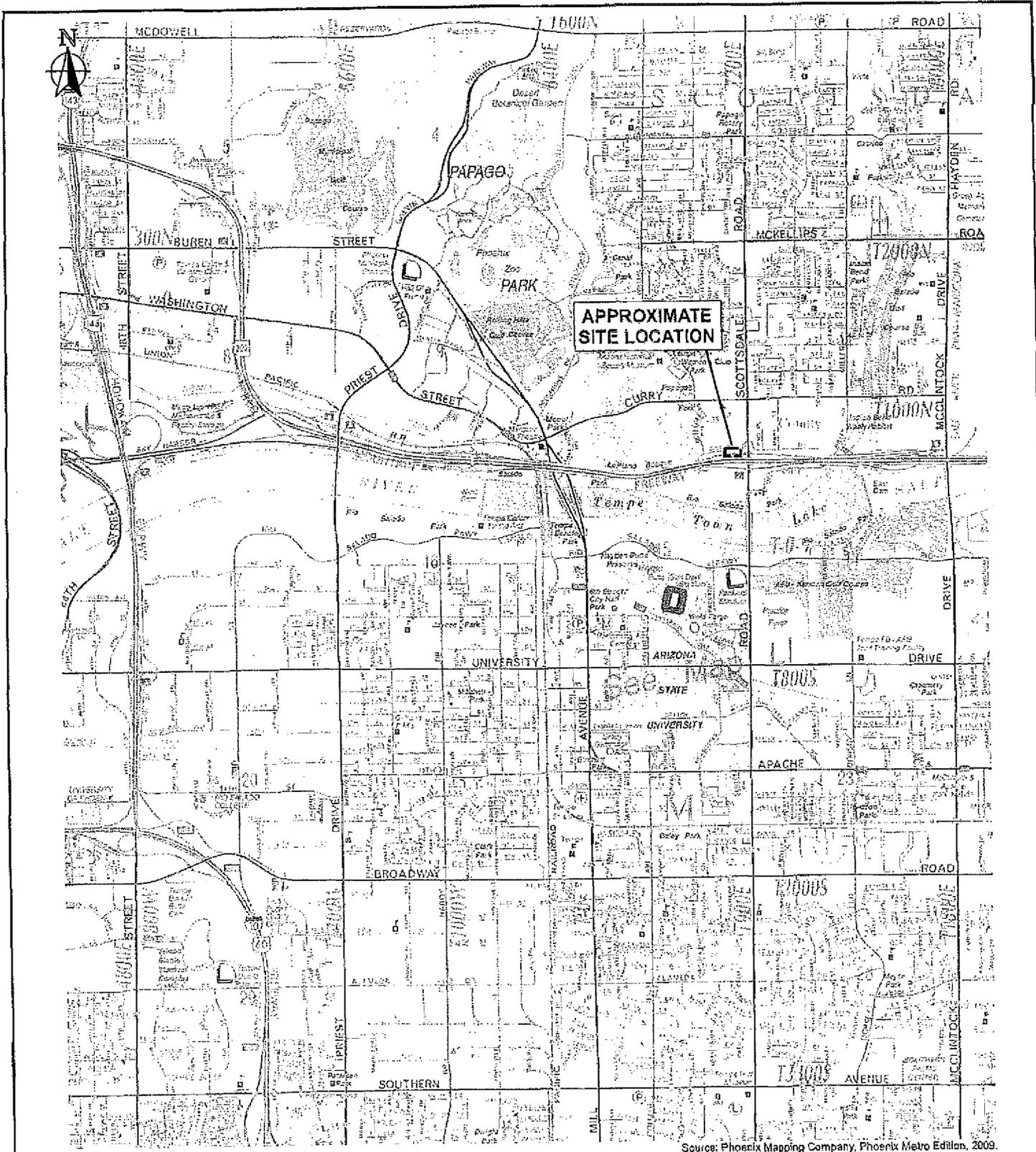
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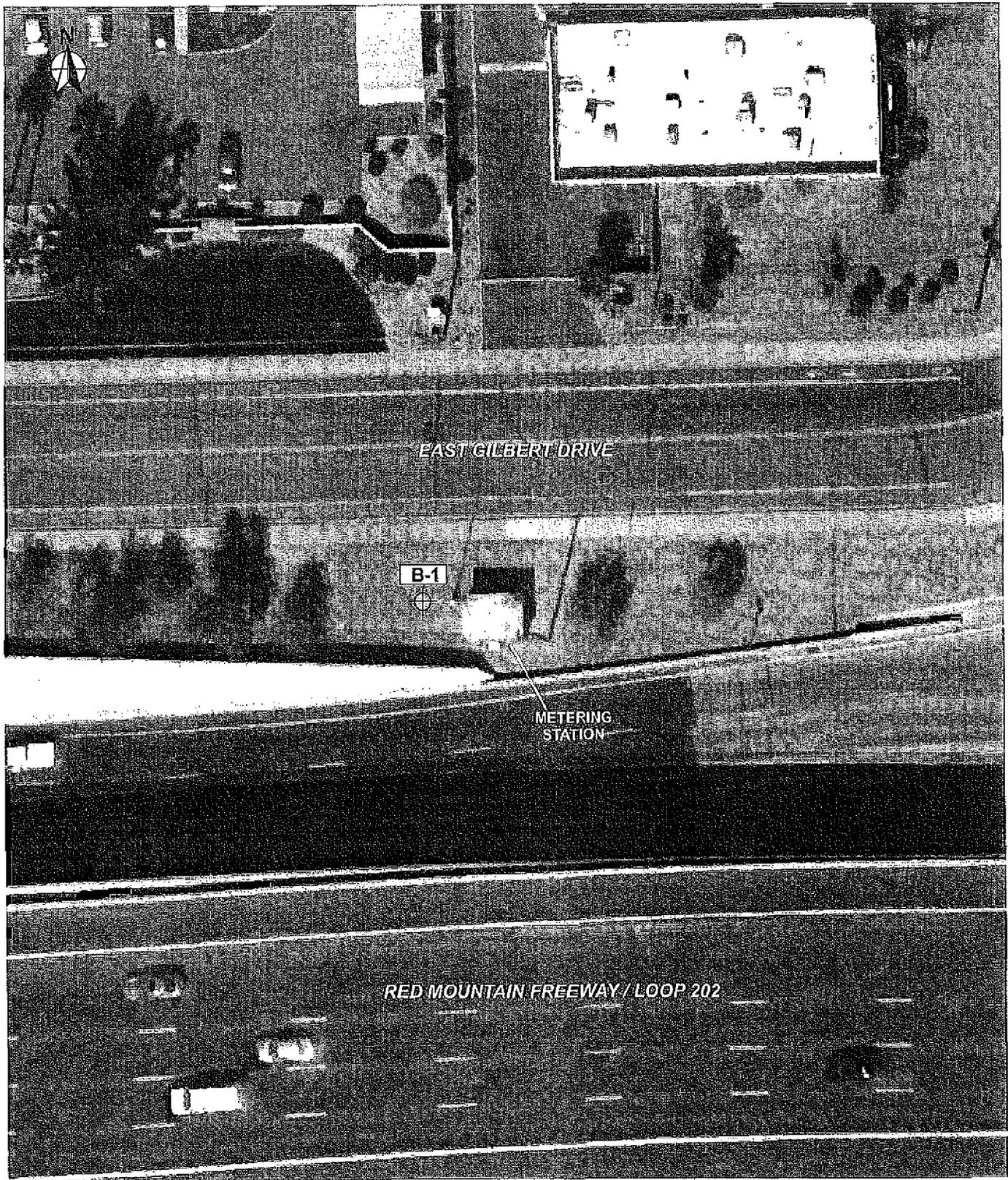
<b>AERIAL PHOTOGRAPHS</b>		
<b>Source</b>	<b>Photo Date</b>	<b>Flight Line</b>
Flood Control District of Maricopa County's website	1930, 1949, 1959, 1962, 1969, 1979, 1993, 1997, 2010	N/A



Source: Phoenix Mapping Company, Phoenix Metro Edition, 2009.

0 3300  
 Approximate Scale:  
 1 inch = 3300 feet

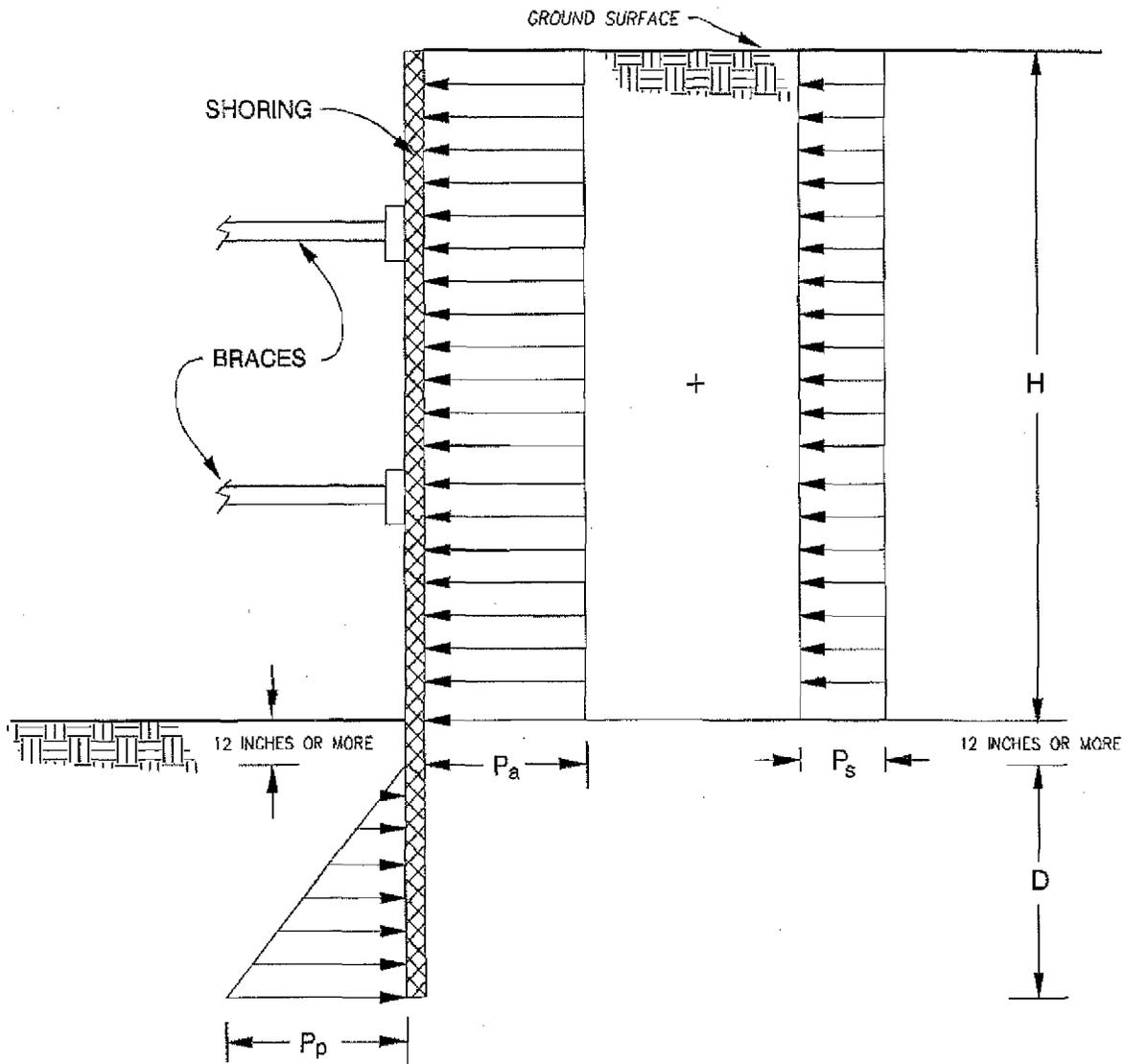
		SITE LOCATION		FIGURE
		GILBERT METERING STATION IMPROVEMENTS 639 EAST GILBERT DRIVE TEMPE, ARIZONA		1
PROJECT NO: 602128029	DATE: 10/11			



Source: NAVTEQ, 03/03/2011.

0 200  
 Approximate Scale:  
 1 inch = 200 feet

<b>Ninyo &amp; Moore</b>		BORING LOCATION	FIGURE
PROJECT NO: 602128029	DATE: 10/11	GILBERT METERING STATION IMPROVEMENTS 639 EAST GILBERT DRIVE TEMPE, ARIZONA	<b>2</b>



NOTES:

1. APPARENT LATERAL EARTH PRESSURE,  $P_a$   
 $P_a = 22H$  psf
2. CONSTRUCTION TRAFFIC INDUCED SURCHARGE PRESSURE,  $P_s$   
 $P_s = 120$  psf
3. PASSIVE LATERAL EARTH PRESSURE,  $P_p$   
 $P_p = 300 D$  psf
4. ASSUMES GROUNDWATER IS NOT PRESENT
5. SURCHARGES FROM EXCAVATED SOIL OR CONSTRUCTION MATERIALS ARE NOT INCLUDED
6. H AND D ARE IN FEET

**Ninyo & Moore**

LATERAL EARTH PRESSURE FOR  
BRACED EXCAVATION

FIGURE

**3**

PROJECT NO:  
602128029

DATE:  
10/11

GILBERT METERING STATION IMPROVEMENTS  
639 EAST GILBERT DRIVE  
TEMPE, ARIZONA

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## APPENDIX A

### BORING LOGS

#### Field Procedure for the Collection of Disturbed Samples

Disturbed soil samples were obtained in the field using the following methods.

##### Bulk Samples

Bulk samples of representative earth materials were obtained from the exploratory borings. The samples were bagged and transported to the laboratory for testing.

##### The Standard Penetration Test (SPT) Spoon

Disturbed drive samples of earth materials were obtained by means of a Standard Penetration Test spoon sampler. The sampler is composed of a split barrel with an external diameter of 2 inches and an unlined internal diameter of 1-3/8 inches. The spoon was driven into the ground 12 to 18 inches with a 140-pound hammer free-falling from a height of 30 inches in general accordance with ASTM D 1586. The blow counts were recorded for every 6 inches of penetration; the blow counts reported on the logs are those for the last 12 inches of penetration. Soil samples were observed and removed from the spoon, bagged, sealed and transported to the laboratory for testing.

#### Field Procedure for the Collection of Relatively Undisturbed Samples

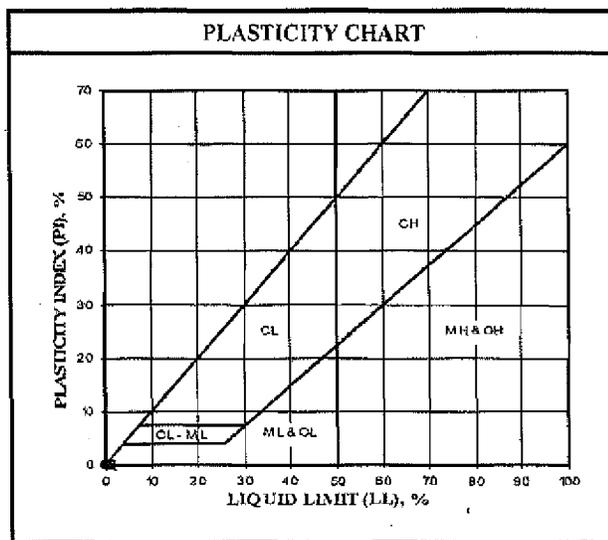
Relatively undisturbed soil samples were obtained in the field using the following methods.

##### The Modified Split-Barrel Drive Sampler

The sampler, with an external diameter of 3.0 inches, was lined with 1-inch long, thin brass rings with inside diameters of approximately 2.4 inches. The sample barrel was driven into the ground with the weight of a hammer or the kelly bar of the drill rig in general accordance with ASTM D 3550. The driving weight was permitted to fall freely. The approximate length of the fall, the weight of the hammer or bar, and the number of blows per foot of driving are presented on the boring logs as an index to the relative resistance of the materials sampled. The samples were removed from the sample barrel in the brass rings, sealed, and transported to the laboratory for testing.

U.S.C.S. METHOD OF SOIL CLASSIFICATION		
MAJOR DIVISIONS	SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS (More than 1/2 of soil > No. 200 sieve size)	GRAVELS (More than 1/2 of coarse fraction > No. 4 sieve size)	GW Well graded gravels or gravel-sand mixtures, little or no fines
		GP Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM Silty gravels, gravel-sand-silt mixtures
		GC Clayey gravels, gravel-sand-clay mixtures
	SANDS (More than 1/2 of coarse fraction < No. 4 sieve size)	SW Well graded sands or gravelly sands, little or no fines
		SP Poorly graded sands or gravelly sands, little or no fines
		SM Silty sands, sand-silt mixtures
		SC Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (More than 1/2 of soil < No. 200 sieve size)	SILTS & CLAYS Liquid Limit < 50	ML Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with
		CL Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean
		OL Organic silts and organic silty clays of low plasticity
	SILTS & CLAYS Liquid Limit > 50	MH Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH Inorganic clays of high plasticity, fat clays
		OH Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS	Pt Peat and other highly organic soils	

GRAIN SIZE CHART		
CLASSIFICATION	RANGE OF GRAIN SIZE	
	U.S. Standard Sieve Size	Grain Size in Millimeters
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76.2
GRAVEL Coarse Fine	3" to No. 4	76.2 to 4.76
	3" to 3/4"	76.2 to 19.1
	3/4" to No. 4	19.1 to 4.76
SAND Coarse Medium Fine	No. 4 to No. 200	4.76 to 0.075
	No. 4 to No. 10	4.76 to 2.00
	No. 10 to No. 40	2.00 to 0.420
	No. 40 to No. 200	0.420 to 0.075
SILT & CLAY	Below No. 200	Below 0.075



# BORING LOG EXPLANATION SHEET

DEPTH (feet)	BULK SAMPLES Driver	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	
0	■						Bulk sample.
	■						Modified split-barrel drive sampler.
	■						No recovery with modified split-barrel drive sampler.
	■						Sample retained by others.
	■						Standard Penetration Test (SPT).
5	■						No recovery with a SPT.
	■	XX/XX					Shelby tube sample. Distance pushed in inches/length of sample recovered in inches.
	■						No recovery with Shelby tube sampler.
	■						Continuous Push Sample.
	■		○				Seepage.
10	■						Groundwater encountered during drilling. Groundwater measured after drilling.
	■				■	SM	ALLUVIUM: Solid line denotes unit change.
	■				---		Dashed line denotes material change.
15	■						Attitudes: Strike/Dip b: Bedding c: Contact j: Joint f: Fracture F: Fault cs: Clay Seam s: Shear bss: Basal Slide Surface sf: Shear Fracture sz: Shear Zone sbs: Sheared Bedding Surface
20	■						The total depth line is a solid line that is drawn at the bottom of the boring.



## BORING LOG

### EXPLANATION OF BORING LOG SYMBOLS

PROJECT NO.

DATE  
Rev. 01/03

FIGURE

DEPTH (feet)	SAMPLES Bulk Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED	BORING NO.
							DESCRIPTION/INTERPRETATION	
							8/31/11 & 9/28/11	B-1
							1,160' ± MSL	SHEET 1 OF 3
							METHOD OF DRILLING <u>Dietrich D-120, 8" Diameter Hollow-Stem Auger (D&amp;S Drilling)</u>	
							140lbs. (Automatic)	DROP 30"
							DM	DM
							HAH	
0						SM	ASPHALT CONCRETE: Approximately 2.5 inches thick.	
							FILL: Brown, damp, medium dense, silty fine to coarse SAND; trace fine gravel.	
12								
29			4.4	116.8			Coarse gravel.	
5								
29						SM	ALLUVIUM: Brown, damp, dense, silty fine to coarse SAND; few fine to coarse gravel.	
						GP	Brown, damp, very dense, GRAVEL; cobbles.	
		50/2"					Refusal on gravel and cobbles with hollow-stem augers. Backfilled and patched on 8/31/11 promptly after completion of drilling. Drilling continued on 9/28/11 using percussion drilling equipment.	
10						SP	Brown, damp, medium dense, poorly graded SAND with gravel.	
						GP	Brown, damp, dense, GRAVEL with sand; possible cobbles and boulders.	
15								
		50/2"					Very dense.	
20								

**Ninyo & Moore**

**BORING LOG**

Gilbert Metering Station Improvements  
639 East Gilbert Drive, Tempe, Arizona

PROJECT NO.  
602128029

DATE  
10/11

FIGURE  
A-1

DEPTH (feet)	SAMPLES Bulk Driven	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED	BORING NO.	
							8/31/11 & 9/28/11	B-1	
							GROUND ELEVATION	SHEET	OF
							1,160' ± MSL	2	3
							METHOD OF DRILLING <u>Diedrich D-120, 8" Diameter Hollow-Stem Auger (D&amp;S Drilling)</u>		
							DRIVE WEIGHT	DROP	
							140lbs. (Automatic)	30"	
							SAMPLED BY	LOGGED BY	REVIEWED BY
							DM	DM	HAH
							DESCRIPTION/INTERPRETATION		
20						GP	ALLUVIUM: (Continued) Brown, damp, very dense, GRAVEL with sand; possible cobbles and boulders.		
		50/4"	⦿			SP	Brown, saturated, very dense, poorly-graded SAND with gravel. Groundwater encountered during drilling.		
25									
		50/3"				GP	Brown, saturated, very dense, GRAVEL with sand; possible cobbles and boulders.		
30									
		50/2"							
35									
							Thin lense of clayey fine sand at 38 feet.		
						GC	Brown, saturated, very dense, clayey GRAVEL with sand.		
40		37							

**Ninyo & Moore**

**BORING LOG**

Gilbert Metering Station Improvements  
639 East Gilbert Drive, Tempe, Arizona

PROJECT NO.  
602128029

DATE  
10/11

FIGURE  
A-2

DEPTH (feet)	BULK DRIVEN	SAMPLES	BLOWS/FOOT	MOISTURE (%)	DRY DENSITY (PCF)	SYMBOL	CLASSIFICATION U.S.C.S.	DATE DRILLED	BORING NO.	
								8/31/11 & 9/28/11	B-1	
								GROUND ELEVATION	SHEET	OF
								1,160' ± MSL	3	3
								METHOD OF DRILLING		
								Diedrich D-120, 8" Diameter Hollow-Stem Auger (D&S Drilling)		
								DRIVE WEIGHT	DROP	
								140lbs. (Automatic)	30"	
								SAMPLED BY	LOGGED BY	REVIEWED BY
								DM	DM	RAH
								DESCRIPTION/INTERPRETATION		
40								Total Depth = 40 feet. Groundwater was measured during drilling at a depth of approximately 24 feet in borehole. Backfilled and patched on 9/28/11 promptly after completion of drilling. <u>Note:</u> Groundwater may rise to a higher level than that measured in borehole due to seasonal variations in precipitation and several other factors as discussed in the report.		
45										
50										
55										
60										



**BORING LOG**

Gilbert Metering Station Improvements  
639 East Gilbert Drive, Tempe, Arizona

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10/11

FIGURE

A-3

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## APPENDIX B

### LABORATORY TESTING

#### Classification

Soils were visually and texturally classified in accordance with the Unified Soil Classification System (USCS) in general accordance with ASTM D 2488. Soil classifications are indicated on the logs of the exploratory borings in Appendix A.

#### In-Place Moisture and Density Tests

The moisture content and dry density of relatively undisturbed samples obtained from the exploratory excavations were evaluated in general accordance with ASTM D 2937. The test results are presented on the logs of the exploratory excavations in Appendix A.

#### Gradation Analysis

A Gradation analysis test was performed on a selected representative soil sample in general accordance with ASTM D 422. The grain-size distribution curve is shown on Figure B-1. These test results were utilized in evaluating the soil classifications in accordance with the Unified Soil Classification System.

#### Atterberg Limits

Tests were performed on a selected representative fine-grained soil sample to evaluate the liquid limit, plastic limit, and plasticity index in general accordance with ASTM D 4318. These test results were utilized to evaluate the soil classification in accordance with the Unified Soil Classification System. The test results and classification are shown on Figure B-2.

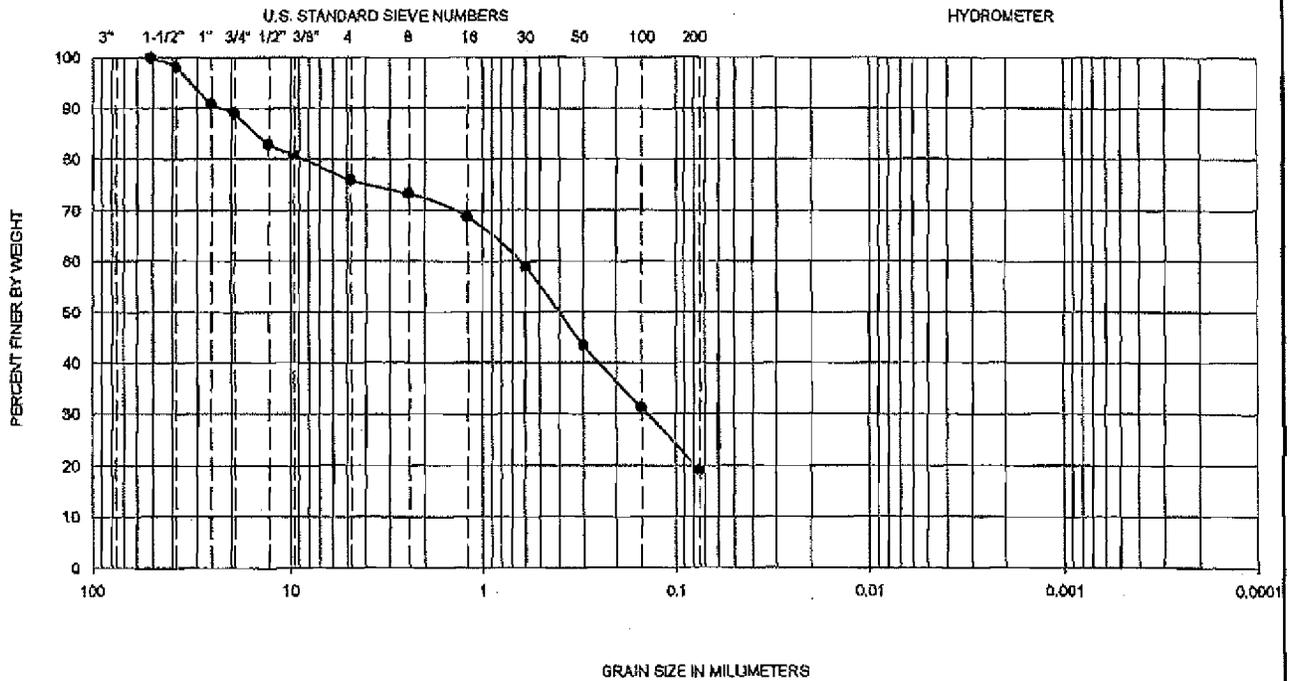
#### Consolidation Tests

One consolidation tests was performed on a selected relatively undisturbed soil samples in general accordance with ASTM D 2435. The sample was inundated during testing to represent adverse field conditions. The percent of consolidation for each load cycle was recorded as a ratio of the amount of vertical compression to the original height of the sample. The results of the test are summarized on Figure B-3.

#### Soil Corrosivity Tests

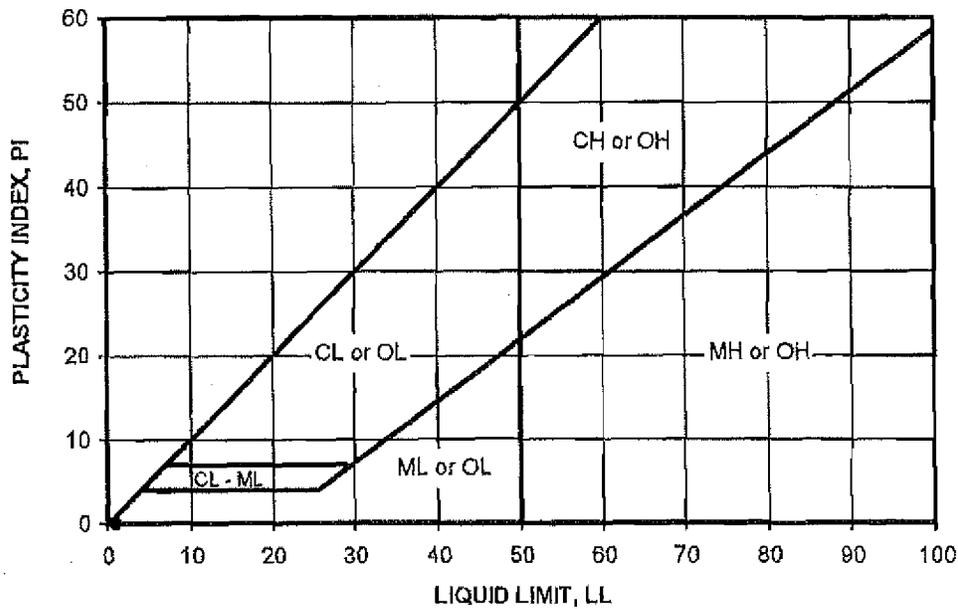
Soil pH and minimum resistivity tests were performed on representative samples in general accordance with Arizona Test 236b. Soluble sulfate and chloride content tests were also performed on these samples in general accordance with Arizona Test 733 and 736, respectively. The test results are presented on Figure B-4.

GRAVEL		SAND			FINES	
Coarse	Fine	Coarse	Medium	Fine	Silt	Clay



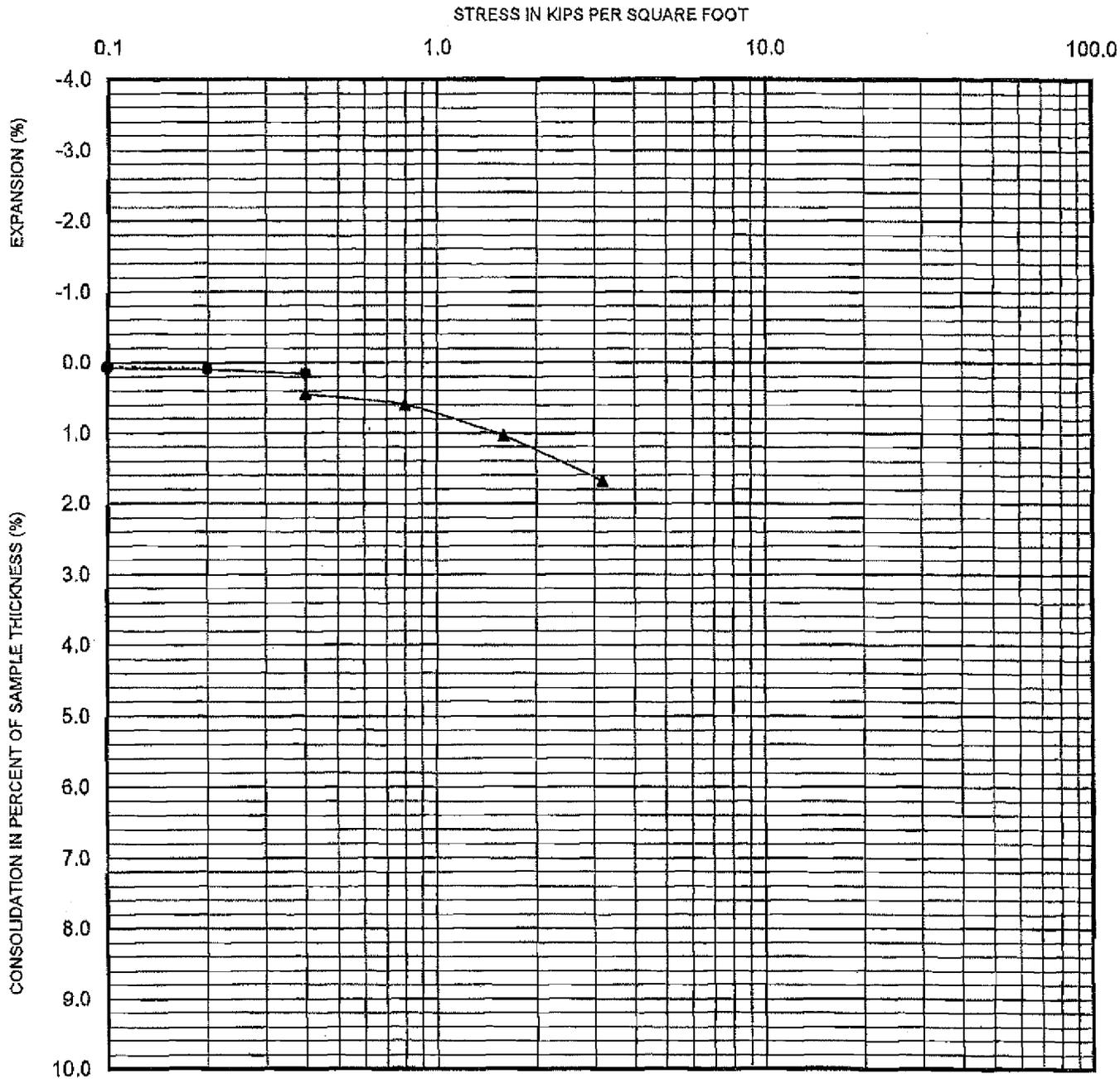
SYMBOL	LOCATION	DEPTH (FT)	LIQUID LIMIT, LL	PLASTIC LIMIT, PL	PLASTICITY INDEX, PI	USCS CLASSIFICATION (Fraction Finer Than No. 40 Sieve)	USCS (Entire Sample)
•	B-1	0-5	—	—	NP	ML	SM

NP - INDICATES NON-PLASTIC



PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 4318

<b>Ninyo &amp; Moore</b>		<b>ATTERBERG LIMITS TEST RESULTS</b>	<b>FIGURE</b>  <b>B-2</b>
PROJECT NO.	DATE	GILBERT METERING STATION IMPROVEMENTS 839 EAST GILBERT DRIVE TEMPE, ARIZONA	
602128029	10/11		



- - - ● - - - Seating Cycle                      Sample Location    B-1  
 — ● — Loading Prior to Inundation        Depth (ft.)        0-5  
 — ▲ — Loading After Inundation            Soil Type            SM  
 - - - ▲ - - - Rebound Cycle

PERFORMED IN GENERAL ACCORDANCE WITH ASTM D 2435

<b>Ninyo &amp; Moore</b>		<b>CONSOLIDATION TEST RESULTS</b>	FIGURE
PROJECT NO.	DATE		GILBERT METERING STATION IMPROVEMENTS 639 EAST GILBERT DRIVE TEMPE, ARIZONA
602128029	10/11		

SAMPLE LOCATION	SAMPLE DEPTH (FT)	pH <sup>1</sup>	RESISTIVITY <sup>1</sup> (Ohm-cm)	SULFATE CONTENT <sup>2</sup>		CHLORIDE CONTENT <sup>3</sup> (ppm)
				(ppm)	(%)	
B-1	0.5	7.8	1,163	67	0.007	38

<sup>1</sup> PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 236b

<sup>2</sup> PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 733

<sup>3</sup> PERFORMED IN GENERAL ACCORDANCE WITH ARIZONA TEST METHOD 736

<b>Ninyo &amp; Moore</b>		<b>CORROSIVITY TEST RESULTS</b>	FIGURE  <b>B-4</b>
PROJECT NO.	DATE	GILBERT METERING STATION IMPROVEMENTS	
602128029	10/11	639 EAST GILBERT DRIVE TEMPE, ARIZONA	