City of Phoenix
Office of the City Engineer
Design and Construction Procurement

LIFT STATION 76 PHASE II EXPANSION
WS90400067

ADDENDUM NO. 3

ISSUE DATE: APRIL 25, 2024

Bidders are hereby notified that the Bidding and Contract Documents for the above project, for which Bids are to be received on May 7th, 2024, are amended as follows:

IMPORTANT INFORMATION:

- Bids due May 7th, 2024, at 2:00 PM (Phoenix time)
- Confirm bid items due at time of bid submittal
- Confirm post-bid items due 3 days after bid opening by 5 PM
- Submittal MUST be delivered to Phoenix City Hall, 1st floor.

NOTE: Bidders must acknowledge receipt of this and all Addendums by listing the number and date, where provided, on the PROPOSAL P-1.

Per Phoenix City Code G-7241, effective April 25, 2024, any Contractor whose employees and contract workers perform work in an outdoor environment under this contract must keep on file a written heat safety plan. The City may request a copy of this plan and documentation of all heat safety and mitigation efforts currently implemented to prevent heat-related illnesses and injuries in the workplace. The plan must also be posted where it is accessible to employees. At a minimum, the heat safety and mitigation plan and documentation required under this provision shall include each of the following as it relates to heat safety and mitigation:

1. Availability of sanitized cool drink water free of charge at locations that are accessible to all employees and contract workers.
2. Ability to take regular and necessary breaks as needed and additional breaks for hydration.
3. Access to shaded areas and/or air conditioning.
4. Access to air conditioning in vehicles with enclosed cabs. All such vehicles must contain functioning air conditioning by no later than May 1, 2025.

5. Effective acclimatization practices to promote the physiological adaptations of employees or contract workers newly assigned or reassigned to work in an outside environment.
6. Conduct training and make it available and understandable to all employees and contract workers on heat illness and injury that focuses on the environmental and personal risk factors, prevention, how to recognize and report signs and symptoms of heat illness and injury, how to administer appropriate first aid measures and how to report heat illness and injury to emergency medical personnel.

The Contractor further agrees that this clause will be incorporated in all subcontracts with subconsultants, sublicensees or sublessees who may perform labor or services in connection with this contract. Additionally, the Contractor agrees to require all subcontractors, sublicensees or sublessees to include this clause in all contracts with any third party who is contracted to perform labor or services in connection with this contract. It is the obligation of the Contractor to ensure compliance by its subcontractors.

GENERAL

1. **QUESTION 1: Regarding the temporary sewer bypass – what is the current flow rate of the 8" force main? ANSWER:** Specification 01143 section 1.1, paragraph K describes the bypass pumping requirements**.**

2. **QUESTION 2 (4): On C07 Sheet 11 of 41 Detail "Transmitter W/ Mounting Detail" it calls for a Weld-O-Let, as this is ductile Iron Pipe, I think a Saddle or TEE with tapped blind flange is what should be used, Please Advise? ANSWER:** Weld-O-Let is required and should be ordered when purchasing the ductile iron pipe, Manufacturer of DIP will make spool piece with Weld-O-Let in Factory.

3. **QUESTION 3 (10): Prime Contract Supplementary Conditions: SC 4.02A2.a states West Anthem LS No. 76 Project No. WS90400067 lists a set of documents by Stanley Consultants dated December 4th 2018. Can the City of Phoenix please provide the as builts of the previous and original project for LS 76 so that bidders can comply with the Supplementary Conditions. ANSWER:** See attached drawing set.

4. **QUESTION 4 (19): State Land surrounds the Lift Station, what Easements and Right of Way (ROW) do we as Contractors have to execute the work outside the LS Walls? In addition, does this include activities for Bypass Pump Operations, night time Mechanics? How about marshalling and yard storage that the Contractors, Subcontractors, and Suppliers need to marshal their stored materials, and field offices? Is the expectation from the City that we will do this all within the walls of the existing facility? To be absolutely clear, can the City provide the Limits of the Staging Areas and confines of our Activities prior to bidding this Project? ANSWER:** City property boundary shown per the Contract

Drawings that can be used as needed for the construction of the project. Areas outside property are means and methods of the contractor.

5. **QUESTION 5 (34): Please provide Report on Geotechnical Investigation, West Anthem Wastewater Improvements, Index no. WS90500278, WS9040067, WS90501005, Dated May 17th, 2017 as listed in SC-4.02.A.1.a? ANSWER:** Report attached.

6. **QUESTION 6 (35): Please provide West Anthem Wastewater Improvements Pioneer Road to Carefree Highway, Seismic Refraction Surveys, Dated October 16, 2017 as listed in SC-4.02.A.1.a. ANSWERED:** Survey will be provided please see attached.

7. **QUESTION 7 (36): Please provide West Anthem Lift Station No. 76, Project No. WS90400067, Volume 4 of 5, Stanley Consultants, Dated December 4th, 2018 as listed in SC-4.02.A.2.a? ANSWER:** Document attached.

8. **QUESTION 8 (37): Please provide Lift Station 76 Project, Limited Lead and Asbestos Survey, Dated November 17th, 2023 By RFI as listed in SC-4.08.A.1? ANSWER:** Please see attached report.

9. **QUESTION 9 (47): Sheet E05 of the bid drawings shows 2 new hand holes (note #9) with the statement that existing conduits will be utilized from the hand holes back to the electrical pad. Per site inspection there are 7 (1" empty conduits exiting the bottom of the mcc. Is there an as-built drawing available that shows the counts and locations of the spare and existing conduits on the North side of the Drive? ANSWER:** As Built Drawing Set is included in this Addendum, Please see attached.

10. **QUESTION 10 (48): Sheet E06, Note 4, states existing conduits for pumps 1 & 2 are to be utilized from the MCC to the intercept point for the new pump feeds. As the existing 35HP pumps can be fed with a 1" conduit we are looking for confirmation of the existing pump feed conduit size. NEC dictates 1.25" conduit is required for 4#1 conductors. As no pictures were allowed at the site visit, I need to verify the excising pump conduits are large enough to accommodate the new pump motors. We need to know is saw cutting the drive to install new 1.25" conduits will be required. ANSWER:** As Built Drawing Set is included in this Addendum, Please see attached.

11. **QUESTION 11 (49): Attached is a request for an alternative for the wet well pumps (Spec. Section 11212) ANSWER:** Request documentation not sufficient to determine if equal to model specified and information submitted beyond the 12 day requirement before the bid date.

PROJECT CONTRACT DOCUMENTS

1. **CONTRACT DOCUMENTS:** Section 00300 – BID FORM, under section 1 **ADD** "1.4 Whenever quantities between the Bid Tab, Specifications and Drawings conflict, Contractor shall furnish the higher quantity requirement and adjust the bid tab bid price accordingly."

2. **CONTRACT DOCUMENTS:** Section 0300 – BID FORM, page 3 (sheet 25 of 936) Bid Item 12 **DELETE** reference quantity reference "3" and **REPLACE** with "5".

3. **CONTRACT DOCUMENTS:** Section 0300 – BID FORM, page 4 (sheet 26 of 936) Bid Item 19, Description column **DELETE** "Furnish and install New Bioxide Odor Control Facilities" and **REPLACE** with "Bioxide Odor Control Facilities Support Items".

PROJECT TECHNICAL SPECIFICATIONS

1. **PROJECT TECHNICAL SPECIFICATIONS:** SPECIFICATION 01271 – MEASUREMENT AND PAYMENT, paragraph 1.4.S **DELETE** paragraph
   "S. Item 19 – Furnish and Install New Bioxide Odor Control Facilities:
      2. A per lump sum (LS) payment for Item 19 will be full compensation for installation of the bioxide odor control system facilities including but not limited to, the 4,350-gallon double wall high density cross-linked polyethylene storage tank, chemical feed pump skid, instrumentation and level sensors, chemical injection lines, and electrical supply."
   and **REPLACE** the it with;
   "S. Item 19 – Bioxide Odor Control Facilities Support Items:
      1. A per lump sum (LS) payment for Item 19 will be full compensation for installation of but not limited to, associated Bioxide facility concrete pad, chemical injection lines, and electrical supply. The City will provide the tank and pump skid".

2. **PROJECT TECHNICAL SPECIFICATIONS:** SPECIFICATION 01271 – MEASUREMENT AND PAYMENT, paragraph 1.4.EE **DELETE** paragraph

   "EE. Item 31 – Rock Removal:
      1. A per ton (TON) payment for Item 31 will be full compensation for removal and hauling of any and all boulders, cobbles, and stones encountered at the site during excavation".

   and **REPLACE** the it with;
   "EE. Item 31 – Rock Removal:

1. A per ton (TON) payment for Item 31 will be full compensation for removal and hauling of any and all boulders, cobbles, and stones encountered at the site during excavation. Rock removal or hard dig shall be defined as any excavation that would require specialized rock excavation attachments or any excavation that can't be done using a 50,000 lb excavator (i.e 320 class trackhoe excavator)."

2. **PROJECT TECHNICAL SPECIFICATIONS:** SPECIFICATION 01323 – CONSTRUCTION PHOTOGRAPHS **DELETE** paragraph 1.1.A in it's entirety and **REPLACE** with "A. Contractor shall dedicate a staff member to perform the services specified below for taking photographs"

3. **PROJECT TECHNICAL SPECIFICATIONS:** SPECIFICATION 01323 – CONSTRUCTION PHOTOGRAPHS **DELETE** paragraph "1.3 Prints" in it's entirety.

4. **PROJECT TECHNICAL SPECIFICATIONS:** SPECIFICATION 01323 – CONSTRUCTION PHOTOGRAPHS **DELETE** paragraph 1.2.E in it's entirety and **REPLACE** it with "E. Furnish a total of 30 digital photographs to the ENGINEER with each Monthly Progress Payment. Photos shall be overall pictures of the construction progress from the previous month. Digital photographs shall be provided on USB drive monthly and be in the format of ".jpg". The digital photographs shall be provided in addition to the standard photographs required under Paragraph 1.3.C above. Need to provide a file for all required under paragraph 1.2.A. Provide interior and exterior photographs of each buried structure prior to burial. Provide a minimum of four internal views and four external views of each structural. One picture view shall be provided of each wall, detail, floor and top of structure. Digital photographs file name shall include date photo was taken and description of photo."

5. **PROJECT TECHNICAL SPECIFICATIONS:** For SPECIFICATION 01332 – SHOP DRAWING PROCEDURE, section 1.2 **ADD** the following paragraph;

"X. For all shop drawings, a copy of the associated specification shall be submitted, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the

CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration."

3. **PROJECT TECHNICAL SPECIFICATIONS**: **ADD** in it's entirety "SPECIFICATION 01521 – ENGINEER'S FIELD OFFICE".

4. **PROJECT TECHNICAL SPECIFICATIONS:** SPECIFICATION 01724 – CONNECTION TO EXISTING FACILITIES, paragraph 1.4.A **DELETE** "A temporary standby generator shall be brought onsite to provide temporary standby power to the site during construction." and **REPLACE** with "A temporary standby generator shall be brought onsite to provide temporary standby power to the temporary construction facilities during construction as required."

5. **PROJECT TECHNICAL SPECIFICATIONS: ADD** in it's entirety "SPECIFICATION 05581 – FLOOR ACCESS HATCH COVERS".

6. **PROJECT TECHNICAL SPECIFICATIONS: ADD** in it's entirety "SPECIFICATION 09910 – SPECIAL FINISHES".

7. **PROJECT TECHNICAL SPECIFICATIONS: DELETE "**SPECIFICATION 11212-VERTICAL SUBMERSIBLE WELL PUMP" in it's entirety and **REPLACE** with "SPECIFICATION 11318 – END SUCTION SUBMERSIBLE PUMP".

8. **PROJECT TECHNICAL SPECIFICATIONS: DELETE "**SPECIFICATION 15114-CHECK VALVES AND APPURTENANCES" in it's entirety and **REPLACE** with "SPECIFICATION 15114 – CHECK VALVES AND APPURTENANCES" as part of this addendum.

9. **PROJECT TECHNICAL SPECIFICATIONS**: SPECIFICATION 15119 Paragraph e.3.a **DELETE** "Air/Vacuum Valves" and **REPLACE** with "Combination Air / Vacuum Valve".

10. **PROJECT TECHNICAL SPECIFICATIONS**: SPECIFICATION 15119 Paragraph e.5.a **DELETE** "Crispin- as manufactured by Multiplex Manufacturing Co, AX Series". and **REPLACE** with "ARI, Model D-26".

11. **PROJECT TECHNICAL SPECIFICATIONS**: SPECIFICATION 15119 Paragraph e.5.b **DELETE** "H-Tec, Model 986"

12. **PROJECT TECHNICAL SPECIFICATIONS**: SPECIFICATION 15119 Paragraph e.5.c **DELETE** "Or Approved Equal"

13. **PROJECT TECHNICAL SPECIFICATIONS**: **ADD** in it's entirety "SPECIFICATION 16136 – OUTLET BOXES".

14. **PROJECT TECHNICAL SPECIFICATIONS**: **ADD** in it's entirety "SPECIFICATION 16138 – MANHOLES AND HANDHOLES"

15. **PROJECT TECHNICAL SPECIFICATIONS**: **ADD** in it's entirety "SPECIFICATION 16141 – RECEPTACLES".

16. **PROJECT TECHNICAL SPECIFICATIONS**: **ADD** in it's entirety "SPECIFICATION 16920 – ELECTRICAL ACCEPTANCE TESTING".

17. **PROJECT TECHNICAL SPECIFICATIONS:** SPECIFICATION 17260 – CONTROL PANELS paragraph 1.4.B **ADD** "4. Vertech Industrial Systems, 4409 East Baseline Road, Phoenix, AZ 85042; 5. Industrial Power Solutions, 6615 W State Avenue, Glendale, AZ 85301; 6. Felix Construction, 2530 S 52nd Avenue, Phoenix, AZ 85043; 7. Keller Electrical, 1881 East University Drive, Phoenix, AZ 85034."

18. **PROJECT TECHNICAL SPECIFICATIONS**: **ADD** in it's entirety "SPECIFICATION 17262 – PLC-SOFTWARE AND PROGRAMMING".

PROJECT TECHNICAL DRAWINGS

19. **PROJECT TECHNICAL DRAWINGS:** Sheet C-05, **DELETE** call outs "NEW 60" DIA MH NO. 1 PER MAG DETAIL 419" and "NEW 60" DIA MH NO. 2 PER MAG DETAIL 419" and **REPLACE** callouts with "NEW 60" DIA MH NO. 2 PER MAG DETAIL 420" and "NEW 60" DIA MH NO. 2 PER MAG DETAIL 420", respectively.

20. **PROJECT TECHNICAL DRAWINGS:** Sheet C-05, **ADD** callout pointing to existing AC paved access road that states "REPLACE AC PAVEMENT IN KIND AS REQUIRED".

21. **PROJECT TECHNICAL DRAWINGS:** Sheet C07 Transmitter Mounting Detail **ADD** 2-inch diameter Type 316 stainless steel isolation ball valve between Weld-O-Let and Tee.

22. **PROJECT TECHNICAL DRAWINGS:** Sheet M03 at the end of Note 5 **ADD** "CORE DRILL QUANTITY SHALL BE TWO TOTAL AND BE 6-INCHES IN DIAMETER. LOCATION WITHIN STRUCTURE SHALL BE COORDINATED WITH ENGINEER "

23. **PROJECT TECHNICAL DRAWINGS:** Sheet M03 section ABANDON WET WELL IN PLACE SECTION AND DETAIL Callout to Native Material Fill **DELETE** "10'-0" and **REPLACE** with "5'-0" Min".

24. **PROJECT TECHNICAL DRAWINGS:** Sheet M03 at the end of Note 6 **ADD** "CORE DRILL QUANTITY SHALL BE TWO TOTAL AND BE 6-INCHES IN DIAMETER. A TOTAL OF TWO 6-INCH DIAMTER. LOCATION WITHIN STRUCTURE SHALL BE COORDINATED WITH ENGINEER "

25. **PROJECT TECHNICAL DRAWINGS:** Sheet M03 plan view LIFT STATION TOP PLAN, **DELETE** Callout "5' X 4' HATCH (TO REMAIN) and **REPLACE** with "5' X 4" HATCH TO BE REMOVED".

26. **PROJECT TECHNICAL DRAWINGS:** **DELETE** Sheet M04 in it's entirety and **REPLACE** with attached revised Sheet M04, modifications are clouded.

27. **PROJECT TECHNICAL DRAWINGS:** **DELETE** Sheet M05 in it's entirety and **REPLACE** with attached Revised Sheet M05, modifications are clouded.

28. **PROJECT TECHNICAL DRAWINGS:** **DELETE** Sheet M06 in it's entirety and **REPLACE** with attached Revised Sheet M06, modifications are clouded.

29. **PROJECT TECHNICAL DRAWINGS:** **DELETE** Sheet M09 in it's entirety and **REPLACE** with attached Revised Sheet M09, modifications are clouded.

30. **PROJECT TECHNICAL DRAWINGS:** Sheet S02 Section 1 **DELETE** Callout "1'-8" " on the east wall and **REPLACE** Callout with "10" " per the plan view dimensions on the same sheet.

31. **PROJECT TECHNICAL DRAWINGS:** **ADD** Sheet S04, attached

32. **PROJECT TECHNICAL DRAWINGS:** **ADD** Sheets E-SK1, E-SK2, E-SK3, E11, E12, and E13, attached.

END OF ADDENDUM

SECTION 01521

ENGINEER'S FIELD OFFICE

PART 1 - GENERAL

1.1 DESCRIPTION

A. Furnish, install, and maintain the field office, furnishings, and equipment for ENGINEER. Locate office near CONTRACTOR'S office in a location approved by ENGINEER. Provide office complete within four weeks after the Notice-to-Proceed.

B. Allocate three reserved parking spaces marked for use by the ENGINEER and one reserved parking space for use by OWNER. Reserved parking spaces shall be adjacent to ENGINEER'S field office and shall be graded and paved.

C. The office shall be separate from all CONTRACTOR'S offices.

D. CONTRACTOR shall submit, pay for and obtain any required permits.

E. Field office security shall be the responsibility of CONTRACTOR. Deliver 5 field office door keys and all furniture keys to ENGINEER upon installation of field office to site.

F. Complete layout of office shall be submitted to the ENGINEER for approval. Submittal shall include a hard copy of the relevant Specification Section and shall be clearly marked to indicate whether the requirements for equipment and/or services in the Specification Section are met by writing "accept" or "deviate" next to each Paragraph. If clarifications are needed to any of the Paragraphs in the Specification Sections due to deviations, they shall be addressed next to the Paragraph as such and explained further with any additional information necessary. If any exceptions and/or deviations are proposed to any of the Specifications, they shall be clearly noted as such in the Submittal, and an explanation of any deviation and/or exception shall be provided. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected.

1.2 MINIMUM CONSTRUCTION

A. Mobile single wide office trailer 12' x 60' in first class, new condition acceptable to ENGINEER, which is specifically designed for this type of use and conforms to requirements above and below. Provide trailer by Pac-Van, GE Modular Space, or approved equal.

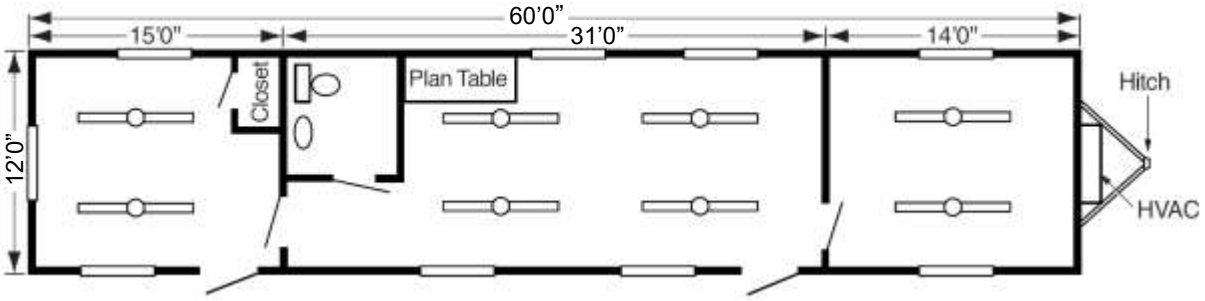
B. Trailers owned by the CONTRACTOR that do not meet the criteria listed will not be allowed.

C. Concrete or boardwalk steps, landings and sidewalks of four feet minimum width for complete access to field office. Access to the office must comply with ADA (Americans with Disabilities Act) Standards, as applicable. Access doors shall be furnished with locking security bar doors as approved by the ENGINEER.

D. Trailer shall be completely weather tight and insulated, with resilient floor tiles and carpet in first class, new condition.

E. All interior finishes acceptable to ENGINEER.

F. Area: 720 square feet minimum consisting of two offices, conference room, and lavatory as depicted below. Interior layout shall be submitted to the ENGINEER for approval prior to ordering.



G. Windows: Ten percent of floor area with operable sash and screens. Windows shall be furnished with locks and exterior security bars approved by the ENGINEER. All windows shall be equipped with operable venetian blinds. All offices shall be furnished with a window.

1.3 MINIMUM SERVICES

A. Interior lighting of 50 foot candles at desktop height.

B. Exterior light at entrance(s) and at parking areas.

C. Automatic heating to maintain 75°F in winter. CONTRACTOR shall furnish and pay for all fuel/electric.

D. Automatic cooling to maintain 70°F in summer. CONTRACTOR shall furnish and pay for all fuel/electric.

E. Continuous electric service required and pay all charges.

F. A minimum of one electric duplex receptacle wall outlets that are accessible from six feet along any wall.

G. Provide continuous Internet service with all associated equipment a maximum of two weeks after trailer is installed. Configure Internet so service is available by all workstations, with a minimum connection speed of 100 Mbps download. Provide one internet connection along with cabling and required hardware for each desk. Internet shall also have a secure wireless connection as well, with firewall (to be coordinated with Engineer/Owner).

H. One bottled water cooler with chilled and hot drinking water and cups. Supply bottled water and cups as required for the duration of the Contract.

I. Private sanitary facilities with one water closet, one lavatory, with hot and cold running water, medicine cabinet with mirror, one tissue paper holder and one paper towel holder. Supply tissue paper, hand soap and paper towels as required for the duration of the Contract.

J. All plumbing facilities and sewers required in accordance with local codes. Protect from freezing.

K. One new color combination copy machine and printer. Unit shall be able to connect to network and have document feeder, with reduction, enlargement, auto-document feed, auto stapler function, high capacity feeder, bypass tray, four paper trays, top tray, stacker tray and sorting capability. Copier/printer shall have email capabilities for sending files. Provide service, warranty (including toner and replacement cartridges) and maintenance for the duration of the Contract. Provide 8-1/2-inch by 11-inch, 8-1/2-inch by 14-inch, and 11-inch by 17-inch copy paper for the duration of the Contract. Copier shall make up to 11-inch by 17-inch copies. Copier shall copy at a rate no slower than 40 copies per minute.

1.4 MINIMUM FURNISHINGS

A. Field Office Furniture: Lease (or purchase) and install the following equipment for the duration of the Contract:
   1. Furnishings for each individual office, two offices total:
      a. Two desks, 36-inches wide by 72-inches long table top with locking lap and 5-side drawers.
      b. One 4-drawer locking legal size filing cabinet.
      c. One 6-shelve bookcase, 36-inches wide by 84-inches high by 12-inches deep.
      d. Two cushioned swivel arm chair and two cushioned folding chairs.
      e. Two 48-inches by 36-inches liquid marking board with two sets of compatible markers (six colors and one eraser per set).
      f. Two standard size wastepaper baskets.

2. Furnishings to be provided for conference room shall include:
   a. Two 30-inches by 96-inches folding tables.
   b. Sixteen upholstered executive high-back chairs with cushioned seat and back, five-star base, wheels, arms, swivel, tilt control conference chairs.
   c. Two 48-inches by 60-inches liquid marking board with two sets of compatible markers (four colors and one eraser per set).
   d. One 48-inch by 60-inches cork bulletin board.
   e. Two standard size wastepaper baskets.
3. Furnishings to be provided for hallways and other areas:
   a. Two 4-drawer legal size, fire-proof filing cabinets.
   b. Two 6-shelve bookcases, 36-inches wide by 84-inches high by 12-inches deep.
   c. Two folding reference tables, 30-inches wide by 72-inches long.
4. Furnishings to be provided with Kitchen area shall include:
   a. One, new refrigerator with freezer, minimum 12 cu.ft. frost-free, GE or approved equal.
   b. Ten-pound ABC approved fire extinguishers (number as required by Phoenix Building Code).
   c. One OSHA approved first aid kit, First Aid Only Contractor's First Aid Kit (Model 9302-25M), or approved equal. Upkeep as needed.
   d. One, new microwave oven, 0.9 cu.ft. minimum 1100 watts rotating base, and keypad controls.
   e. One standard size wastepaper basket.
5. Furnishings to be provided in the toilet area shall include:
   a. One 15-gallon electric water heater (220 volt).
   b. One water closet accessible to handicap with grab bars.
   c. One toilet paper and paper towel dispenser.
   d. One 8-inch ceiling mounted exhaust fan, 60 cfm, Marlite.
   e. One 6-shelve bookcases, 36-inches wide by 84-inches high by 12-inches deep.
   f. Vinyl cove base on wall.
   g. One wastebasket.
   h. Provide paper products and sanitizing soap for the duration of the Contract.

B. Smoke detectors (number as required by Phoenix Building Code).

C. Identifying exterior sign, professionally lettered, at least 24-inches by 36-inches, with wording acceptable to ENGINEER.

D. Three battery operated clocks, wall mounted.

E. Three Calendars.

F. Walk-off mats at all entrances.

G. Furnish and install a new complete computer system ready to operate. This system will consist of two laptop computers, and one printer connected in a network. Each computer shall be able to access the other computers. They shall be able to share files and make use of the internet lines and printer. Minimum hardware requirements shall be as follows:
   1. Provide one new networked color printer with high volume printing capabilities.
      a. HP Color LaserJet Pro m255dw Wireless Laser Printer.
   2. Computers shall be capable to be setup in a Peer to Peer network connected by a CAT5, twisted pair, with RJ 45, Ethernet 10 Base T cable connections. One computer shall be the file server for the NT network. Access to the system shall be password protected and each user will have their own unique login name and password.
   3. One 10/100 Base T, RJ 45, 8-Port 3 com office connect switch. Switch shall be installed where the office CAT5 data drops terminate. Power source to be provided.
   4. CAT5, RJ 45 twisted pair data lines for three data lines. Each office will have two CAT5 data drop near each desk and two CAT5 data drop in the conference room area. All CAT5 data drops will terminate in one location for proper installation to the network hub.
   5. The computer network shall be capable of Virtual Private Network access through the internet, a Cox connection, or a CenturyLink connection.

H. Furnish office supplies, consumables, and service contracts for office and communications equipment for the duration of the Contract.

1.5 MAINTENANCE

A. Continuous maintenance of office and services. Cleaned not less than once per week.

B. Provide soap, paper towels, toilet tissues, cleansers, sanitary supplies, janitorial service (including vacuuming, washing floors, and cleaning toilets weekly) and implements.

C. Repair immediately any damage, leaks or defective service.

D. Maintenance shall be for the duration of the Contract.

E. Provide maintenance contract for the items described in Paragraphs 1.3.G., 1.3.K., 1.4.G. and 1.6 for the duration of the Contract. Also, provide a 24-hour response, service contract, for equipment with a minimum of eight hours pre-paid service per month.

1.6 PROVISIONS

A. All items shall be furnished and maintained by CONTRACTOR from the Notice to Proceed to the date of Final Acceptance. The cost of these items shall be considered incidental to the cost of the Project. No separate measurement of payment shall be made for these items.

1.7 REMOVAL

A. The office, together with the equipment, furnishings and facilities thereof, except miscellaneous small supplies shall become the property of CONTRACTOR and shall be removed from the site of the Work upon OWNER Acceptance of the Project or when directed by ENGINEER.

B. At the completion of the Project, the OWNER'S computers, filing cabinets and filing cabinet contents shall become the property of the OWNER, unless directed otherwise. All titles for software and hardware shall be transferred to the OWNER.

C. At the completion of the Project, the ENGINEER'S computers and any other ENGINEER provided belongings shall remain the property of the ENGINEER.

D. At the completion of the Project, the ENGINEER and OWNER will return field office keys to CONTRACTOR.

E. Remove underground installations to minimum depth of 24-inches and grade to match surrounding conditions.

F. Restore existing facilities used during construction to specified or original condition.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

+ + END OF SECTION + +

SECTION 05581

FLOOR ACCESS HATCH COVERS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish hinged floor access hatch covers.
   2. The types of floor access hatch covers include the following:
      a. Aluminum covers with standard angle frame.

1.2 QUALITY ASSURANCE

A. Manufacturer: All floor covers for the project shall be the product of a single manufacturer. Covers from more than one manufacturer will not be permitted.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
   1. ASTM B 209, Specification for Aluminum and Aluminum Alloy Sheet and Plate.
   2. ASTM B 210, Specification for Aluminum and Aluminum Alloy Drawn Seamless Tubes.
   3. ASTM B 221, Specification for Aluminum and Aluminum Alloy Extruded Bars, Rods, Wire, Shapes and Tubes.
   4. NAAM, Metal Finishes Manual and Metal Box Grating Manual.
   5. Aluminum Association Standards.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Dimensional plans of all floor covers, quantity schedule, details of fabrication and erection, and anchorage.
   2. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
   3. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
   4. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each

paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

1.4 GUARANTEE

A. Furnish a written guarantee obtained from the manufacturer. Guarantee shall state the following:
   1. Floor covers are to operate properly and be free of defects in material and workmanship for a period of five years from date of purchase.
   2. Should any part fail to function, or break in normal use during this period, manufacturer shall furnish a new part at no additional cost to OWNER.

PART 2 - PRODUCTS

2.1 MATERIALS AND FABRICATION

A. General:
   1. Provide Manufacturer's standard fabricated units, modified, if necessary, to comply with the requirements of the Contract Documents. Where standard units are not available for the sizes and types required, custom fabricate units to match manufacturer's similar units.
   2. Fabricate each unit in the shop, complete with anchors, gaskets, hardware and accessory items, as required.

B. Aluminum Covers with Standard Frame:
   1. Provide aluminum covers, with standard angle frame, designed to withstand H-20 loadings.
   2. Provide frame and cover to prevent storm water infiltration
   3. Provide Type 316 stainless steel hinges and hardware.
   4. Product and Manufacturer: Provide one of the following:

a. Double leaf door covers of sizes shown on the Drawings.
   1) Type BDDH, as manufactured by Babcock-Davis Associates Incorporated.
   2) Type J-AL , as manufactured by The Bilco Company.
   3) Type HATCH THD by the U.S.F Fabrication Inc
   4) Or equal.
b. Single leaf door covers fabricated of aluminum and of sizes shown on the Drawings.
   1) Type BFDDH, as manufactured by Babcock-Davis Associates.
   2) Type JD-AL, as manufactured by The Bilco Company.
   3) Type HATCH THS by the U.S.F Fabrication Inc
   4) Or equal.

C. Aluminum Covers with Standard Frame:
   1. Provide aluminum covers, with standard angle frame, designed to withstand loadings of 300 pounds per square foot.
   2. Provide Type 316 stainless steel hinges and hardware.
   3. Product and Manufacturer: Provide one of the following:
      a. Double leaf door covers of sizes shown on the Drawings.
         1) Type BFDNP, as manufactured by Babcock-Davis Associates Incorporated.
         2) Type J-AL, as manufactured by The Bilco Company.
         3) Type HATCH TPD by the U.S.F Fabrication Inc
         4) Or equal.
      b. Single leaf door covers of sizes shown on the Drawings.
         1) Type BFDNP, as manufactured by Babcock-Davis Associates.
         2) Type J-AL, as manufactured by The Bilco Company.
         3) Type HATCH TPS by the U.S.F Fabrication Inc
         4) Or equal.

D. Door leaves shall be checkered or diamond plate, or other approved non-slip surface.

E. Frames shall have anchor flanges or strap anchors.

F. Door shall have hold-open devices.

G. Door leaves ten square feet and larger shall have torsion bars, springs or other approved means, for counterbalanced operation.

H. Covers shall have flush exterior locking device with removable handle, and interior turn handle.

I. All aluminum covers shall be mill finished. Protect finish with a factory applied coating of lacquer standard with the manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install doors in accordance with approved Shop Drawings and Manufacturer's instructions.

B. Set doors plumb, level and true to line or grade, without warp or rack, for anchoring under other Sections of these Specifications.

C. Protection of Aluminum from Dissimilar Materials: Coat all surfaces of aluminum in contact with dissimilar materials such as concrete, masonry, steel and other metals as specified in Section 09900, Painting.

+ + END OF SECTION + +

SECTION 09910

SPECIAL FINISHES

PART 1 - GENERAL

1.1 SUMMARY

A. CONTRACTOR shall provide all labor, materials, equipment, services, and incidentals required to furnish and install corrosion resistant coatings for the manholes as specified herein.

1.2 SECTION INCLUDES

A. Corrosion resistant coating.

1.3 SUBMITTALS

A. Submit the following for approval:
   1. Letters of Certification of Compliance on materials, equipment, etc.
   2. Identify product name and number, manufacturer and local distributor name, address, and telephone number.
   3. Samples.
   4. Operating and/or service manuals, and all other data pertinent to operating or servicing the complete apparatus. Include detailed procedures for light repairs such as dents and scratches.
   5. Manufacturer’s installation methods:
      a. Safety data sheets (SDS)
      b. Maximum storage life and storage requirements
      c. Mixing and proportioning requirements
      d. Environmental requirements for application and worker safety, including ventilation, humidity, and temperature ranges
      e. Application film thickness PM coat of primer and finish coat
      f. Curing time required
   6. Identify manufacturer's recommended, published spreading rate and dry film thickness of each coating material proposed for use.
   7. Mixing instructions, shelf life, method of application, recommended number of coats, and drying time.
   8. General bulletins and catalog cuts describing complete coating system, including all principles and fundamentals.
   9. Materials of construction of all components.
   10. Material gradation, design mix, job mix formula, and/or material analysis.
   11. Copies of the CONTRACTOR'S proposed protection procedures in each area of Work.

12. Sample of finished product showing final color: Coating shall be light in color.
13. A written certification of the applicator's qualifications to the ENGINEER for approval. Applicator shall be an Arizona licensed contractor. Each of the applicator's employees applying coatings and underlayment's shall be certified by the manufacturer as having sufficient training and knowledge to properly apply their products
14. Quality Assurance and Testing Reports.

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. All surface coating materials shall be delivered to the job site in original sealed containers and shall be used directly from these sealed containers.

B. All containers shall have the following labels naming title of material, manufacturer's name and stock number, contents by volume, color name and number, and application instructions.

C. All surface coating materials shall be stored in an area according to manufacturer's recommendations.

D. The storage area shall be kept neat and clean. Floors and other surfaces shall be adequately protected. Any damage caused by the CONTRACTOR to surfaces in the storage area shall be thoroughly cleaned and repaired.

E. All oily rags, waste, etc., shall be placed in a covered material container and removed by the CONTRACTOR at the end of each shift.

1.5 QUALITY ASSURANCE

A. Corrosion resistant coating manufacturer and applicator shall have at least five years experience in production and coating applications, respectively.

B. Provide the services of a qualified manufacturer's representative at the Project site for a minimum of two trips and two, eight hour work days at the commencement of Work to advise on materials, installation, and finishing techniques.

C. Certify long-term compatibility of all coatings with all substrates.

D. Provide the services of a qualified manufacturer's representative at the Project site for a minimum of two trips and four, eight hour work days during Work and completion of the Work for inspection. Within seven calendar days after inspection by the manufacturer, the CONTRACTOR shall provide a written report from the manufacturer certifying the coatings have been applied properly and in accordance with the manufacturer's recommendations and requirements. Deficiencies in the coating system, if any, noted by the manufacturer during final inspection shall be

defined in the manufacturer's report including corrective measures to be implemented by the CONTRACTOR at the CONTRACTOR'S expense. Following corrective measures by the CONTRACTOR, the manufacturer shall re-inspect the Work. Within seven days after re-inspection, provide a written report form the manufacturer certifying the coatings have been applied properly and in accordance with the manufacturer's recommendations and requirements.

E. Pre-Application Meeting:

1. A pre-application meeting MUST take place at the job-site or mutually agreed upon site a minimum 3 (three) weeks before the application of any coating or lining work proceeding. Attendance is required of all principal decision making parties directly affecting work of this section, including OWNER, ENGINEER, CONTRACTOR, COATING MANUFACTURER'S REPRESENTATIVE and COATING INSPECTOR etc. Record the discussions of the conference and the decisions and agreements (or disagreements) and furnish a copy of the record to each party attending. Review foreseeable methods and procedures relating to the painting Work, including but not necessarily limited to, the following:
   a. Review Project Coating Specification, Project requirements, including Contract Documents, Project Schedule, approved Shop Drawings, pending and approved Change Orders and requests for information.
   b. Field quality control: Contractors responsibilities, i.e providing written daily reports and review required samples and submittals, both completed and yet to be completed.
   c. Review status of surfaces including drying, surface preparations and similar considerations.
   d. Review availability of materials, tradesman, equipment and facilities needed to make progress, avoid delays and protect the Work from damaging conditions.
   e. Coating Inspector's authority and responsibilities, required inspections, testing services, certifications and quality control procedures.
   f. Review weather and forecasted weather conditions, and procedures for coping with unfavorable conditions. Supplemental heating sources, as may be required to continue the Work under low temperature conditions, shall be in operating order and acceptable to coating applicator.
   g. Review methods for complying with regulations of governing authorities having jurisdiction, such as compliance with environmental protection, health, safety, fire and similar regulations.
   h. Material storage requirements
   i. Protection of surfaces not scheduled to be coated
   j. Application requirements and procedures
   k. Protection of coating systems

2. Provide meeting minutes to all parties for review and possible clarification. Should any correction to the meeting minutes be required, the minutes should be corrected and resubmitted to all parties.
3. Reconvene the meeting at the earliest opportunity if additional information must be developed in order to conclude the subjects under consideration.
4. Record any revisions or changes agreed upon, reasons therefore, and parties agreeing or disagreeing with them.

G. Maintain a Coating Application Log containing the information as shown on the log attached at the end of this Section 09900, Painting. The Paint Application Log shall be maintained on a daily basis for all areas where the Work is being performed. The Paint Application Log shall be turned over to the ENGINEER by 9:00 a.m. the following day that the work was performed. The log shall include the following:
1. Date.
2. Time.
3. Weather condition (at work location).
4. Air temperature (at work location).
5. Surface temperature (at work location).
6. Dew point (at work location).
7. Humidity (at work location).
8. Material temperature (Before (Separately) and Mixed (Combined)
9. Location/area square footage.
10. Description of Work performed.
11. Materials used, colors and batch numbers, quantity of materials used (not including waste).
12. Application/surface preparation equipment and personnel.
13. WFT/surface profile measurements.
14. Comments, quality control procedures.
15. Signature/title.

1.6 WARRANTY

A. The corrosion resistant coating manufacturers shall warrant the products being supplied to the OWNER against defects for a period of five years under normal use. The warranty shall be in printed form.

B. Warranty Period Inspection:
1. OWNER may conduct inspection at any time prior to five (5) years following completion of new coating work and /or repaired coating work. CONTRACTOR and representative of coating manufacturer shall be notified of any apparent coating failures. Defective work or coating failures shall be repaired in accordance with this specification and to the satisfaction of OWNER.

2. If warranty inspections are not held, CONTRACTOR is not relieved of responsibilities under Contract Documents.

PART 2 - PRODUCTS

2.1 PRODUCTS FOR COATINGS

A. Manholes and Lift Station, including all concrete surfaces such as walls, baffles, columns, and floor; and openings:
   1. Sauereisen Sewergard 210TN Troweled Industrial coating
   2. No approved equal.

2.2 MATERIALS

A. Manholes:
   1. Troweled product shall be applied in one layer to a minimum of 125 mils dry film thickness after the concrete filler/sealer has been applied (or as required by the coating manufacturer and approved by the ENGINEER) to the concrete surfaces. In floor coatings, CONTRACTOR shall incorporate silica sand or other approved natural or synthetic grit to provide a slip-resistant surface. The additive shall be mixed in the coating compound prior to application.

PART 3 - EXECUTION

3.1 SAFETY

A. The CONTRACTOR shall perform all surface preparation and application of the coatings as described below. All surface preparation and coating application shall be in compliance with all applicable Federal, State, and local occupational safety, health, and air pollution control regulations. All safety precautions recommended by the manufacturer in printed instructions or special bulletins, and as required by applicable regulations. The CONTRACTOR shall provide forced ventilation in all areas where inadequate ventilation exists.

3.2 SURFACE PREPARATION

A. New concrete shall cure as required for an acceptable surface to apply coating system as determined by the coating manufacturer. Testing the new concrete to determine whether it is acceptable for a coating system includes capillary moisture in accordance with ASTM D4263 and further testing in accordance with ASTM F1869 if moisture is detected and ground water intrusion is suspected. Test for moisture content of concrete surfaces before commencement of painting Work.

There are many tests for moisture in concrete such as ASTM D 4263, ASTM F 1869 or ASTM F 2170. Provide from the submitted coating manufacturer in writing as to which standard they want used and what results must be obtained for satisfactory compliance. Report results to ENGINEER before starting Work.

B. The concrete shall be prepared in accordance with SSPC/NACE Preparation of Concrete. The concrete surface shall be abrasive blast cleaned in accordance with ASTM D4259 to a uniform texture of 50-60 grit sandpaper and a surface profile of 4-6 mils. When sandblasting a surface to be coated, the CONTRACTOR shall protect all surrounding surfaces from sustaining any damage. All surfaces to be sound, clean, dry, and free of all contaminants prior to application of the coating system. Patch all holes as recommended by the coating manufacturer.

C. Test for moisture content of concrete surfaces before commencement of painting Work. There are many tests for moisture in concrete such as ASTM D 4263, ASTM F 1869 or ASTM F 2170. Provide from the submitted coating manufacturer in writing as to which standard they want used and what results must be obtained for satisfactory compliance. Report results to ENGINEER before starting Work.

D. Verify that the pH levels, of the cleaned concrete surfaces to be coated, are 10 to 12 or within the coating manufacturers' current written acceptable range. The pH of the concrete substrate will be measured using pH indicating papers. The pH testing is to be performed once every 50 square feet (5 square meters). Acceptable pH values can be measured using color indicating pH paper with readable color calibrations and a scale at whole numbers (minimum). Use Hydrion Insta-Check Jumbo 1-12, or equal. The paper shall be touched to the surface once using moderate gloved finger pressure. The surface shall not be wiped or moved laterally to disturb the surface during pH testing. Following the one touch, lift the paper vertically to not "wipe" the surface. Compare the color indicated with the scale provided and record the pH. Spot check any areas that may be questionable with phenolphthalein solution. Where paint system is used to provide chemical containment barrier protection, repair cracks and expansion joints in concrete and provide 2-inch radius cove base fillets at all equipment pads and containment walls as part of the complete chemical containment paint system Work. Use materials and techniques recommended by the specified Manufacturer.

E. Remove all cast-in-place concrete fins, projections, tie wire, nails and other surface irregularities, which would protrude above the level of finished intermediate fillers and surfacers by chipping and scarification by mechanical abrasion.

F. Using specified filler and surfacer, patch all cast-in-place concrete and precast concrete surfaces as required to completely fill surface air holes and honeycombing. Level all protrusions and grind filler and surfacing compounds smooth and level with adjacent surfaces.

G. Where concrete masonry unit block filler is specified, spot patch holes and cracks with a putty knife using specified block filler to provide smooth finish for large surfaces coating materials can be applied by airless spray and backroll uniformly using a roller with a synthetic nap cover. While the coating material; is still wet a rubber squeegee can be used to provide a smooth finish.

3.3 INSTALLATION

A. The corrosion resistant coating shall be applied by a coating applicator specialist qualified to apply the coating in accordance with the manufacturer's specification.

B. Do not open containers or mix components until necessary preparatory work has been completed and application work will start immediately.

C. Handling of materials before, during, and after application in such a manner as to prevent inclusion of foreign materials.

D. All interior spaces of the manholes and Lift Station No. 77 shall be coated. This includes the floor, walls , openings and ceiling. The joint between the 54-inch RCP sewer lining and the wet well coating system shall be made at the recommendation of the respective manufacturers.

E. Prior to Coating Installation, CONTRACTOR shall perform adhesion testing of the concrete per ASTM C 1583.

F. Use only application methods approved by the manufacturer.

3.4 TESTING

A. Contractor shall give ENGINEER a minimum of three days advance notice before the start of any surface preparation, underlayment application work, coating application work or testing.

B. All testing shall be performed in presence of ENGINEER.

C. Acceptance for holiday testing, adhesion testing and dry film thickness testing shall be witnessed by an independent Testing Agency or Laboratory approved by the OWNER. Costs of this inspection and Testing shall be the responsibility of the CONTRACTOR. At OWNER’s option, OWNER may waive requirement of CONTRACTOR provided testing agency or laboratory and have ENGINEER witness this testing.

D. Additional illumination, scaffolding, and permit required confined space entry equipment and support shall be provided by CONTRACTOR as necessary to facilitate inspection by ENGINEER and/or Testing Agency when requested.

E. Holiday testing equipment and procedures shall be in strict accordance with the latest edition of NACE "Standard Recommended Practice-Discontinuity (Holiday) Testing of Protective Coatings." and ASTM D4787-13. Areas containing holidays shall be marked repaired or recoated and re-tested in accordance with coating manufacturer's printed instructions.
   1. Holiday detectors shall be high voltage plus-type detectors as manufactured by Tinker & Rasor or D.E.Sterns Co. Unit Shall be adjusted to operate at voltage required to cause sparks jump across air gap equal to twice specified coating thickness. Minimum applied voltage for 125 Mil coating shall be 17,000 volts.

F. Dry film thickness measurements shall be provided by report submitted by CONTRACTOR to ENGINEER. The report shall be presented after completion of underlayment, top coating operations and shall state number of manufacturer's product units used and total square footage of surfaced area covered. ENGINEER shall have option of requiring CONTRACTOR to document number of units (coating materials) on hand before and after coating operations to verify actual minimum dry film thickness applied
   1. All film thickness not meeting required minimum will be recoated per manufacturer's recommendations to required minimum 125 mil thickness.

G. CONTRACTOR shall perform adhesion test on 15% of coated surface areas. Adhesion tests shall conform to ASTM D7234, minimum pull off strength of 200 psi concrete. A minimum pull off strength of 150 psi on concrete will be acceptable if substrate is adhered to coating and dolly on more than ½ the area of the dolly. 50mm dollies shall be used for adhesion testing. In the event of a failure, ENGINEER and CONTRACTOR shall determine limits of failure through additional investigation, sounding and pull tests. Failed areas shall be removed and repaired in accordance with these specification and manufacturer's recommendations. Repaired area shall undergo testing as specified herein.

3.5 CLEAN-UP

A. During progress of the Work, remove from the site all discarded materials, rubbish, cans or buckets, and rags at the end of each Work day.

B. Upon completion of the Work, clean all coating-spattered surfaces. Remove spattered coating by proper methods of washing and scraping, using care not to scratch or otherwise damage surfaces.

C. At the completion of Work of other trades, touch-up and restore all damaged or defaced coated surfaces as determined by the ENGINEER.

D. Ensure that all Federal, State, and Municipal laws and regulations are met during the disposal of coating material or any other hazardous material associated with the coating process.

END OF SECTION

SECTION 11318

END SUCTION SUBMERSIBLE PUMPS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals required to furnish and install sea water submersible, end suction centrifugal pumps complete and operational with motors, alarm equipment, alternator and accessories as shown on the Drawings and specified. Anchor bolts are included in this Section.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Manufacturer shall have a minimum of five years of experience of producing substantially similar equipment, and shall be able to show evidence of at least five installations in satisfactory operation for at least five years.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
   1. Standards of the Hydraulic Institute.
   2. National Electrical Code (NEC) current adoption.
   3. City of Phoenix – Amendments to the National Electrical Code.
   4. Standards of National Electrical Manufacturers Association.
   5. Institute of Electrical and Electronic Engineers.
   6. American National Standards Institute.
   7. Standards of American Water Works Association.

C. Shop Tests:
   1. Pump casings shall be hydrostatically tested to twice the discharge head or 1-1/2 times the shutoff head whichever is greater.
   2. Running Test: Pump assembly shall be operated from zero to maximum capacity as shown on the approved curve. Results of the test shall be shown in a plot of test curves showing head, flow, horsepower, efficiency, and current. Readings shall be taken at a minimum of five evenly spaced capacity points including shut-off, design point and minimum head for which pump is designed to operate.
   3. Each test shall be witnessed by a Registered Professional Engineer, who may be an employee of the manufacturer. The Registered Professional Engineer shall sign and seal all copies of curves and shall certify that hydrostatic tests were performed. Tests shall be conducted in conformance with the methods described in Section A6 of AWWA E101.

4. Pumps shall not be shipped until the ENGINEER has approved the test reports.

D. Unit Responsibility: Assign Unit Responsibility as specified in Section 01600, General Equipment Provisions, to the manufacturer or supplier for the equipment specified in this Section. A Certificate of Unit Responsibility shall be provided.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
1. Manufacturer's literature, illustrations, specifications and engineering data including: dimensions, materials, size, weight, performance data and pump curves showing overall pump efficiencies, flow rate, head, brake horsepower, motor horsepower, speed and shut-off head.
2. Shop Drawings Showing: Fabrication, assembly, installation and wiring diagrams.
3. Guarantee.
4. Motor tests and data as described in PART 2 below.
5. Submit Shop Test results conforming to Paragraph 1.2.C., above.

B. Operation and Maintenance Manuals:
1. Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules, pump curves, description of operation and spare parts information.
2. Furnish operation and maintenance manuals in conformance with the requirements of Section 01781, Operation and Maintenance Data.

1.4 WARRANTY

A. The pump manufacturer shall warranty the units being supplied to the OWNER against defects in workmanship and material for a period of five years under normal use, operation, and service. The warranty shall cover parts and labor and shall be in printed form and apply to all similar units.

PART 2 - PRODUCTS

2.1 SERVICE CONDITIONS

A. Pumps shall be non-clog submersible end suction centrifugal slide rail type. Pumps shall be designed for operation under complete submersion, partial submersion and also under dry conditions. Each pump shall be specially designed, constructed, and installed for the service intended and shall comply with the design conditions listed below.

B. Design Conditions:

Location:	Lift Station 76
Use:	Sewage
No. Required:	2
Drive Type:	Constant Speed
Design Flow: gpm	1,736
Design TH: ft.	95
Min. Shut-off Head: ft.	182.5
Min. Hydraulic Efficiency at Design: %	73
Motor Hp: Max.	60
Max. Speed: rpm	1775
Sphere Diameter: in.	3
Discharge Size: in.	6
Flow at 2nd Design Point: gpm	1,200
TH at 2nd Design Point: ft.	118
Flow at 3rd Design Point: gpm	2,200
TH at 3rd Design Point: ft	70
Shut off Head:	182.5

LS 76 SYSTEM CURVE TABLE				
	C-Value Phase II System Curve (110)		C-Value Phase II System Curve (140)	
	Flow, gpm	Head, ft	Flow, gpm	Head, ft
System Point No. 1	1,200	81.29	1,200	79.82
System Point No. 2	1,500	86.96	1,500	84.79
System Point No. 3	2,000	98.82	2,000	95.21
System Point No. 4	2,500	113.58	2,500	108.25
System Point No. 5	3,000	131.18	3,000	123.83

2.2 DETAILS OF CONSTRUCTION

A. Pump Materials and Construction: The pumps shall be heavy duty, electrical, submersible, centrifugal, non-clog unit designed to handle raw sewage up to 4% Total Suspended Solids (TSS). The pumping units shall automatically and positively mate with its discharge piping when lowered into place. The pumps shall

be removable for inspection or service requiring no bolts, nuts or other fastenings to be disconnected. Each pump shall be fitted with a stainless steel chain of adequate strength and length for pump removal. Lifting safety type hooks shall be provided at both ends of the chain. The manufacturer shall provide guide rail brackets, base elbow, self-seating flange and disconnect and other items required for a guide rail type removal system. The pumps, with appurtenances and cable, shall be designed for continuous operation under submergence, without leakage, in water to a depth of 35 feet.

1. Stator casing, oil casing, sliding bracket, volute and impeller shall be close grained grey cast iron.
2. Impeller shall be of high-chrome hard iron, ASTM A532, Class III, Type A, dynamically balanced, double shrouded, non-clogging design, having a long throughlet without acute turns. The impeller shall be capable of handling solids, fibrous materials, and heavy sludge. The fit between the impeller and the shaft shall be a sliding fit with one key.
3. A wear ring system shall be installed to provide efficient sealing between the volute and impeller. The wear ring system shall consist of a stationary ring made of high-chrom hard iron, ASTM A532, Class III, Type A with a minimum Brinell Hardness number of 450 when tested in accordance with ASTM E10, encased in nitrile rubber. The wear ring system shall be fitted to the volute inlet.
4. External Hardware: All bolts, nuts and cap screws shall have hexagon heads and be of 316 stainless steel.
5. Shaft: Stainless steel.
6. Each pump shall be provided with a tandem mechanical shaft seal system consisting of two totally independent seal assemblies. The seals shall operate in a lubricant reservoir that hydro-dynamically lubricates the lapped seal faces at a constant rate. The lower, primary seal unit, located between the pump and the lubricant chamber, shall contain one stationary and one positively driven rotating tungsten-carbide ring. The upper, secondary seal unit, located between the lubricant chamber and the motor housing, shall contain one stationary tungsten-carbide seal ring and one positively driven rotating tungsten-carbide seal ring. Each interface shall be held in contact by its own spring system. The seals shall require neither maintenance nor adjustment, but shall be easily inspected and replaceable. The following seal types shall not be considered acceptable (not equal to the dual independent seal specified): shaft seals without positively driven rotating members, or conventional double mechanical seals containing either a common single or double spring acting between the upper and lower units. Cartridge seals shall not be acceptable.
7. Each pump shall be provided with an oil chamber for the shaft sealing system. The seal oil shall be FDA approved and non-toxic. Seal lubrication shall require an oil chamber capacity no greater than 16 pints. The drain and inspection plug, with positive anti-leak seal, shall be easily accessible from the outside.

8. Coating: All surfaces in contact with wastewater shall be protected with two layers of Tankguard-412 – 8 mils DFT per layer. Blast Surfaces to SP 10 near white metal cleaning prior to coating.
9. Bearings: Anti-friction, grease or oil lubricated with a minimum B-10 life of 100,000 hours. The upper bearing shall be a single roller bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces.
10. Stainless steel manufacturer's nameplate giving the model and serial number, rated capacity, head, speed and all other pertinent data shall be attached to the pump.
11. Guide rails shall be Type 316 stainless steel. The guide rail supports shall be placed at 8 foot maximum intervals or less as required to provide support. The system shall allow the pump to be automatically connected to the discharge connection when lowered into place and shall be easily removed for inspection or service. Sealing of the pumping unit to the discharge connection shall be accomplished by a linear downward motion of the pump to a metal-to-metal interface or to a profile gasket seal.
12. Each pump shall be provided with a minimum of 50 feet of nylon line connected to a short length of high tensile, proof tested stainless steel chain. The nylon line shall be sized to sustain all tensile stresses during lifting of the pump. The stainless steel chain shall be connected to the lifting eye. A steel forged grip-eye shall be provided separately to connect the end of the lifting chain to the pump.
13. Submersible Cable: Provide power and control cable from junction box to each pump suitable for submersible applications and indicate same by a code or legend permanently embossed on the cable. Size cable in accordance with applicable NEC requirements. Cable shall be listed by a recognizable testing agency or laboratory.
14. Access Frames and Covers: Pumping units shall be furnished with rectangular 6061 T6 aluminum alloy access frames and covers complete with heavy duty stainless steel hinges and locking hasp. Covers shall be designed for 300 pound per square foot live loading and shall have safety checked or abrasive, nonslip surfaces. Opening sizes shall be as shown on the Drawings. The access frames and covers shall conform to the requirements of Section 05581, Floor Access Hatch Covers.
15. All submersible pumps shall be explosion proof and rated for Class 1, Div. 1 environments.

B. Motors:
1. Motors shall conform to the requirements of Section 11000, Electric Motors 250 Horsepower or Less.
2. Motors shall be solid shaft of stainless steel, ball bearing type. Motor casing shall be air-filled and watertight with moisture resistant Class H 215°C insulation. Power shall be 480 Volts, 60 Hz, and 3 phase.
3. Cable entry shall be isolated with an internal terminal board.

4. Pump and motor shall be designed for continuous and intermittent operation up to twelve starts per hour in a non-submerged condition without damage.
5. Motors shall be non-overloading for the entire pump operating curve.
6. Control module shall be Flygt MAS-801, or equal, and compatible with motor sensors.
7. Pump motor cable shall be designed for submersible duty and shall be indicated by code or legend permanently applied to cable. Cable and sizing shall conform to Phoenix Electrical Code for pump motors and shall be supplied in sufficient length to extend continuously, without splices, from the pump to the pump control panel. The power cable entry assembly shall be stainless steel and shall be provided with a strain relief element to inhibit leakage in the event the cable is pulled. Motor power cords shall meet the requirements of the Mine Safety and Health Administration for trailing cables. Motor power cords shall be suitable for direct burial.
8. Motor thrust bearings shall be designed for continuous thrust loads under all conditions of pump operation from zero head to shut-off. The anti-friction bearings shall be rated for a B-10 life of 100,000 hours.
9. Motor Sensors:
    a. Each pump motor shall be equipped with a minimum of three thermal sensors embedded in the stator windings and wired to the control panel for supplemental motor protection.
    b. Leakage sensor in lower part of stator housing shall be wired to leads in the junction chamber.
10. Motors shall have built-in thermal overload protection.
11. Motor Tests and Data:
    a. For each motor furnish an inspection report for the motor or for a previously manufactured electrically duplicate motor which was tested. Provide the following minimum data:
        1) Running current.
        2) Locked rotor current.
        3) Winding resistance measurement.
        4) High potential test.
        5) Bearing inspection.

C. Accessory Equipment:
1. Provide the following accessories for each pump as required for a complete installation.
    a. Anchor Bolts: Type 316 stainless steel.
    b. Guide Bar Brackets, Upper: Type 316 stainless steel.
    c. Guide Bar Brackets, Intermediate: Type 316 stainless steel.
    d. Safety Chain Hook: Type 316 stainless steel.
    e. Cable Holder and Support Grip: Type 316 stainless steel.
    f. Discharge Elbow: Ductile iron.

D. Controls:

1. Pumping units shall be controlled with liquid level sensors with sufficient length of electrical cable. Level sensors shall be of the sealed mercury switch non-floating, displacement type.
2. Electrical Controls: Furnish and install an automatic pump control center in a NEMA 4X enclosure for operation on a 480 Volt, 3 phase, 60 Hertz electrical power. Each pumping unit shall be provided with an individual disconnect switch, three phase overload protection with manual reset and a magnetic contactor. A 120 volt control circuit transformer with disconnect and overload protection shall be included. Provide an automatic electrical sequence for multi-pumping units.

E. Monitoring Equipment:
   1. General:
      a. Provide power and control cables and motor protective control devices as specified in Paragraph 2.2.B., above, and in Paragraph 2.2.E.2., below.
      b. Instrumentation and control system operational functional requirements relative to the pump applications are shown on the Drawings and specified in applicable Sections in Division 17000.
   2. Motor Protective Control Devices:
      a. For each pump motor assembly:
         1) Provide a solid state monitoring relay with SPDT dry contact closure control outputs for:
            a) Stator winding overtemperature.
            b) Stator housing leakage sensor.
         2) Relays shall be mounted in control panel by others.

F. Product and Manufacturer: Provide the following:
   1. Flygt, Model NP 3202 HT

2.3 SPARE PARTS

A. Each pump shall be furnished with a manufacturers repair kit that shall include as a minimum the following:
   1. One set of mechanical seals.
   2. One set of wear rings.
   3. One set of bearings.
   4. One set of gaskets.

B. Spare parts shall be packed in sturdy containers with clear indelible identification markings and shall be stored in a dry, warm location until transferred to the OWNER at the conclusion of the Project. Comply with the requirements of Section 01783, Spare Parts and Maintenance Materials.

2.4 SURFACE PREPARATION AND PAINTING

A. Pumps, motors, drives, frames, baseplates, appurtenances, etc., shall receive shop primer and shop finish coating conforming to the requirements of Section 09900, Painting. If any damage to the paint system occurs, the equipment shall be repainted as directed by the ENGINEER.

B. Surface preparation and painting shall conform to the requirements of Section 09900, Painting.

C. All gears, bearing surfaces, machined surfaces and other surfaces which are to remain unpainted shall receive a heavy application of grease or other rust-resistant coating. This coating shall be maintained during storage and until the equipment is placed into operation.

D. Certify, in writing, that the shop primer and shop coating system conforms to the requirements of Section 09900, Painting.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspect all equipment immediately upon delivery to site. If damaged, notify ENGINEER and manufacturer immediately.

B. Make adjustments required to place system in proper operating condition. Do not install damaged equipment until repairs are made in accordance with manufacturer's written instructions and approved by the ENGINEER. Only minor repair work shall be permitted in the field. All other damaged items shall be sent to factory for repair or replacement.

3.2 START-UP AND TEST

A. Manufacturer's representative shall check and approve the installation before operation. Manufacturer's representative shall field test and calibrate the equipment to assure that the system operates to the OWNER'S satisfaction.

B. Make adjustments required to place system in proper operating condition. Field test and calibrate the equipment to assure that the system operates in accordance with these Specifications and to the satisfaction of the ENGINEER.

C. After completion of installation, the system shall be completely tested to ensure compliance with the operating requirements as specified, indicated on the Drawings and in accordance with Section 01752, Equipment and System Startup and Performance Testing.

D. All equipment will be given running tests by CONTRACTOR at the job site following installation of the equipment and controls. Should the tests indicate any malfunction, make any necessary repairs and/or adjustments. Such tests and adjustments shall be repeated until, in the opinion of the ENGINEER, the installation is complete and the equipment is functioning properly and accurately, and is ready for permanent operation.

3.3 MANUFACTURER'S SERVICES

A. A factory trained representative shall be provided for installation supervision, start-up and test services and operation and maintenance personnel training services. The representative shall make a minimum of three site visits, minimum eight hours on-site for the first two visits. The first visit shall be for assistance in the installation of equipment. The second visit shall be for checking the completed installation and start-up of the system. The third visit shall be as described under Section 01821, Instruction of Operations and Maintenance Personnel, minimum of four hours. Manufacturer's representative shall test operate the system in the presence of the ENGINEER and verify that the pumps conform to requirements. Manufacturer's representative shall revisit the job site as often as necessary until all trouble is corrected and the installation is entirely satisfactory.

B. All costs, including travel, lodging, meals and incidentals, shall be considered as included in CONTRACTOR'S bid price.

+ + END OF SECTION + +

SECTION 15114

CHECK VALVES AND APPURTENANCES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals required to furnish and install all check valves and appurtenances complete and operational as shown on the Drawings and as specified.
   2. The Work includes, but is not necessarily limited to, all types of valves required for buried, exposed, submerged and other types of piping, except where otherwise specifically included in other Sections.

B. Coordination:
   1. Review installation procedures under other Sections and coordinate with the Work which is related to this Section including buried piping installation, exposed piping installation and site utilities.

1.2 QUALITY ASSURANCE

A. Manufacturer's Qualifications:
   1. Manufacturer shall have a minimum of five years experience of producing substantially similar equipment, and shall be able to show evidence of at least five installations in satisfactory operation for at least five years.
   2. Each type of check valve shall be the product of one manufacturer.

B. Reference Standards: Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.
   1. AGMA Standards.
   2. ANSI B16.1, Cast Iron Pipe Flanges and Flanged Fittings.
   3. ANSI B16.4, Cast Iron Fittings.
   4. ASTM A 48, Specification for Gray Iron Castings.
   5. ASTM A 126, Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings.
   6. ASTM A 216, Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
   7. ASTM A 240, Specification for Heat-Resisting Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels.

8. ASTM A 285, Specification for Pressure Vessel Plates, Carbon Steel, Low-and Intermediate-Tensile Strength.
9. ASTM A 307, Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
10. ASTM A 354, Specification for Quenched and Tempered Alloy Steel Bolts, Studs and Other Externally Threaded Fasteners.
11. ASTM A 436, Specification for Austenitic Gray Iron Castings.
12. ASTM A 536, Specification for Ductile Iron Castings.
13. ASTM B 62, Specification for Composition Bronze or Ounce Metal Castings.
14. ASTM D 1784, Specification for Rigid Poly (Vinyl Chloride) PVC Compounds and Chlorinated Poly (Vinyl Chloride) CPVC compounds.
15. AWWA C111, Rubber-Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
16. AWWA C506, Backflow Prevention Devices - Reduced Pressure Principle and Double Check Valve Types.
17. AWWA C508, Swing Check Valves for Waterworks Service, 2-inch through 24-inch NPS.
18. NEMA, National Electrical Manufacturer's Association.
19. Comply with National Sanitation Foundation (NSF-61) and Arizona Administration Code requirements.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Manufacturer's literature, illustrations, paint certifications, specifications, detailed drawings, data and descriptive literature on all valves and appurtenances.
   2. Deviations from Contract Documents.
   3. Engineering data including dimensions, materials, size and weight.
   4. Fabrication, assembly and installation drawings.
   5. Control characteristics of modulating valves.
   6. Certificates of compliance with AWWA Standards, where applicable.
   7. Corrosion resistance information to confirm suitability of the valve materials for the application. Information on chemical resistance of elastomers shall be furnished from the elastomer manufacturers.
   8. Power and control wiring diagrams, including terminals numbers.
   9. Complete manufacturer’s nameplate data of valves.
   10. Special tools list.
   11. Cv Values and headloss curves.

B. Operation and Maintenance Manuals:

1. Submit complete installation, operation and maintenance manuals including test reports, maintenance data and schedules, description of operation, and spare parts information.
2. Furnish Operation and Maintenance Manuals.

C. Certificates: Where specified or otherwise required by ENGINEER, submit test certificates.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver materials to the site to ensure uninterrupted progress of the Work. Deliver anchor bolts and anchorage devices, which are to be embedded in cast-in-place concrete, in ample time to not delay the Work.

B. All boxes, crates and packages shall be inspected by CONTRACTOR upon delivery to the site. Notify ENGINEER if any loss or damage exists to equipment or components. Replace loss and repair damage to new condition, in accordance with manufacturer's instructions.

C. Store materials to permit easy access for inspection and identification. Keep all material off the ground, using pallets, platforms or other supports. Protect steel members and packaged materials from corrosion and deterioration.

D. Store all mechanical equipment in covered storage off the ground and prevent condensation and in accordance with the manufacturer's recommendations for long term storage.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:
1. Valves shall have manufacturer's name and working pressure cast in raised letters on valve body.
2. Unless otherwise specified, all flanged valves shall have ends conforming to ANSI B16.1. The pressure class of the flanges shall be equal to or greater than the specified pressure rating of the valves.
3. All bolts, nuts and studs on/or required to connect buried or submerged valves shall be Type 316 stainless steel.
4. All bolts and studs embedded in concrete and studs required for wall pipe shall be of Type 316 stainless steel.

5. For stainless steel bolting, except where Nitronic-60 nuts are required, use anti-seize compound, graphite free, to prevent galling. Strength of the joint shall not be affected by the use of anti-seize compound.
6. All other bolts, nuts and studs shall, unless otherwise approved, conform to ASTM A 307, Grade B; or ASTM A 354.
7. Bolts and nuts shall have hexagon heads and nuts.
8. Gasket material and installation shall conform to manufacturer's recommendations.
9. Identification: Identify each valve 4-inches and larger with a stainless steel manufacturer's nameplate stamped with the approved designation. Manufacturer's nameplate shall be permanently fastened to valve body at the factory. Stenciled designations are acceptable for buried valves.
10. All materials of construction of the valves shall be suitable for the applications as shown on the Drawings.
11. Protect wetted parts from galvanic corrosion due to contact of two different metals.

B. 3-Inch Diameter and Larger – Hydraulic - Oil Cushion Type:
1. Provide valves conforming to AWWA C508-09 and as specified herein.
2. Valve shall be a counterweighted, rubber seated swing check valve with external hydraulic oil cushion chamber. Valve shall permit flow in one direction only and close tightly, without slamming, when its discharge pressure exceeds its inlet pressure.
3. Valve shall have a hinge shaft located completely above the waterway, and shall be Type 316 stainless steel with the disc-arm and counterweight arm keyed thereon. Hinge shaft packing gland shall be of adjustable packing gland design employing a compression type packing. Simple O-ring shaft seals will not be accepted.
4. Valve shall be tight seating when closed, and provide a full equivalent pipe area when open fully. Seating shall be by a resilient field replacement ring on the valve disc contacting a Type 316 stainless steel seat ring in the valve body.
5. Provide an external adjustable counterweight to initiate valve closure, and an hydraulic oil cushion chamber mounted externally to dampen valve closure due to counterweight action. The air cushion chamber shall be of all bronze or bronze and stainless steel, and shall be field adjustable.
6. The Oil Cushioning valve shall have a three-stage closing control throughout the entire range of closing. Each state shall be independently adjustable
    a. Stage 1: Timing valve permits rapid closure from full open and is adjustable to set the position where the second stage begins.
    b. Second Stage: Closure speeds is controlled by a color -coded micometer type control valve with a locking set screw
    c. Third Stage: Cushioned cylinder head with speed adjustment for slower control of the last few degrees of travel

7. Materials of Construction: All materials of construction shall conform to AWWA C508 and shall be as follows for various valve components:
   a. Body, Disc, Cover and Gland: Cast-iron or ductile iron.
   b. Disc Arm: Ductile iron.
   c. Hinge Shaft: Type 316 stainless steel.
   d. Hinge Shaft Bushings: Bronze.
   e. Shaft End Plate: Type 316 stainless steel.
   f. Body Seat: Type 316 stainless steel.
   g. Follower ring for Rubber Seat on Disc: Type 316 stainless steel.
   h. Disc Center Pin Assembly: Type 316 stainless steel.
   i. Oil Cushion Chamber:
      1) Chamber and Plunger: Type 316 stainless steel.
      2) Linkages and Pins: Type 316 stainless steel.
      3) Hydraulic Hoses: S.A.E certified.
   j. All Rubber Items:
      1) Up to 180°F Fluid Temperature: Buna-N, or other synthetic rubber suitable for the application.
      2) Greater than 180°F Fluid Temperature: Viton, or other synthetic rubber suitable for the application.
   k. All internal and external bolting and other hardware including pins, set screws, studs, bolts, nuts and washers: Type 316 stainless steel.
   l. Gland Packing: Graphite and Kevlar.
8. Testing:
   a. Test all valves in the shop in conformance with AWWA C508.
   b. Permitted Leakage at Rated Pressures: Zero.
9. Shop Painting:
   a. Interior metal surfaces of the valve, except finished or bearing surfaces, shall be shop painted with two coats of an NSF 61 approved epoxy coating applied in accordance with the manufacturer's recommendations.
   b. Exterior surfaces of the valve shall be shop painted as specified hereinafter under Article 2.2, below.
10. Product and Manufacturer: Provide one of the following:
    a. DeZurik
    b. Crispin.
11. Provide a multiple limit switch on each pump discharge check valve, as shown on the Drawings. Contacts on this switch shall be interlocked to:
    a. Prevent start of motor, unless the valve is closed.
    b. Display an alarm and stop the motor after an adjustable time delay should the check valve fail to open or fail to close.
    c. Display an alarm and stop the motor should the check valve close when the level in the wet well is such that the pump is operating.
    d. Limit switch shall be of the precision plunger type with a differential of 1/10-inch or less. Distance between the center of the valve shaft and the

plunger of the limit switch shall not be less than the diameter of the valve disc. Limit switch shall indicate that the disc is not more than one degree open, and shall not indicate that the valve is closed until the disc is within 1/4 degree of being completely closed.

e. Assembly shall be suitable to be mounted on an outside weight and lever swing check valve without modification of the valve or piping, and shall provide proper signals to permit the control system to function as described above without causing false pump cutout and alarm indications, when properly adjusted.

f. Mount the assembly on the valve in accordance with the manufacturer's recommendations and instructions, and shall make all necessary adjustments to actuate the limit switch to provide the specified functional features.

2.2 SURFACE PREPARATION AND PAINTING

A. Valves, appurtenances, etc., shall receive shop primer and shop finish coating conforming to the requirements of Section 09900, Painting. If any damage to the paint system occurs, the equipment shall be repainted as directed by the ENGINEER.

B. Surface preparation and painting shall conform to the requirements of Section 09900, Painting.

C. All gears, bearing surfaces, machined surfaces and other surfaces which are to remain unpainted shall receive a heavy application of grease or other rust-resistant coating. This coating shall be maintained during storage and until the equipment is placed into operation.

D. Certify, in writing, that the shop primer and shop finish coating system conforms to the requirements of Section 09900, Painting.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all valves and appurtenances in accordance with manufacturer's instructions and recommendations.

B. Unless otherwise approved by the ENGINEER, install all valves plumb and level. Install valves free from distortion and strain caused by misaligned piping, equipment or other causes.

3.2 FIELD TESTS AND ADJUSTMENTS

A. Adjust all parts and components as required to provide correct operation.

B. Conduct functional field test of each valve in presence of ENGINEER to demonstrate that each part and all components together function correctly.

3.3 MANUFACTURER'S SERVICE

A. A factory trained representative shall be provided for installation supervision, start-up and test services and operation and maintenance personnel training services. The representative shall make a minimum of 3 visits, 2 hours per visit, to the site. The first visit shall be for assistance in the installation of equipment. The second visit shall be for checking the completed installation and start-up of the system. The third visit shall be for training plant staff. Manufacturer's representative shall test operate the system in the presence of the ENGINEER and verify that valves conform to the requirements. Manufacturer’s representative shall revisit the job site as often as necessary until all trouble is corrected and the installation is entirely satisfactory.

B. All costs, including travel, lodging, meals and incidentals, shall be considered as included in CONTRACTOR’S bid price.

+ + END OF SECTION + +

SECTION 16136

OUTLET BOXES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install outlet boxes for mounting wiring devices and lighting fixtures.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. Phoenix Electrical Code, Article 370, Outlet, Switch and Junction Boxes and Fittings.
   2. UL Standard No. 514, Electrical Outlet Boxes and Fittings.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
   2. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
   3. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification

sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

4. Manufacturers technical information for outlet boxes proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Device Boxes:
   1. Material: Cast gray iron alloy, or cast malleable iron, with zinc electroplate finish in wet locations and zinc-coated sheet steel in dusty locations. Cast boxes shall be hub type and include external mounting lugs. In corrosive locations, boxes shall include a factory applied 40-mil PVC coating. In dusty locations, where conduit is installed concealed, boxes shall be steel galvanized and shall include suitable extension rings and covers, as required.
   2. Device Cover Plates:
      a. Stainless steel Type 302 alloy for indoor finished areas.
      b. Weatherproof while-in-use door type for wet and corrosive locations. Plates in corrosive locations shall include a factory applied 40-mil PVC coating.
      c. Integral with device for hazardous locations.
      d. Stainless steel screws and hardware.

B. Manufacturer: Provide device boxes of one of the following:
   a. Crouse-Hinds Company.
   b. Appleton Electric Company.
   c. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten boxes rigidly and neatly to supporting structures.

B. For units mounted on masonry or concrete walls, provide suitable 1/2-inch spacers to prevent mounting back of box directly against wall.

C. Leave no open conduit holes in boxes. Close unused openings with capped bushings.

D. Label each circuit in boxes and identify in accordance with Section 16122, 600 Volt Cable.

E. Install in conformance with Phoenix Electrical Code.

+ +END OF SECTION+ +

SECTION 16138

MANHOLES AND HANDHOLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install manholes and handholes.

B. Coordination: Coordinate manhole and handhole installation with piping, sheeting and other underground systems and structures and locate clear of interferences.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. National Electrical Code (NEC) current adoption.
   2. City of Phoenix – Amendments to the National Electrical Code.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
   2. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
   3. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with

the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

4. Manufacturer's technical information for manholes, handholes and accessories proposed for use.
5. Drawings showing interior and exterior dimensions and details of openings, jointing, inserts and reinforcing.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Material and Construction:
   1. Precast or cast-in-place type of reinforced concrete.
   2. Minimum interior dimensions as shown on the Drawings.
   3. Duct entrances sized and located to suit duct banks.
   4. Handholes and Manholes must have a bottom.

B. Accessories:
   1. Frames and Covers:
      a. Material: Covers and frames shall be cast aluminum alloy, Class H-20 highway rated.
      b. Covers: Watertight, sealed type marked "ELECTRICAL" in raised 2-inch letters. Identify covers as shown on the Drawings.
         1) Manhole covers to be 36 inch minimum.
      c. Frame shall be grouted on the manhole or handhole.
      d. Product and Manufacturer: Provide frames and covers of one of the following:
         1) Neenah Foundry Company.
         2) Campbell Foundry Company.
   2. Pulling Irons:
      a. Material: Galvanized steel.
      b. Cast in the wall opposite to the centerline of each incoming duct bank and 12-inches below centerline of bottom line of ducts.
      c. Product and Manufacturer: Provide one of the following:
         1) Catalog No. 8119 by A.B. Chance Company.
         2) Catalog No. DU2T3 by McGraw Edison Company.
   3. Cable Racks:
      a. Material: Galvanized steel.
      b. Cable racks shall adequately support cables with space allowed for future cables.

c. Each rack shall be a vertical assembly of 24-inch cable racks extending from within 6-inches of the manhole roof slab to within 6-inches of the manhole floor.
d. Product and Manufacturer: Provide one of the following:
1) Catalog No. J-5125 by Joslyn Manufacturing Company.
2) Catalog No. C203-1125 by A.B. Chance Company.

4. Cable Hooks:
a. Material: Galvanized steel.
b. Length: 7-1/2-inch minimum.
c. Product and Manufacturer: Provide one of the following:
1) Catalog No. J-5132A by Joslyn Manufacturing Company.
2) Catalog No. C203-1132 by A.B. Chance Company.

5. Insulators:
a. Material: Porcelain.
b. Product and Manufacturer: Provide one of the following:
1) Catalog No. J-5122 by Joslyn Manufacturing Company.
2) Catalog No. C203-1120 by A.B. Chance Company.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install manholes and handholes where shown on the Drawings. Verify final locations in field. Responsibility belongs to CONTRACTOR for all excavation and backfilling required for installation.

B. Complete installation of manholes and handholes so that structures are watertight. Apply foam sealant to all openings and penetrations. Seal all conduit openings to provide a water/bug-tight seal.
1. Product and Manufacturer: Provide one of the following:
a. Type DUX - Duct Sealing Compound, as manufactured by O-Z/Gedney
b. Type FST Foam Sealant, as manufactured by American Polywater Corp

C. Cable Supports in Manholes:
1. Attach cable racks with 3-inch by 3/8-inch diameter "tamp-in" studs mounted in 1-inch holes drilled into walls of manholes in the absence of inserts. Apply PVC coating to all racks.
2. Provide cable hooks to support each cable on each rack along the cable run within the manholes. Apply PVC coating to all hooks.
3. Individually support each cable at each hook on porcelain insulators. Provide sufficient slack for each cable.

4. Securely tie each cable in place at each insulator block to prevent excessive movement of insulators, cables, or fireproof tape. Tie cables with non-metallic 3/4-inch strapping tape as manufactured by 3M or tie down with nylon straps.

D. Grounding: Install a 3/4-inch by 10-foot copper-clad ground rod for each manhole. Bond all exposed metal manhole accessories and the concrete reinforcing rods with No. 4 AWG minimum bare copper wire and connect to the ground rod and to the duct bank ground cable.

E. Sump: Provide a 12-inch by 12-inch by 6-inch sump in manhole floor.

F. Provide grading rings for manholes when required to adjust cover to proper grade. Grading ring shall be minimum of 12-inches in height, constructed on the roof slab or cone section on which the manhole frame and cover shall be placed. The height of the grading ring shall be such as is necessary to bring the frame to the proper grade.

G. Metal Pullbox: Install NEMA 4X stainless steel wall mounted pullbox inside manholes/handholes where analog signal cables are mixed with power cables. Route conduits for analog cables directly into and out of metal pullbox so that no analog cables are exposed.

+ +END OF SECTION+ +

SECTION 16141

RECEPTACLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Scope:
   1. Provide all labor, materials, equipment and incidentals as shown on the Drawings, specified and required to furnish and install receptacles.

1.2 QUALITY ASSURANCE

A. Reference Standards: Comply with applicable provisions and recommendations of the following, except where otherwise shown or specified:
   1. Phoenix Electrical Code.
   2. UL Standard No. 1010, Electrical Receptacle Plug Combinations for Use in Hazardous Locations.
   3. Phoenix Building Code.

1.3 SUBMITTALS

A. Shop Drawings: Submit for approval the following:
   1. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
   2. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format. Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.
   3. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification

sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.

4. Manufacturer's technical information for receptacles proposed for use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Receptacles for Non-Hazardous Locations:
   1. Duplex grounding receptacle, two pole, three wire, 125 volt AC, 20 amperes.
      a. Product and Manufacturer: Provide one of the following:
         1) Catalog No. 5362, for dry indoor locations and Catalog No. 53CM62, for wet and corrosive locations, by Harvey Hubbell Incorporated.
         2) Catalog No. 5362, for dry indoor locations and Catalog No. 5362-CR, for wet and corrosive locations, by Arrow-Hart Incorporated.
         3) Or equal.
   2. Single grounding receptacle, corrosion resistant, two pole, three wire, 125 volt AC, 20 amperes.
      a. Product and Manufacturer: Provide one of the following:
         1) Catalog No. 53CM61, by Harvey Hubbell Incorporated.
         2) Catalog No. 5361-CR, by Arrow-Hart Incorporated.
         3) Or equal.

B. Receptacles for Hazardous Locations:
   1. Material: Factory sealed receptacle suitable for installation in Class I, Group D hazardous locations. Copper free aluminum receptacle and cover with cast gray iron alloy or cast malleable iron mounting box with zinc electroplate finish. Receptacle rated at 20 amperes, 125 to 250 volt AC, two wire, three pole. Provide matching plug for each receptacle.
   2. Product and Manufacturer: Provide one of the following:
      a. Series CPS by Crouse Hinds Company.
      b. Type CPS by Appleton Electric Company.
      c. Or equal.

C. Ground Fault Receptacles:
   1. Duplex receptacle, two pole, three wire, 125 volt AC, 20 amperes.
   2. If receptacles are installed outdoors, the receptacles must be rated Weather Resistant (WR) and must be marked as such on the receptacle itself with WR on the device.
   3. Product and Manufacturer: Provide one of the following:
      a. Catalog No. GF5362 or GFRS5326TR, by Harvey Hubbell Incorporated.
      b. Catalog No. TWRVGF20x, Cooper Wiring Devices

D. Surge Suppression Receptacles:
   1. Duplex grounding, surge suppression receptacle, two pole, three wire, 125 volt AC, 20 amperes, capable of absorbing a transient surge 6,000 volts minimum. Receptacle to include power on indicator light:
      a. Product and Manufacturer: Provide one of the following:
         1) Catalog No. 5350S by Harvey Hubbell Inc.
         2) Catalog No. 5380-GY by Leviton Manufacturing Company.

E. Power Receptacles: 480 volt interlocked receptacle with enclosed safety switch service outlet: Provide service outlets, quantity as shown on the Drawings for portable equipment.
   1. Material: Copper free aluminum enclosure with operating handle NEMA 4, with gasketed hinged door.
   2. Switch: Heavy duty, three pole, with visible blades, a quick make a break mechanism with reinforced, positive pressure type blade and fuse clips. Switch shall be mechanically interlocked with the receptacle. The switch cannot be closed until the plug is fully inserted and the plug cannot be withdrawn or inserted, unless the switch is open.
   3. Receptacle: Single ground receptacle, three wire, four pole, 600 volt, 60 amp. Provide two matching plugs.
      a. Type WSR, and Type APS plugs by Crouse-Hinds Company.

F. Power and Special Receptacles: Provide receptacles with number of poles and voltage and current rating as shown on the Drawings. Coordinate with equipment plugs. Provide matching plug for each receptacle.

G. Weatherproof While-In-Use Covers:
   1. Provide weatherproof while-in-use cover for all outdoor receptacles, including receptacles designated as WP, WPU, WR and WRU. Cover shall be hinged and be able to fully close with cords plugged into the receptacle.
   2. Product and Manufacturer: Provide one of the following:
      a. TayMac MM710C, as manufactured by Hubbell Corporation.
      b. Or equal.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install receptacles at locations as shown on the Drawings in outlet or device boxes in accordance with Section 16136, Outlet Boxes, in non-hazardous locations.

B. Install receptacles in PVC coated galvanized rigid steel conduit systems in hazardous locations.

C. Install receptacles with ground pole in the down position.

D. Mount receptacles 18-inches above finished floor, or in accordance with Phoenix Building Code, in non-hazardous locations and 4 feet-6 inches above finished floor in hazardous locations, unless otherwise noted.

E. Identify each conductor with the circuit number and the lighting panel number. Identification shall conform to the requirements of Section 16122, 600 Volt Cable.

F. Identify each receptacle with a permanent self adhesive label. Approximate size 3/8" x 1¼". The label shall include the panel name and circuit number.
    a. Product and Manufacturer: Provide one of the following:
        1) Catalog No. PTL-45422 by Brady.
        2) Or Equal

G. Install in conformance with Phoenix Electrical Code.

+ +END OF SECTION+ +

SECTION 16920

ELECTRICAL ACCEPTANCE TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Requirements for electrical acceptance testing of electrical equipment and materials.
   2. It is the intent of the tests described herein to assure that all electrical equipment is operational and within industry and manufacturer's tolerances and is installed in accordance with design specifications.
   3. Acceptance testing performed by equipment vendors at the point of manufacturer must conform to all requirements of this specification. Testing performed at the point of manufacture which conforms to generally accepted industry practices is also acceptable so long as adequate test result documentation is provided.

B. Scope:
   1. All of the Acceptance Tests are required to be performed whether they are described in this Section or other applicable Sections. At a minimum, the following electrical systems are to be tested:
      a. Service entrance section.
      b. Main distribution panel.
      c. Motor control centers.
      d. Switchgear, low and medium voltage.
      e. Panelboards, power and lighting/receptacle.
      f. Transformers, dry type and oil filled.
      g. Feeders.
      h. Cables rated 600 volts and higher.
      i. Transfer switches, manual and automatic.
      j. Surge Protection Devices.
      k. Grounding and bonding system.
      l. Lighting fixtures and associated controls.
      m. Other systems as listed under Part 3 of this Specification.

C. Related Documents:
   1. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and other Division 1, General Requirements, Specification Sections, apply to the Work of this section.

2. All work performed under this Section of the Work is subject to all requirements contained under Section 16050, General Provisions.
3. All Division 16, Electrical, Specifications for electrical equipment provided for this Project that requires electrical acceptance testing.

1.2 REFERENCE STANDARDS

A. NETA ATS, Standard for Acceptance Testing Specifications for Electrical Power Equipment and Systems, 2017 edition.

B. NFPA 70, National Electrical Code, 2017 edition, as amended by the City of Phoenix.

C. Incorporated by reference all Codes, Standards, and Specifications referred to in the "Applicable References" section of NETA ATS-2017.

1.3 DEFINITIONS

A. NETA, InterNational Electrical Testing Association Inc.

B. NEC, National Electrical Code.

1.4 SYSTEM DESCRIPTION

A. Conditions:
1. Provide all items, articles, materials, operations, or methods listed, mentioned, or scheduled on Drawings and/or herein including all labor, materials, equipment, and incidentals necessary and required for Electrical Acceptance Testing.
2. Following established procedures, equipment shall be energized after certification by the testing organization that the installation is satisfactory.
3. Correct or replace any current-carrying circuit, electrical equipment, or system which is defective or grounded and correct all other troubles encountered by these tests. All defects, whether through faulty workmanship or materials furnished, shall be corrected under this Section at the CONTRACTOR'S expense.

1.5 SUBMITTALS

A. Submittal General Requirements: Submit for approval the following:
1. Refer to and comply with the requirements of Section 01332, Shop Drawing Procedures.
2. CONTRACTOR shall submit an electronic copy per Specification Section 01332, Shop Drawing Procedures. Text shall be in electronic ASCII format.

Drawings and figures shall be in Version 2012 or newer AutoCAD ".dwg," or pdf ".pdf" format.

3. A copy of this specification section, with addendum updates included, and all referenced and applicable sections, with addendum updates included, with each paragraph check-marked to indicate specification compliance or marked to indicate requested deviations from specification requirements. Check marks (✓) shall denote full compliance with a paragraph as a whole. If deviations from the specifications are indicated, and therefore requested by the CONTRACTOR, each deviation shall be underlined and denoted by a number in the margin to the right of the identified paragraph, referenced to a detailed written explanation of the reasons for requesting the deviation. The ENGINEER shall be the final authority for determining acceptability of requested deviations. The CONTRACTOR shall furnish equipment and/or services as specified if an exception and/or deviation is rejected. The remaining portions of the paragraph not underlined will signify compliance on the part of the CONTRACTOR with the specifications. Failure to include a copy of the marked-up specification sections, along with justification(s) for any requested deviations to the specification requirements, with the submittal shall be sufficient cause for rejection of the entire submittal with no further consideration.
4. The CONTRACTOR shall submit the preventive maintenance information package as part of the shop drawing submittal package to the ENGINEER for review and approval. **SHOP DRAWING SUBMITTAL PACKAGE WILL NOT BE APPROVED WITHOUT ACCEPTANCE OF PREVENTIVE MAINTENANCE INFORMATION AS DESCRIBED IN SPECIFICATION SECTION 01785.**

B. Test Report Forms:
1. All test reports shall be submitted using NETA test forms. Reports shall be legible using permanent ink. Pencil is not acceptable.
2. Provide for ENGINEER'S review and approval a copy of each test form to be used on the Project. No testing shall be started prior to approval of all test forms.
3. All test reports shall include the following information:
   a. Summary/description of the Project.
   b. Description of equipment tested.
   c. Description of the tests.
   d. Test data and analysis of the data indicating whether the equipment passed or failed the test.
   e. Each completed test form shall be signed by the testing agency technician.
4. All test data records shall include the following minimum requirements:
   a. Equipment identification, including tag numbers.

b. Humidity, temperature, and other conditions that may affect the results of the tests and/or calibrations.
c. Date of inspections, tests, maintenance, and/or calibrations.
d. Identification of the testing technician and their employer.
e. Indication of inspections, tests, maintenance, and/or calibrations to be performed and recorded.
f. Indication of expected results when calibrations are to be performed.
g. Indication of "as-found" and "as-left" results, as applicable.
h. Sufficient spaces to allow all results and comments to be indicated.

5. Provide completed 16000 series test forms in Section 01331—Reference Forms for each item tested.

C. Qualifications Submittals:
1. Submit appropriate documentation demonstrating that the testing organization and its technicians meet the requirements listed herein. No testing shall be started prior to approval of qualifications submittals and approval of proposed test form submittals.

D. Closeout Submittals:
1. Provide one copy each to ENGINEER and OWNER of all testing reports organized as follows:
a. Bind report in 3-ring binder(s).
b. Identify Project name, description, testing organizations name, and submittal date on front face and back cover of binder.
c. Provide all test reports, organized by equipment tag number.
d. Separate different equipment numbers with colored or numbered tabs.
e. Provide an index/table of contents.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Any materials provided as part of the testing shall be new, unused, and in manufacturer's original packing.

2.2 TEST INSTRUMENT CALIBRATION

A. Contractor performing the testing shall have a calibration program which assures that all applicable test instruments are maintained within rated accuracy for each test instrument calibrated.

B. Contractor performing the testing shall maintain up-to-date instrument calibration instructions and procedures for each test instrument calibrated.

C. It is preferred that instrument calibration accuracy be directly traceable to the national Institute of Standards and Technology (NIST).

D. Instruments shall be calibrated in accordance with the following frequency schedule:
   1. Field Instruments: Analog, six months maximum. Digital, 12 months maximum
   2. Laboratory Instruments: 12 months maximum
   3. Leased Specialty Equipment: 12 months maximum.

E. Dated calibration labels shall be visible on all test equipment.

F. Records, which show date and results of instruments calibrated or tested, must be kept up to date.

G. Calibrating standard shall be better accuracy than that of the instrument tested.

PART 3 - EXECUTION

3.1 QUALIFICATIONS

A. The testing organization shall be an independent, third party entity, which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems being evaluated. The testing organization must meet the following requirements:
   1. The testing organization shall be regularly engaged in the testing of electrical equipment, devices, installations, and systems.
   2. The testing organization shall use technicians who are regularly employed for testing purposes.
   3. The testing organization shall be a member of NETA.
   4. Submit appropriate documentation demonstrating that the testing organization meets the requirements listed above.
   5. Technicians performing these electrical tests and inspections shall be trained and experienced concerning the apparatus and systems being evaluated. These individuals shall be capable of conducting the tests in a safe manner and with complete knowledge of the hazards involved. They must evaluate the test data and make a judgment on the serviceability of the specific equipment.
   6. Technicians shall be certified in accordance with ANSI/NETA ETT-2010, “Standard for Certification of Electrical Testing Technicians”. Each on-site crew leader shall hold a current certification, Level III or higher, in electrical testing.

3.2 NOTIFICATION

A. Notify ENGINEER and Construction Manager at least two days prior to testing so that they may be present during testing.

3.3 SAFETY AND PRECAUTIONS

A. Safety practices shall include, but are not limited to, the following requirements:
   1. Occupational Safety and Health Act OSHA.
   2. Accident Prevention Manual for Industrial Operations, National Safety Council, Chapter 4.
   3. Applicable State and local safety operating procedures.
   4. NETA Safety/Accident Prevention Program.
   5. National Fire Protection Association - NFPA 70E.
   6. ANSI Z244.1 American National Standards for Personnel Protection.

B. All tests shall be performed with apparatus de-energized, except where otherwise specifically specified.

C. The testing firm shall have a designated safety representative on the Project to supervise operations with respect to safety.

3.4 EQUIPMENT TESTING REQUIREMENTS

A. The intent of this Specification is not to duplicate testing performed at the point of manufacture or to impose additional burden on the CONTRACTOR which does not benefit the Project. The intent is to verify that electrical equipment has been securely fastened down, supported, and installed in accordance with the manufacturer's requirements. The intent is also to verify that all electrical connections are correctly torqued, properly aligned, properly insulated, and properly supported and that equipment is clean and ready for operation.

B. Except as noted below or as approved by engineer, test the following equipment and assemblies in full accordance with NETA-ATS 2017.

C. Switchgear and switchboard assemblies.

D. Transformers, dry type, air-cooled, low-voltage, small.

E. Transformers, dry type, air-cooled, large.

F. Transformers, liquid-filled.

G. Cables, low-voltage, 600 volt maximum.
   1. Perform tests only on cables Size #4 AWG and larger.

H. Cables, medium-voltage and high-voltage.

I. Metal-enclosed busways.

J. Switches, air, low-voltage:
   1. Perform tests only on switches rated 100 amps or higher.

K. Switches, air, medium-voltage, metal-enclosed.

L. Switches, oil, medium-voltage.

M. Switches, vacuum, medium-voltage.

N. Switches, Cutouts:
   1. Perform tests only on equipment rated 100 amps or higher.

O. Circuit Breakers, Air, Insulated-Case, Molded-Case:
   1. Perform visual and mechanical inspections in accordance with NETA for all circuit breakers.
   2. Perform electrical tests only on circuit breakers rated 100 amps or higher provided in power distribution and lighting/receptacle panelboards.
   3. No testing is required for circuit breakers provided as part of any of the following:
      a. A UL listed control panel.
      b. UL listed factory supplied motor control centers.
      c. Stand-alone combination motor starters.

P. Circuit breakers, air, medium voltage.

Q. Circuit breakers, oil, medium voltage and high voltage.

R. Circuit breakers, vacuum, medium voltage.

S. Circuit switchers.

T. Network protectors, 600 volt class.

U. Protective relays.

V. Metering devices.

W. Regulating apparatus, voltage, step and induction voltage regulators.

X. Regulating apparatus, load tap-changers.

Y. Grounding systems.

Z. Ground-fault protection systems, low-voltage.

AA. Rotating Machinery, AC Motors, and Generators:
1. Motors provided as part of valve actuators do not require testing.
2. Perform visual and mechanical inspections on all motors.
3. Perform rotation tests on all motors.
4. Perform electrical tests only on motors 50 horsepower and larger.

BB. Motor control, motor starters, low-voltage.

CC. Motor control, motor starters, medium-voltage.

DD. Adjustable speed drive systems.

EE. Direct-current systems, batteries, flooded and valve-regulated lead-acid.

FF. Direct-current systems, chargers.

GG. Surge arresters, low-voltage surge protection devices.

HH. Surge arresters, medium and high-voltage surge protection devices.

II. Capacitors and reactors - all types.

JJ. Outdoor bus structure.

KK. Emergency and standby power systems, engine generator.

LL. Emergency and standby power systems, UPS.

MM. Emergency and standby power systems, automatic transfer switches.

NN. Fiber-optic cables.

3.5 CONSTRUCTION

A. Interface with Other Work:
1. Coordinate all testing activities with other disciplines. Retest any equipment disturbed or damaged in any manner after initial testing.

3.6 CLOSEOUT REPORT

A. Provide comprehensive bound test report in accordance with Part 1 of this Specification.

++ END OF SECTION ++

SECTION 17262

PROGRAMMABLE LOGIC CONTROLLER, HARDWARE, SOFTWARE, AND PROGRAMMING

PART 1 - GENERAL

1.1 SCOPE

A. Contract documents illustrate and specify general requirements of the Programmable Logic Controller (PLC), Operator Interface Terminal (OIT), hardware, software, networking, and programming. This document does not necessarily show or specify all components, wiring, or accessories required for a completely integrated system.

B. Provide all labor, materials, equipment, documentation, furnish, install, calibrate, test, start-up, program, configure, commission, and place into satisfactory operation of all PLCs, OITs, networking hardware, software, and programs.

C. Conform the design and programming of all PLCs, OITs, software, and programs to the specifications herein.

D. Provide all necessary tools, such as cabling, software, etc, as required to fulfill the programming requirements of the contract documents.

1.2 COORDINATION

A. Coordinate the installation of all items specified herein as required to ensure the complete and proper functionality of all PLCs, OITs, software, programs, networking, and accessories.

B. Provide all PLCs, OITs, software, networking, and programs to meet the functional requirements as detailed in Section 17051 – Computer Control System Process Control Descriptions as depicted in the CONTRACT DRAWINGS.

C. Install and wire all Inputs/Outputs (I/O) as specified in Sections 17260 – Control Panels.

D. Install PLCs or remote I/O in control panels with voltages of 120 VAC or less.

E. Relinquish all usernames and passwords to the OWNER, this includes but is not limited to all hardware, software, and programs. All usernames and passwords are the property of the OWNER.

F. Provide separate 120 VAC receptacles in the control panel for PLC hardware. Label each receptacle, i.e. "Fiber Optic Converter Use Only". Provide an isolating supplementary protector for each receptacle.

G. Provide all PLC and OIT hardware and accessories with Heresite conformal coating, or equal protection, against hydrogen sulfide levels up to seven ppm.

1.3 DEFINITIONS

A. **PLC:** Programmable Logic Controller.

B. **OIT:** Operator Interface Terminal. This terminal is located in the field on a local control panel usually connected directly to a PLC. The purpose is to locally control the process or machine, for example a Magelis Screen.

C. **HMI:** Human Machine Interface. The City of Phoenix uses a desk top computer, Operator Workstation (OWS), which interfaces the operator with the entire process.

D. **DISTRIBUTED INPUT / OUTPUT (I/O):** Is generally when multiple processors control different section of a process using communication protocols, i.e. Modbus RTU, Modbus TCP/IP.

E. **REMOTE I/O:** One processor connected to several remote racks, drops, by parallel cables or network equipment.

1.4 QUALITY ASSURANCE

A. REFERENCE STANDARDS: PLCs, OITs, networking hardware, software, programs, and accessories must comply with applicable provisions of the following, except where otherwise shown or specified.
   1. International Electrotechnical Commission (IEC).
   2. American National Standard Institute (ANSI).
   3. Institute of Electrical and Electronic Engineering (IEEE).
   4. National Electrical Manufacturer's Association Standards (NEMA).
   5. Operational Safety and Health Administration (OSHA) Regulations.
   6. National Fire Protection Agency (NFPA).
   7. State and local code requirements.
   8. Where any conflict arises between codes or standards, the more stringent requirement applies.
   9. Provide all panel devices with the label of the Underwriters' Laboratory (UL), Inc. Document the UL/UR listed number on the Bill of Materials (BOM) of the control panel drawings.

1.5 SUBMITTALS

A. Submittals:

1. The PLC submittal requirements and BOM are to be submitted with the control panel submittal package prior to the 90% design review. Reference Section 17260 – Control Panels.
2. Provide the manufacturer's technical data sheets, cut sheets, and product literature for all PLCs, OITs, networking hardware, software, programs, and accessories. Clearly identify exact equipment and materials that are being supplied on the manufacturer's data sheets.

B. PLC Program Coordination Workshop:
1. Conduct a program software coordination workshop with the PLC PROGRAMMER, ENGINEER, and OWNER prior to shipment of the equipment.
   a. Workshop Agenda:
2. Review the control logic and function block programming styles.
3. Review the PLC I/O signal list.
4. Review the hardware configuration
5. Review the network configuration.
6. Review the DNP3 configuration associated with the NOR module. This should include files from the M340 BMXNOR RTUconf Tool software.
7. Review CONTRACT DRAWINGS and Section 17051 – Process Control Description.
   a. Attendees:
      1) PROGRAMMER/CONTROL PANEL SUPPLIER.
      2) CONTRACTOR.
      3) OWNER PROCESS CONTROL REPRESENTATIVE.
      4) ENGINEER.
      5) DESIGN ENGINEER FIRM REPRESENTATIVE.
      6) I&C INSPECTOR.
      7) OWNER PROJECT MANAGER (OPTIONAL).
8. Conduct a minimum of a 4 hour workshop on site, unless stated otherwise. This workshop is to ensure that the software code, OIT screens, hardware configuration, and addressing are compatible with the OWNER'S system.
9. Provide 3 hard copies and 3 soft copies of all OIT and PLC programming with addressing, comments, and descriptions at a minimum of
10. 3 weeks prior to the workshop.

1.6 O&M MANUALS

A. Comply with the requirements of Section 01781 – Operations and Maintenance Data and the following:
1. Provide a hard copy of all PLC programs complete with comments and address descriptions.
2. Provide a USB Flash Drive containing a copy of the OIT and PLC program with complete annotated documentation. Remove any passwords and

relinquish all rights of the program to the OWNER with READ/WRITE access.

PART 2 - PRODUCTS

2.1 PROGRAMMABLE LOGIC CONTROLLERS

A. General:
   1. Provide a M580 processor on a X80 I/O platform with the following functionality:
      a. All operational, protective, status, and alarm functions execute as described per Section 17051 – Process Control Description, 17260 – Control Panels and the CONTRACT DRAWINGS.
      b. Perform process control functions, data collection, communicate with other PLCs, and distribute process information along the local area network (LAN).
      c. Capable of stand-alone operation during any communication failure.
      d. Capable of downloading and uploading programs from a remote workstation over the LAN and locally programmed from a portable laptop computer.
      e. Field expandable to allow for the growth of the system by simple addition and configuration of hardware.
      f. I/O modules are capable of insertion and removal under power.
      g. I/O modules can only be inserted one direction to prevent improper installation of modules.
      h. Key all modules and connectors to safeguard against improper insertion of a module into the backplane slot.
      i. Each component must include a clearly visible faceplate with appropriate data such as the manufacturer's model number and a brief description of the component's functionality.
      j. Provide all cables and connectors as specified by the manufacturer. Assemble and install cables per the manufacturer's recommendations.
      k. Provide configurable alarming capability. Each alarm point can be configured to display an alphanumeric message in the alarm buffer. The alarm buffer can be displayed from an OIT.
   2. PLC Module Fusing:
      a. Provide each analog and discrete I/O module with at least one properly sized fuse per the manufacture recommendations.
   3. Surge Protection:
      a. Install the surge protection as stated in Guide Specification 17260 – Control Panels.
   4. Virtual Private Network (VPN) access will NOT be granted for any programming, troubleshooting, testing, and/or support. If needed a PCTS laptop can be provided.

B. Chassis:
   1. Backplanes and modules if applicable shall be the Hardened (H) model.
   2. Backplanes will be Ethernet BME modules only:
      a. BME XBP 0400H (Ethernet).
      b. BME XBP 0800H (Ethernet).
      c. BME XBP 1200H (Ethernet).
   3. General Chassis Layout: If the cabinet space permits provide a spare slot between the last communication module and each of the different types of I/O modules, i.e. communication module, spare dust cover, DI's, spare, DO's, spare, AI's, spare, AO's spare.
      a. Install the power supply in the first slot (CPS).
      b. Install the CPU to the right of the power supply.
         1) M580 requires two slots, 00 and 01.
      c. Install additional communication modules and specialty modules to the right of the CPU.
   4. Treatment Plants require an additional communication module for redundancy BMENOC0321C.
   5. If multiple communication modules are required, install them in this order.
      a. NOC.
      b. NOR.
      c. Specialty protocol for example, (BMEAHI0812H) HART.
         1) Install any specialty modules if applicable, to the right of the communication modules.
      d. If a fiber module is required, install it in the last slot on the backplane, for example: in slot 07 on an BMEXPB0800H 8 slot Ethernet backplane.
      e. Install all DI modules next, based on required spares leave an open slot if needed for an additional module. Install a dust cover in the empty slot, do not leave the slot empty, part number BMXXEM010.
      f. Install all DO Modules to the right of the DI modules or open slot.
      g. If backplane and cabinet space permit leave an open slot between the discrete modules and the analog modules.
      h. Install AI modules next, based on required spares leave an open slot if needed for an additional module.
      i. Install AO modules to the right of the AI modules, based on required spares leave an open slot if needed for an additional module.
      j. If cabinet space permits upsize the backplane to meet the needs of the required spares and spaces between discrete and analog modules.
   6. Remote I/O (RIO)
      a. Each backplane that does not contain the CPU will need:
         1) Ethernet capability
         2) BME CRA 31210C (module)
         3) Create a daisy chain loop using copper or fiber depending on the distance from the main backplane and the RIO backplane.
            a) A copper cable connection between two consecutive RIO backplanes cannot exceed 100m (328 ft.).

b) A multi-mode fiber connection between two consecutive RIO backplanes cannot exceed 2.5km (1.5 mi.).
c) A single-mode fiber connection between two consecutive RIO backplanes cannot exceed 15km (9.3 mi.).
d) When the need for a fiber connection is required use the following hardware:

4) BMX NRP 0200, multi-mode.
5) BMX NRP 0201, single-mode.

7. Dust Cover:
   a. BMX XEM 010.

C. Power Supply:
1. Provide a chassis mounted power supply with the capacity to power the backplane, CPU, required modules, and similar future modules. Preferred but not limited to:
   a. BMX CPS 3500H
   b. BMX CPS 3020H

D. CPUs:
1. Provide one of the following M580 CPUs.
   a. BME P58 1020H
   b. BME P58 2040H
   c. BME P58 4040
   d. BME H58 2040H

E. Communication / Specialty Modules: Confirm with the manufacture that this is the most accurate and current module for the application.
1. Provide the following modules for Ethernet TCP/IP. All Treatment Plant PLCs require at least one redundant Ethernet TCP/IP communication module.
   a. BME NOC 0321C, Gig Speed
2. Provide the following module for DNP3 or Serial RTU communication. All SCADA PLCs require a DNP3 communication module.
   a. BME NOR 2200H
3. Provide the following module for HART communications.
   a. BME AHI 0812H
4. Provide the following module for Thermocouples or RTD's.
   a. BMX ART 0814H
5. Prove one of the following modules for High Speed Counting.
   a. BMX EHC 0200H
   b. BMX EHC 0800H

F. Discrete and Analog I/O Modules:
1. Provide one of the following modules for Discrete Inputs.
   a. BMX DDI 1602H, 16 Input, 24 V DC
   b. BMX DAI 1604H, 16 Input, 120 V AC

2. Provide one of the following modules for Discrete Outputs.
   a. BMX DDO 1602H, 16 Output, 24 V DC
   b. BMX DDO 1612H, 16 Output, 24 V DC
   c. BMX DAO 1605H, 16 Output, 100..240 V AC
   d. BMX DRA 1605H, 16 Output, Relay, 24 V DC – 24..240 V AC
3. Provide the following module for Mixed Discrete Inputs/Outputs.
   a. BMX DDM 16025H, 8 Input, 8 Output, Relay, 24 V DC
4. Provide the following module for Analog Inputs.
   a. BMX AMI 0810H
5. Provide one of the following modules for Analog Outputs.
   a. BMX AMO 0410H, 4 Output
   b. BMX AMO 0802H, 8 Output
6. Provide the following module for Mixed Analog Inputs/Outputs.
   a. BMX AMM 0600H, 4 Input, 2 Output

G. Terminal Blocks and Wiring:
   1. Provide the required Terminal Blocks for each module.
   2. In addition to the 17260 – Control Panel requirements, ensure all thermocouples and resistive temperature devices (RTD) are wired per the manufacturer recommendations.
   3. Wiring spare I/O to the PLC module is not permitted.

H. PLC System Protection:
   1. ALL REMOTE SITES SHALL BE BACKED UP BY A UPS. See specification section 17260 for model specific part numbers.

I. PLC Environmental Requirements:
   1. All PLCs must meet or exceed the following environmental requirements:
      a. Minimum temperature range:
         1) Operating: 0-55o C (+32 to +131o F)
         2) Storage: -23 to +70 o C (-13 to +158 o F)
      b. Relative humidity: 30 to 95% non-condensing
      c. Altitude:
         1) Operation: 0-6,500 feet minimum
         2) Storage: 0-9,800 feet minimum
      d. Degree of protection: NEMA 1(IP20)
      e. Vibration resistance in accordance with at least one of the following installed rating:
         1) DIN rail mounted PLC: 10-57 Hz, amplitude 0.075 mm, acceleration 25-100 Hz.
         2) Panel or plate mounted PLC: 2-25 Hz, amplitude 1.6mm, acceleration 25-200 Hz.
         3) In compliance with IEC 60068 and IEC 61131.
            a) Shock resistance: $147 m/s^2$ for 11ms.
         4) Environmental Limitations:

a) Equipment should be rated for continuous operation, capable of driving full load without derating, under the following conditions:
b) Remotes located outdoors shall have solar shields for temperature even under a canopy.

2.2 PLC SOFTWARE:

A. Acceptable PLC Programming Software:
   1. Develop all PLC programming application utilizing the LATEST version of Schneider Electric EcoStruxure Control Expert.
   2. CONTRACTOR shall provide the software and license for the City.

2.3 PLC PROGRAMMING:

A. General PLC Software Set Up: List of approved integrators:
   - Black & Veatch Corporation
     2231 E Camelback Rd., Suite 250
     Phoenix, AZ 85016
     Shawn Rohr rohrsb@bv.com
     602-381-4413 or 602-381-4400
     Cell: 623-340-0810
     Darrel Nienhueser NienhueserD@bv.com
     602-381-4447
   - RDC
     3411 S. 44th Street
     Phoenix, AZ 85040
     Steve Vincelette SVincelette@rdc-electrical.com
     602-721-2924
   - Wunderlich-Malec
     1580 North Fiesta Blvd., Suite 102
     Gilbert, AZ 85233
     Steve Garcia steve.garcia@wmeng.com
     480-874-1175 Ext. 3024
     Cell: 602-312-2421
   - Prime Control
     1515 W. University Dr., Suite 104
     Tempe, AZ 85281
     James Gatlin j.gatlin@prime-controls.com
     480-781-0220
     Cell: 602-377-2844
   - M3 Engineering
     2175 W. Pecos Rd., Suite 3
     Chandler, AZ 85224

Jesus Zepeda jesus.zepeda@m3eng.com
480-753-3607

1. Approved protocols are: Modbus RTU, Modbus TCP/IP, DNP3, and HART.
2. If configuring specialty modules using third party software provide the software and file for the module being programmed.
3. Backup Copies & File Sharing: When transferring files to and from organizations, provide archive files (.sta) and exported files (.zef). The file name shall be capitalized with a short description of the area, project subject, and latest revision date separated with underscores.
4. Examples:
   a. 6L-B1_02012020.sta = SCADA site 6L-B1 on February 1st 2020.
   b. VVWTP_TB12_01122019.zef = Val Vista WTP – Traveling Bridge 12 on January 12th 2019.
5. Processor Set Up:
   a. M580 Configuration:
      1) Request OWNER Programmer to supply template file.
      2) Request OWNER Programmer to confirm latest firmware for applicable processors and modules.
      3) Request OWNER Programmer to supply latest DFB Library.
   b. Naming Conventions:
      1) Physical Input/Output Variable/Alias Names
         a) Control Expert allows up to 32 characters for variable names, use as many characters as you need to adequately describe the variable. Use the descriptions from the P&ID drawings, which should match the computer control system tag names in the 17226.
      2) Code Section Names:
      3) First_Letter_Capital_Separated_By_Underscores.
      4) Logical Variable Names:
      5) FirstLettersCapital+Suffix.
         a) First part of suffix to indicate where the variable originates (PLC, OIT, CCS, or SCADA). Second part of suffix is the data type (Discrete, Integer, Real, or Word).
         b) Examples:
         c) VariableNamePD: A Discrete value that originates in the PLC. VariableNameOI: An Integer value that originates in the OIT. VariableNameCR: A Real value that originates in the CCS. VariableNameSW: A Word value that originates in the SCADA.
   c. Communication Networks:
      1) Module Location
         a) All_Caps_Ethernet_Port.
         b) Example: CPU_Ethernet_Port or NOE_Ethernet_Port.
6. Physical IO Data Types:

a. For M580 PLCs
   1) Use Device DDTs with the naming convention as the default.
   2) Assign an Alias' to each input/output used in the program.

7. Logical Data Types:
   a. Use only EDT variable types.
      1) Addressing:
         a) Group addresses for sharing with other devices in a contiguous fashion for efficiency in communications. Submit any unusual addressing conflicts to the Lead UTS.

Variable Type	Group Description	Data Type	Address Range
Discrete Inputs / Reads	Physical DI's	EBOOL	
	Module Status	BOOL	PCL0_d…MOD_HEALTH
	From SCADA/Field Device/CCS	EBOOL	%M001 - %M199
	From OIT	EBOOL	%M1000 - %M1199
Discrete Outputs / Writes	Physical DO's	EBOOL	
	Module Status	BOOL	PCL0_d…MOD_HEALTH
	To SCADA/Field Device/CCS/OIT	EBOOL	%M200 - %M999
Discrete Inputs / Outputs	Miscellaneous if necessary for internal R/W (DO or DI)	EBOOL	%M2000 - %M…
Analog Inputs / Reads	Physical AI's	INT	
	Module Status	BOOL	PCL0_d…MOD_HEALTH
	From SCADA/Field Device/CCS	WORD	%MW001 - %MW199
		REAL	%MW200 - %MW498
		INT	%MW500 - %MW599
	Reserved for NOR Module		%MW1000- %MW1020
	From OIT	INT	%MW1300 - %MW1499
		REAL	%MW1500 - %MW1698
Analog Outputs / Writes	Physical AO's	INT	
	Module Status	EBOOL	PCL0_d…MOD_HEALTH

	To SCADA/Field Device/CCS/OIT	WORD/REAL	%MW600 - %MW798
	To CCS/OIT	REAL	%MW800 - %MW998
Analog Inputs / Outputs	Miscellaneous if necessary for internal R/W (AO or AI)	Any	%MW2000 - %MW…

B. Program Development:
   1. Safety First: It is the responsibility of the integrator to ensure that they identify and comply with the relevant safety standards. Failure to have interlock and permissive code in place may result in personal injury and damage to equipment. If you are unsure, please ask someone.
   2. Functionality: Second to safety concerns, the program must follow the engineering specifications and the process control description.
   3. General:
      a. All control loops are to function as described in section 17051 – Computer Control System Process Control Descriptions, and as depicted on the drawings.
      b. Develop the function block application in a workspace that will allow the section to be printed on standards 8.5 x 11 paper.
      c. When connecting function blocks, provide straight lines that are adequately spaced apart with 90 degree turns. Limit crossing over, intersecting, or overlapping.
      d. Provide a "top down" approach when writing the program functionality. Provide a logical order from the start of the sequence or process to the end.
      e. Keep it simple, the majority of all logic can be accomplished using a few blocks included in EcoStruxure Control Expert.
   4. Sections: Group similar programming function blocks into the same section. Multiple sections of the same type are permitted (i.e. a program may have two DI mapping sections; Discrete_Inputs01 and Discrete_Inputs02). Examples:
      a. PLC_Clock_Status.
      b. Comm_HeartBeat.
      c. Discrete_Inputs.
      d. Descrete_Outputs.
      e. Analog_Inputs.
      f. Analog_Outputs.
      g. Alarms.
   5. Standardized Sections of Logic and PLC Health:
      a. All PLC's, and OIT's require a heartbeat to provide a communication check.
      b. PLC Clock: Set the clock to the correct time using your programming computer.

1) Plant PLCs: The City of Phoenix has code that allows the CCS to synchronize the PLC clock to the correct time at regular intervals. Request code from Lead User Technology Specialist.
2) SCADA PLCs: Utilize the NTP utility from the NOR module.

c. Heartbeat: The City of Phoenix has code that allows the CCS to handshake with the PLC and confirm a communication connection. Request code from Lead User Technology Specialist.
d. Alarms: Request code from Lead User Technology Specialist.

6. Code Segregation: Segregate the code into as many sections as there are topics, do not group unrelated code. If you are unsure if one code snippet is related to another create a new section. This makes finding the code during commissioning, plant upgrades, and troubleshooting much easier.
7. Comments: Comments are significant, they document changes and prevent confusion. Use comment boxes to segregate code with a title and description of the purpose of the code, the more detailed the documentation the better.
8. Language: Write code using only Function Block Diagram (FBD).
9. FFBs versus DFBs: The City of Phoenix has a library of DFBs for common programming, please request the code. Using your best judgment please try to avoid the use of any other DFBs. In practice it has been found that sometimes the code inside executes, other times it does not. It is acceptable to use repetitive code however, if the repetitive code completely occupies or requires more than one section, create a DFB. If user defined function blocks are required provide each block as a single instruction in the programming environment. Designate pin assignments and names for all inputs and outputs. All inputs and outputs required for DFB logic must pass through a pin attached to that DFB, utilize these pins to connect to the PLC database. DFBs that use serial communication to non-PLC devices (i.e. generator) reference this communication internally in the DFB without pins. All DFBs shall be written in FBD language.
10. Analog Scaling: Scale all hardware analog inputs and outputs in the module configuration to engineering units (EU). All analog data to be passed to/from the Computer Control System (CCS) shall be passed in the proper data type to maintain the EU without scaling or conversion.
    a. For Remote Facilities, proper data type will be WORD (with the exception of Run Times and Flow Totals). Additional scaling to add sufficient resolution will be specified by OWNER Programmer.
11. Disable Unused Analog Input/Output Channels: Disable AI/AO channels that are not used in the Module.

2.4 OIT SCREENS

A. Provide one of the following Magelis OITs to meet the requirements of the CONTRACT DOCUMENTS. Model numbers do **NOT** include conformal coating. The CONTRACTOR must add this option from the manufacturer.
   1. HMI GTO6315.

B. Provide a Compact Flash card for uploading and retrieval of historical data logging from the Magelis OIT.
   1. Compact Flash Manufacturer and Part Number:
      a. Modicon, 1GB MPCYN00CF100N.

C. Develop OIT screens utilizing the latest version of Vijeo Designer.

D. Panels Installed Outdoors:
   1. Mount OITs on the inside of the inner cabinet door of the control panel.

E. Animate instruments for devices utilizing a color scheme to indicate current status: The color red indicates “on”, “running”, or “open” and green indicates “off” or “closed”. Provide text with every color indicating the status of the color (i.e. if a button is red, text should overlay the button stating “On”, “Running”, or “Open”).

F. Coordinate OIT screens to resemble existing screens that are in operation with the OWNER, this includes event logging, alarming, trending, fonts, colors, and graphical buttons.

G. Provide a process flow diagram screen with graphics as described in the control description.

H. Utilize the exported database from the corresponding processor for the tag database.

2.5 NETWORKING

A. General:
   1. Refer to the network drawing as shown on the CONTRACT DRAWINGS.
   2. Provide simplex power receptacles for network devices that requires a power source.

B. Provide all networking hardware as follows:
   1. As stated per CONTRACT DRAWINGS.

C. Serial (RS-232, RS-422 and RS-485):
   1. Provide all serial connections as stated per CONTRACT DRAWINGS.
   2. Install in the control panel all necessary cables and hardware that use serial network topology (i.e. media converters, protocol converters, and properly terminated cabling).

D. Ethernet:
   1. Provide all Ethernet connections as stated per CONTRACT DRAWINGS.
   2. Install in the control panel all necessary cable and hardware required by the Ethernet devices.

3. All Ethernet switches must be managed switches. Provide a DIN rail mounted Cisco Managed Ethernet switch in control panels that have multiple Ethernet devices.
4. 4. Provide protocol and media converters as needed.

E. Fiber:
1. In accordance with Section 17101, Process Control System Fiber Optic Cabling and as shown on the CONTRACT DRAWINGS.

F. Radio.
1. CONTRACTOR shall contract SWLan Connections (480-895-9832) for radio path study prior to antenna installation.
2. Provide the following:
   a. High Capacity Subscriber Unit (HSU)
3. Provide high capacity access connectivity of up to 100Mpbs net aggregate throughput Subscriber Unit which supports 4.9 to 5.8Ghz radio and contains an integrated antenna.
   a. Radwin HPMP Model No.: RW-55A0-0150.
4. Provide outdoor PoE device 100BseT/GbE interface for Subscriber Unit, with 120AC power.
   a. Radwin Model No.: RW-9921-0082.
5. Provide IP67 outdoor lightning protection unit supporting data and signal surge protection over PoE.
   a. Radwin Model No.: RW-9924-0106.
6. Provide all necessary outdoor NEC CMX class CAT-6, 4 twisted pair, 24AWG cable, connectors and pole mounting hardware for a complete radio system.
   a. Primus Part No.: C6CMXR-1069BK.

G. CONTRACTOR shall turn over radio and ethernet switch to OWNER for programming. CONTRACTOR shall install radio and ethernet switch after programming is complete

H. Autodialer and Cellular Router.
1. CONTRACTOR to provide RACO Verbatim VSS series and shall be equipped with digital alarm input channels as indicated on the P&ID Contract drawings. CONTRACTOR shall provide DataRemote CDS-9010 POTS in a Box 2-Port cellular backup router. CONTRACTOR shall provide all required cabling for the cellular interface per manufacturer's recommendations. OWNER is responsible for monthly cellular service charges.
2. The CONTRACTOR shall program the automatic dialer with the messages and phone numbers provided by the OWNER. The CONTRACTOR shall test and verify all alarms with the OWNER.

PART 3 - - EXECUTION

3.1 EXAMINATION:

A. Inspect areas, surfaces, and substrates that enclose PLCs for compliance requirements, installation tolerances, and other conditions affecting performance. Adhere to compliance or tolerance requirements of the manufacturer.

3.2 APPLICATIONS:

A. Primary selection of PLCs is based upon OWNER preference followed by I/O, memory, communications, expansion, and other criteria. If multiple types of instrumentation from different vendors will communicating with the PLC, coordinate with the OWNER to insure that communication protocols are acceptable. MODBUS RTU, MODBUS TCP/IP, DNP3, AND HART ARE THE ONLY ACCEPTABLE PROTOCOLS.

3.3 INSTALLATION:

A. Anchor PLCs within enclosures as recommended by the PLC manufacturer.

B. Provide spacing around PLC as required by the PLC manufacturer to insure adequate cooling. Insure that the air surrounding and penetrating the PLC has been conditioned to maintain the required temperature and humidity range of the PLC.

C. Size wires entering and exiting all PLC components and modules to comply with the PLC manufacturer’s requirements.

D. Blocking or obstructing ventilation slots by any means is not permitted.

E. Install all wiring so it is not obstructing the removal of modules from the backplane.

F. Provide accessibility and visibility to all PLC status lights, communication ports and memory card slots when enclosure door is open.

3.4 IDENTIFICATION:

A. Identify PLC components and wiring according to all applicable codes, standards, and contract documents sections.

B. Supply labels on each I/O module calling out each individual Input or Output name. Label spare channels as spare.

3.5 FIELD QUALITY CONTROL:

A. Field Service:

1. Provide a qualified service representative/programmer to perform the following:
   a. Inspect PLCs, wiring, components, connections, and equipment installation.
   b. Assist in field testing of equipment. Test and adjust PLCs and associated programs as necessary.

3.6 RECORD DRAWINGS:

A. Maintain a set of red-line panel drawings and CONTRACT DRAWINGS to reflect changes or deviations that occur during installation, start-up, and commissioning. Incorporate these deviation into the final Operations & Maintenance manual.

B. Provide record drawing in accordance with Section 01782 – Record Documents.

C. Supply laminated 11 X 17 shop drawing in the PLC cabinet, the LCP, or ITP whichever is related to the project. This will include the final red lined drawing set from the project.

3.7 SPARE PARTS:

A. Furnish and deliver spare parts and test equipment as outlined in Section 01783 – Spare Parts and Maintenance Materials.

B. Store PLC parts according to manufacturer's requirements. Minimum storage requirements include storage indoors in a clean, dry space with uniform temperature to prevent condensation. Protect PLCs from exposure to dirt, fumes, water, corrosive substances, and physical damage. Additionally, protect PLCs from all forms of electrical and magnetic energy that could cause damage.

C. The following constitutes the minimum spare parts:
   1. I/O modules:
      a. Provide a minimum of one spare of each type of card identified.
      b. Provide an additional spare for every (1) cards of a specific type installed.
   2. Processors:
      a. Provide a minimum of (1) spare for each type of CPU identified.
   3. Power Supplies:
      a. Provide a minimum of one spare of each type of power supply identified.
      b. Provide an additional spare for every (1) power supply of a specific type installed.
   4. Memory:
      a. Memory Cards:
   5. If a SD memory card is installed, provide a minimum of one spare manufacture approved memory card.
   6. For every (1) memory cards installed, provide an additional spare memory card.

a. Expandable Flash Memory Cards:

7. If a memory extension card is installed to expand the internal memory of a processor, provide the backup processor with a memory extension card to ensure proper memory size of the backup processor.
8. Specialty Modules:
   a. Provide a minimum of one spare of each type of module identified.
   b. Provide an additional spare for every (1) modules of a specific type installed.
9. Backplane:
   a. Provide a minimum of (1) spare backplanes of each type.

3.8 TESTING AND ADJUSTMENTS:

A. Perform system testing and make any adjustments necessary in accordance with this section and Section 17001 – Process Control System General Requirements.

B. Install and test all project generated programming code prior to performing the Factory Acceptance Test (FAT) and Site Acceptance Test (SAT) as stated in Section 17260 – Control Panels.

3.9 SOFTWARE DEVELOPER'S SERVICE:

A. Provide a qualified software PROGRAMMER representative to review and approve the installation of all PLCs and components.

B. Provide a qualified representative for installation supervision, start-up, and testing services. Conduct a minimum of (5) trips to the site to approve the completed installation and to perform start-up testing of the equipment. Coordinate each visit with the ENGINEER prior to arrival on the site. Test the operation of the system in the presence of the ENGINEER and verify that the equipment conforms to the Site Acceptance Test (SAT) document. Revisit the job site as often as necessary until the installation and testing has been signed off by the OWNER or ENGINEER.

C. Provide a qualified software PROGRAMMER representative for operation and maintenance personnel training. Conduct a minimum of (2) trips to the site to perform the services as described under Section 01821 – Instruction of Operations and maintenance Personnel. Coordinate each visit with the ENGINEER prior to arrival on the site.

D. All costs, including travel, lodging, meals, and incidentals for the CONTRACTOR and PROGRAMMER, are considered included in the CONTRACT price.

E. Warranty: One year after substantial completion.

+ + END OF SECTION + +

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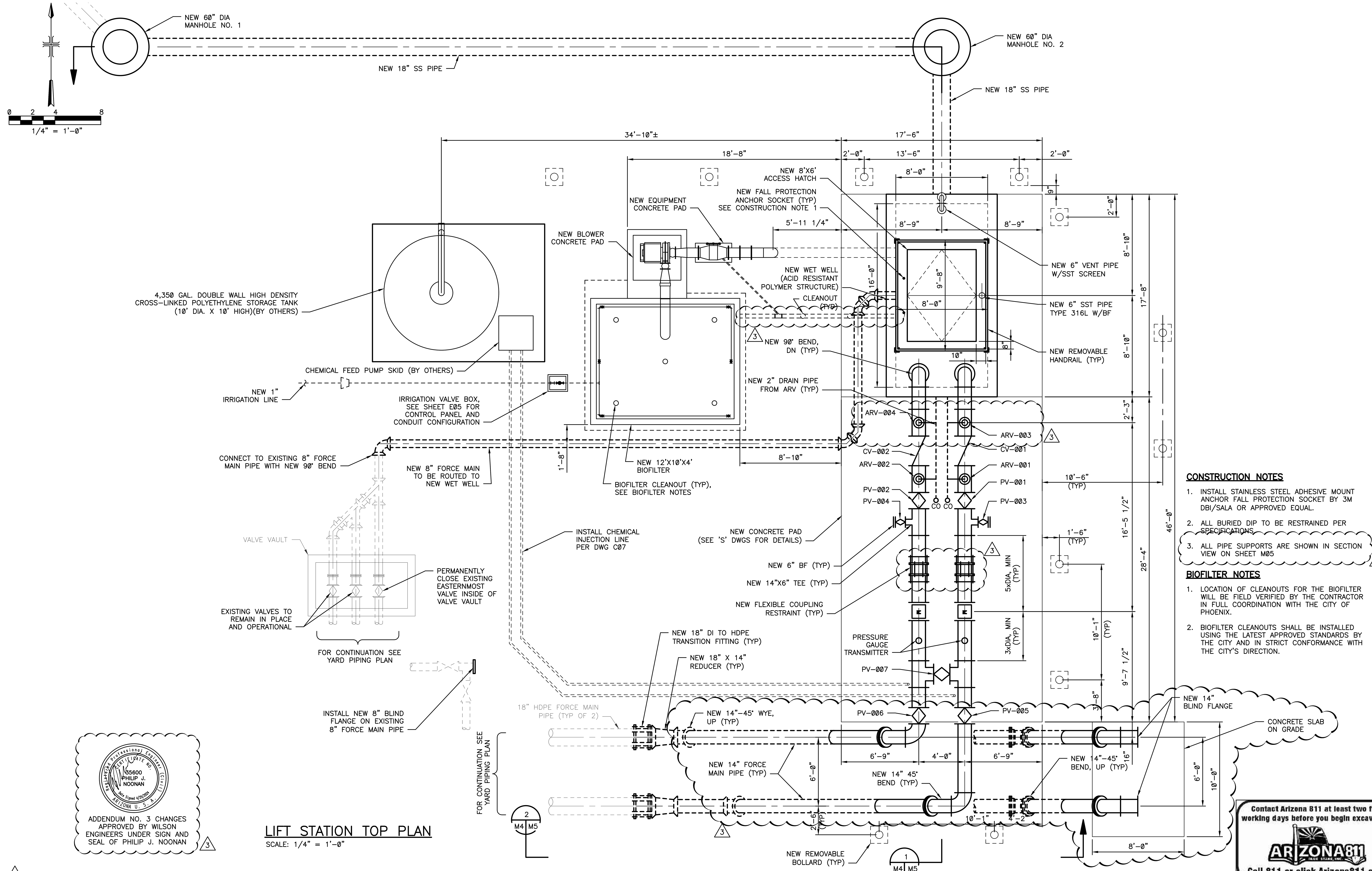

ADDENDUM NO. 3 CHANGES APPROVED BY WILSON ENGINEERS UNDER SIGN AND SEAL OF PHILIP J. NOONAN

(Seal: Registered Professional Engineer (Civil), Certificate No. 35600, PHILIP J. NOONAN, Date Signed 4/25/2024, ARIZONA U.S.A.)

LIFT STATION TOP PLAN

SCALE: 1/4" = 1'-0"

CONSTRUCTION NOTES

1. INSTALL STAINLESS STEEL ADHESIVE MOUNT ANCHOR FALL PROTECTION SOCKET BY 3M DBI/SALA OR APPROVED EQUAL.
2. ALL BURIED DIP TO BE RESTRAINED PER SPECIFICATIONS.
3. ALL PIPE SUPPORTS ARE SHOWN IN SECTION VIEW ON SHEET M05

BIOFILTER NOTES

1. LOCATION OF CLEANOUTS FOR THE BIOFILTER WILL BE FIELD VERIFIED BY THE CONTRACTOR IN FULL COORDINATION WITH THE CITY OF PHOENIX.
2. BIOFILTER CLEANOUTS SHALL BE INSTALLED USING THE LATEST APPROVED STANDARDS BY THE CITY AND IN STRICT CONFORMANCE WITH THE CITY'S DIRECTION.

Contact Arizona 811 at least two full working days before you begin excavation
ARIZONA811
Call 811 or click Arizona811.com

FACILITY DRAWINGS
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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS

FOR CITY OF PHOENIX USE ONLY – REFERENCE CID NUMBER: #

WILSON ENGINEERS

(Seal: Registered Professional Engineer (Civil), Certificate No. 41013, FERNANDO SARMIENTO, ARIZONA, U.S.A.)

GREELEY AND HANSEN
2800 N. 44TH STREET, SUITE 650
PHOENIX, AZ 85008

REVISIONS

NO.	BY	DATE	CKD	REMARKS
3	PJN	4/24/2024	RP	ADDENDUM NO. 3

DES MT/RP
DWN RAM
CKD FS

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT
COLLECTION SYSTEMS
REMOTE FACILITIES

MECHANICAL PROCESS
LIFT STATION 76 PHASE II EXPANSION
NEW LIFT STATION PLAN

CITY PROJECT NO. WS90400067-4
DATE: MAY 2023
M04 SHEET 15 OF 40
CAD FILE: 04276.05_M04

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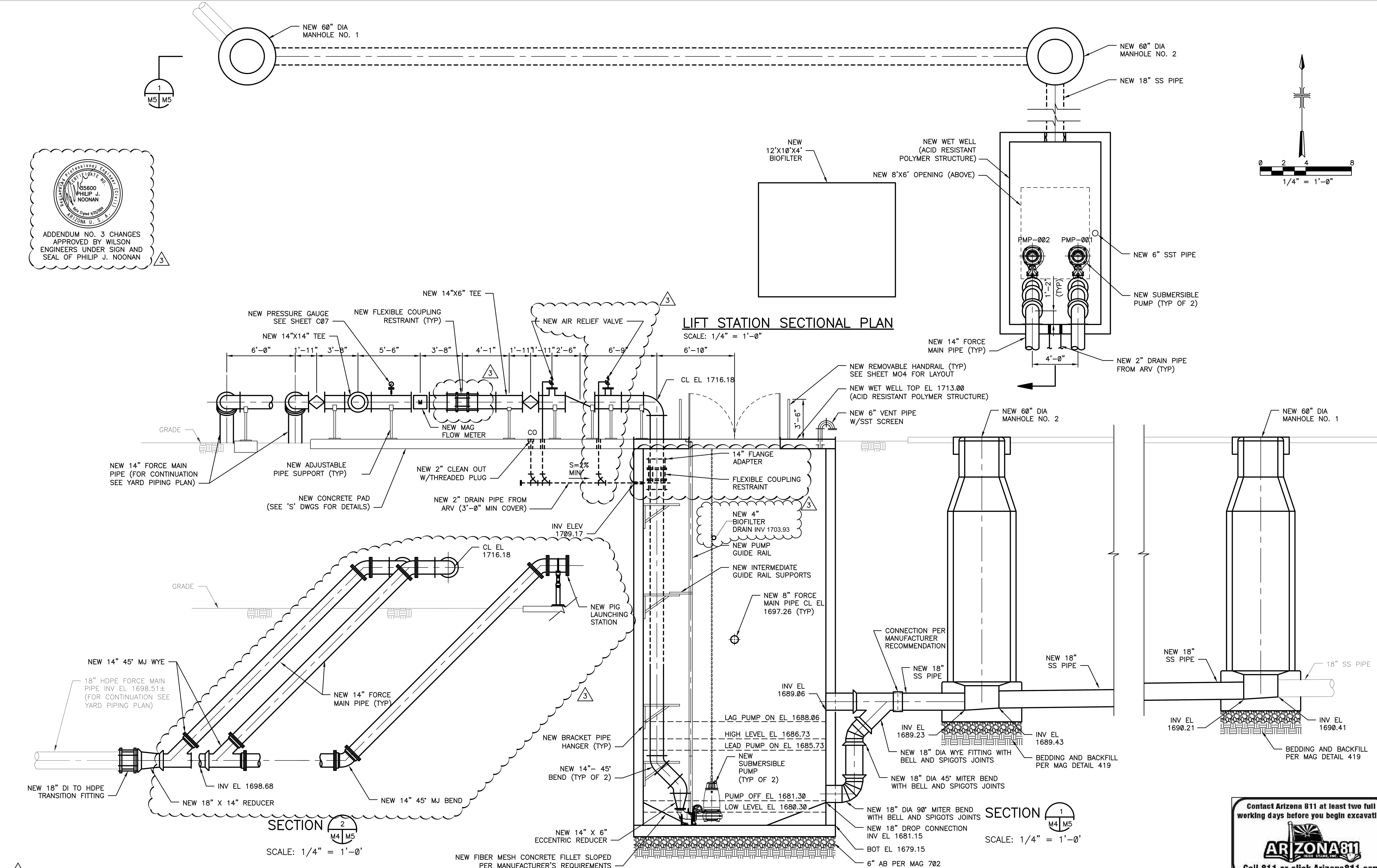

NEW 60" DIA MANHOLE NO. 1
NEW 60" DIA MANHOLE NO. 2
NEW 18" SS PIPE
1 M5 M5
35600 PHILIP J. NOONAN
ADDENDUM NO. 3 CHANGES APPROVED BY WILSON ENGINEERS UNDER SIGN AND SEAL OF PHILIP J. NOONAN
3
NEW 12'X10'X4' BIOFILTER
NEW WET WELL (ACID RESISTANT POLYMER STRUCTURE)
NEW 8'X6' OPENING (ABOVE)
PMP-002
PMP-001
NEW 6" SST PIPE
1'-2" (TYP)
NEW SUBMERSIBLE PUMP (TYP OF 2)
NEW 14" FORCE MAIN PIPE (TYP)
4'-0"
NEW 2" DRAIN PIPE FROM ARV (TYP)
0 2 4 8
1/4" = 1'-0"
LIFT STATION SECTIONAL PLAN
SCALE: 1/4" = 1'-0"
NEW 14"X6" TEE
NEW PRESSURE GAUGE SEE SHEET C07
NEW FLEXIBLE COUPLING RESTRAINT (TYP)
NEW AIR RELIEF VALVE
NEW 14"X14" TEE
6'-0" 1'-11" 3'-8" 5'-6" 3'-8" 4'-1" 1'-11" 1'-11" 2'-6" 6'-9" 6'-10"
CL EL 1716.18
NEW REMOVABLE HANDRAIL (TYP) SEE SHEET M04 FOR LAYOUT
NEW WET WELL TOP EL 1713.00 (ACID RESISTANT POLYMER STRUCTURE)
NEW 6" VENT PIPE W/SST SCREEN
3'-6"
GRADE
CO
NEW MAG FLOW METER
NEW 14" FORCE MAIN PIPE (FOR CONTINUATION SEE YARD PIPING PLAN)
NEW ADJUSTABLE PIPE SUPPORT (TYP)
NEW 2" CLEAN OUT W/THREADED PLUG
S=2% MIN
14" FLANGE ADAPTER
FLEXIBLE COUPLING RESTRAINT
NEW CONCRETE PAD (SEE 'S' DWGS FOR DETAILS)
NEW 2" DRAIN PIPE FROM ARV (3'-0" MIN COVER)
INV ELEV 1709.17
NEW 4" BIOFILTER DRAIN INV 1703.93
NEW PUMP GUIDE RAIL
NEW INTERMEDIATE GUIDE RAIL SUPPORTS
CL EL 1716.18
NEW PIG LAUNCHING STATION
NEW 8" FORCE MAIN PIPE CL EL 1697.26 (TYP)
NEW 60" DIA MANHOLE NO. 2
NEW 60" DIA MANHOLE NO. 1
CONNECTION PER MANUFACTURER RECOMMENDATION
NEW 18" SS PIPE
NEW 18" SS PIPE
NEW 18" SS PIPE
18" SS PIPE
NEW 14" 45' MJ WYE
18" HDPE FORCE MAIN PIPE INV EL 1698.51± (FOR CONTINUATION SEE YARD PIPING PLAN)
NEW 14" FORCE MAIN PIPE (TYP)
INV EL 1689.06
LAG PUMP ON EL 1688.06
HIGH LEVEL EL 1686.73
LEAD PUMP ON EL 1685.73
INV EL 1689.23
INV EL 1689.43
INV EL 1690.21
INV EL 1690.41
NEW 18" DIA WYE FITTING WITH BELL AND SPIGOTS JOINTS
BEDDING AND BACKFILL PER MAG DETAIL 419
BEDDING AND BACKFILL PER MAG DETAIL 419
NEW BRACKET PIPE HANGER (TYP)
NEW 14"- 45' BEND (TYP OF 2)
NEW SUBMERSIBLE PUMP (TYP OF 2)
NEW 18" DIA 45' MITER BEND WITH BELL AND SPIGOTS JOINTS
NEW 18" DI TO HDPE TRANSITION FITTING
INV EL 1698.68
NEW 18" X 14" REDUCER
NEW 14" 45' MJ BEND
PUMP OFF EL 1681.30
LOW LEVEL EL 1680.30
NEW 18" DIA 90' MITER BEND WITH BELL AND SPIGOTS JOINTS
NEW 18" DROP CONNECTION INV EL 1681.15
BOT EL 1679.15
6" AB PER MAG 702
SECTION 2 M4 M5
SCALE: 1/4" = 1'-0'
SECTION 1 M4 M5
SCALE: 1/4" = 1'-0'
NEW 14" X 6" ECCENTRIC REDUCER
NEW FIBER MESH CONCRETE FILLET SLOPED PER MANUFACTURER'S REQUIREMENTS

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WILSON ENGINEERS

41013 FERNANDO SARMIENTO

GREELEY AND HANSEN
2800 N. 44TH STREET, SUITE 650
PHOENIX, AZ 85008

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City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT
COLLECTION SYSTEMS
REMOTE FACILITIES

MECHANICAL PROCESS
LIFT STATION 76 PHASE II EXPANSION
NEW LIFT STATION PLAN & SECTION

CITY PROJECT NO. WS90400067-4
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M05 SHEET 16 OF 40
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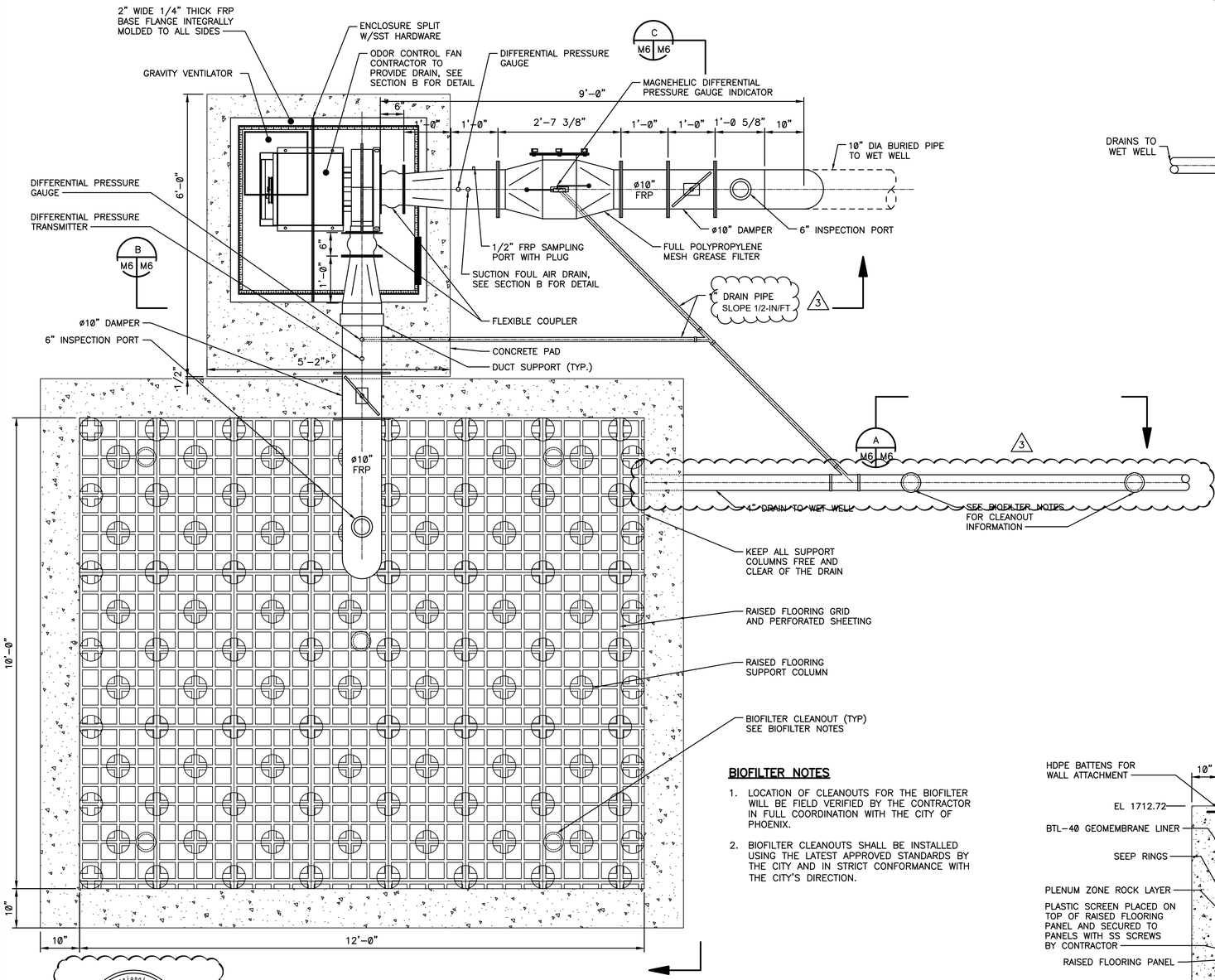


BIOFILTER NOTES

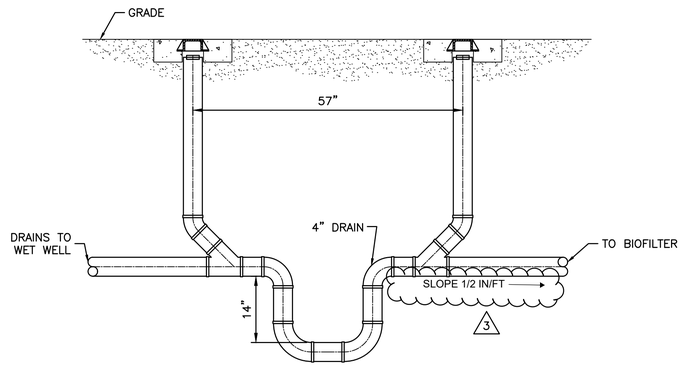
1. LOCATION OF CLEANOUTS FOR THE BIOFILTER WILL BE FIELD VERIFIED BY THE CONTRACTOR IN FULL COORDINATION WITH THE CITY OF PHOENIX.
2. BIOFILTER CLEANOUTS SHALL BE INSTALLED USING THE LATEST APPROVED STANDARDS BY THE CITY AND IN STRICT CONFORMANCE WITH THE CITY'S DIRECTION.

ADDENDUM NO. 3 CHANGES APPROVED BY WILSON ENGINEERS UNDER SIGN AND SEAL OF PHILIP J. NOONAN

3

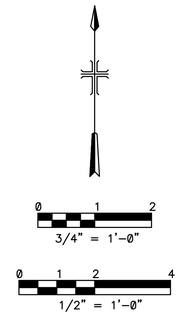
BIOFILTER PLAN VIEW

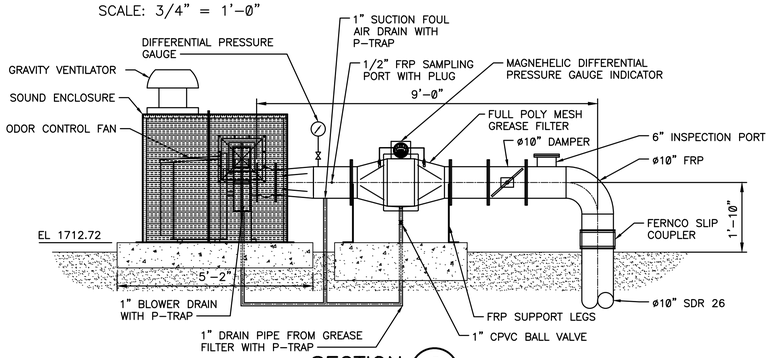
SCALE: 3/4" = 1'-0"



SECTION A M6 M6

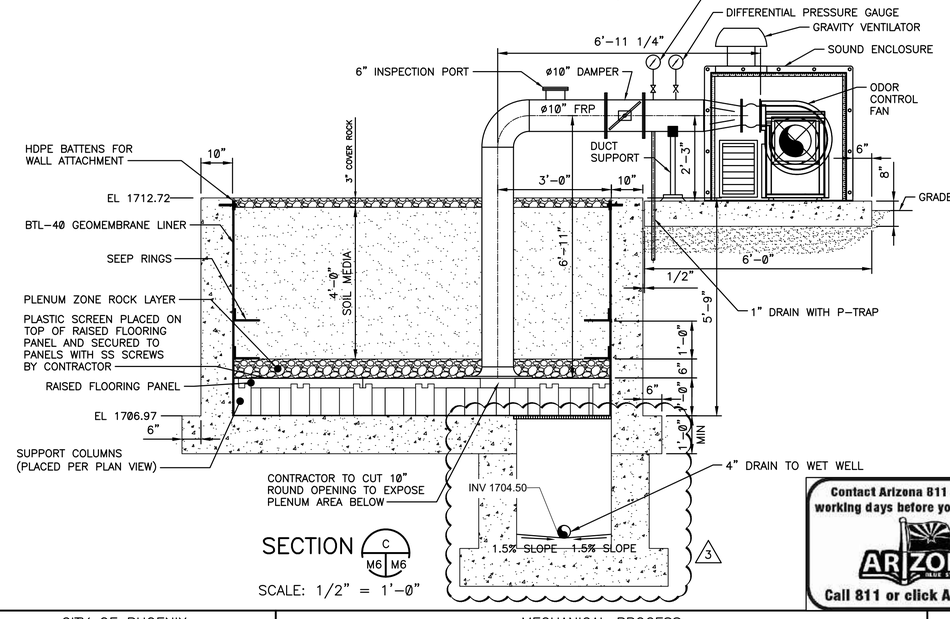
SCALE: 3/4" = 1'-0"





SECTION B M6 M6

SCALE: 1/2" = 1'-0"



SECTION C M6 M6

SCALE: 1/2" = 1'-0"

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ARIZONA811 BLUE STAKE, INC.
Call 811 or click Arizona811.com

FACILITY DRAWINGS
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FOR CITY OF PHOENIX USE ONLY – REFERENCE CID NUMBER: #

REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	REMARKS

DWG NUMBER

WILSON ENGINEERS

Registered Professional Engineer Civil CERTIFICATE NO. 41013 FERNANDO SARMIENTO Date Signed 4/24/2024 ARIZONA U.S.A.

GREELEY AND HANSEN
2800 N. 44TH STREET, SUITE 650
PHOENIX, AZ 85008

REVISIONS				
NO.	BY	DATE	CKD	REMARKS
3	PJN	4/24/2024	RP	ADDENDUM NO. 3

DES MT/RP
DWN RAM
CKD FS

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT
COLLECTION SYSTEMS
REMOTE FACILITIES

MECHANICAL PROCESS

LIFT STATION 76 PHASE II EXPANSION
BIOFILTER PLAN AND SECTION

CITY PROJECT NO. WS90400067-4
DATE: MAY 2023
M06 SHEET 17 OF 40
CAD FILE: 04276.05_M06

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FACILITY DRAWINGS
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PUMP SCHEDULE

TAG No.	TYPE	RATING POINT CAPACITY (GPM)	HEAD (FT)	MIN. EFF. (%)	NPSH AVAILABLE	MIN SHUTOFF HEAD (FT)	MIN SUCTION/ DISCHARGE SIZE	PUMP RPM MIN	PUMP RPM MAX	SEAL TYPE	MOTOR DATA HP	RPM (MAX)	VOLTAGE	PHASES	MOTOR (HZ)	SPECS
PMP-001*	SUBMERSIBLE	1700	94.1	72.2	–	182.5	6 IN	–	1775	MECHANICAL	60	1775	460	3	60	11212
PMP-002*	SUBMERSIBLE	1700	94.1	72.2	–	182.5	6 IN	–	1775	MECHANICAL	60	1775	460	3	60	11212

* PUMP SHALL BE CAPABLE OF PASSING A 2.5-INCH SPHERE, REFER TO SPECIFICATIONS FOR ADDITIONAL REQUIREMENTS.

EXPOSED PIPING SCHEDULE

ABBREV	SERVICE	SIZE	MATERIAL	JOINTS	SPECS
FM	RAW WASTEWATER	14 IN	DIP THICKNESS CLASS 53	FLANGED	15050
RWW	RAW WASTEWATER	2 IN	CPVC SCHEDULE 80	PLAIN END/SOLVENT WELD/FLANGED	15050

BURIED PIPING SCHEDULE

ABBREV	SERVICE	SIZE	MATERIAL	JOINTS	SPECS
SS	RAW WASTEWATER	18 IN	VCP EXTRA STRENGTH	BELL AND SPIGOT	15050
FM	RAW WASTEWATER	14 IN	DIP	RESTRAINED MECHANICAL JOINT	15050
FM	RAW WASTEWATER	8 IN (OD)	DIP	RESTRAINED MECHANICAL JOINT	15050
D	RAW WASTEWATER	4 IN	CPVC SCHEDULE 80	SOLVENT WELD	15050
D	RAW WASTEWATER	1 IN	CPVC SCHEDULE 80	SOLVENT WELD	15050
FA	FOUL AIR	10 IN	FRP	FLANGED	15812
W	POTABLE WATER	2 IN	CPVC SCHEDULE 80	SOLVENT WELD OR FLANGED FOR VALVES	15050
W	POTABLE WATER	1 IN	CPVC SCHEDULE 80	SOLVENT WELD OR FLANGED FOR VALVES	15050

3

VALVE SCHEDULE

VALVE No.	VALVE TYPE AND SIZE	JOINT TYPE	ACTUATOR TYPE	SPECS
ARV-001	AIR RELIEF VALVE-2 IN	THREADED	NONE	15119
~~ARV-002~~	~~AIR RELIEF VALVE-2 IN~~	~~THREADED~~	~~NONE~~	~~15119~~
ARV-003	AIR VACUUM VALVE-3 IN	FLANGED	NONE	15119
ARV-004	AIR VACUUM VALVE-3 IN	FLANGED	NONE	15119
CV-001	CHECK VALVE-14 IN	FLANGED	NONE	15114
CV-002	CHECK VALVE-14 IN	FLANGED	NONE	15114
PV-001	PLUG VALVE-14 IN	FLANGED	MANUAL HAND WHEEL	15112
PV-002	PLUG VALVE-14 IN	FLANGED	MANUAL HAND WHEEL	15112
PV-003	PLUG VALVE-6 IN	FLANGED	MANUAL HAND WHEEL	15112
PV-004	PLUG VALVE-6 IN	FLANGED	MANUAL HAND WHEEL	15112
PV-005	PLUG VALVE-14 IN	FLANGED	MANUAL HAND WHEEL	15112
PV-006	PLUG VALVE-14 IN	FLANGED	MANUAL HAND WHEEL	15112
PV-007	PLUG VALVE-14 IN	FLANGED	MANUAL HAND WHEEL	15112

3

Professional Engineer CERTIFICATE NO. 35600 PHILIP J. NOONAN (Civil) ARIZONA, U.S.A. Date Signed 4/29/2024

ADDENDUM NO. 3 CHANGES APPROVED BY WILSON ENGINEERS UNDER SIGN AND SEAL OF PHILIP J. NOONAN

3

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-
-	-	-	-	-	-	-	-

3

WILSON ENGINEERS

Registered Professional Engineer CERTIFICATE NO. 41013 FERNANDO SARMIENTO (Civil) Date Signed ARIZONA, U.S.A.

GREELEY AND HANSEN
2800 N. 44TH STREET, SUITE 650
PHOENIX, AZ 85008

REVISIONS

NO.	BY	DATE	CKD	REMARKS
3	PJN	4/24/2024	RP	ADDENDUM NO. 3

DES MT
DWN RAM
CKD FS

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT
COLLECTION SYSTEMS
REMOTE FACILITIES

MECHANICAL PROCESS
LIFT STATION 76 PHASE II EXPANSION
MECHANICAL SCHEDULES

CITY PROJECT NO. WS90400067-4
DATE: MAY 2023
M09 SHEET 20 OF 40
CAD FILE: 04276.05_M09

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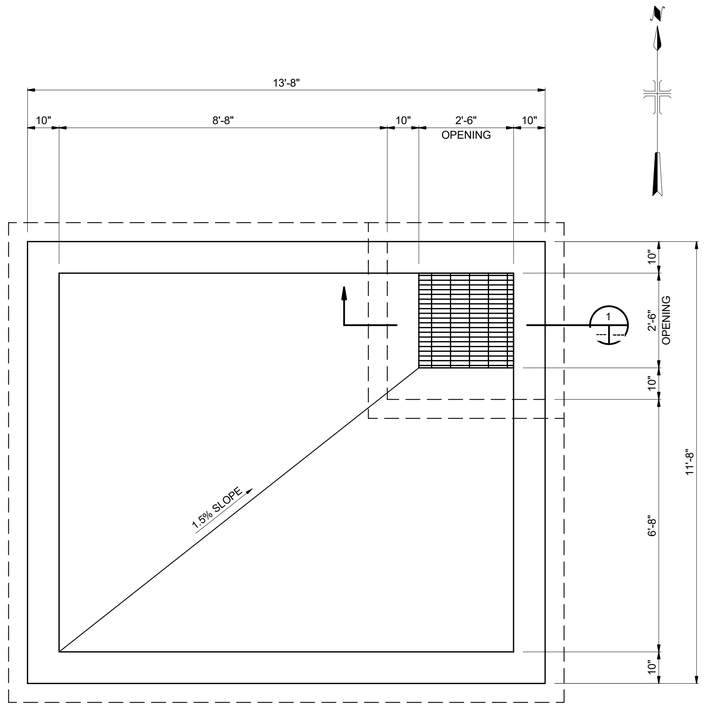
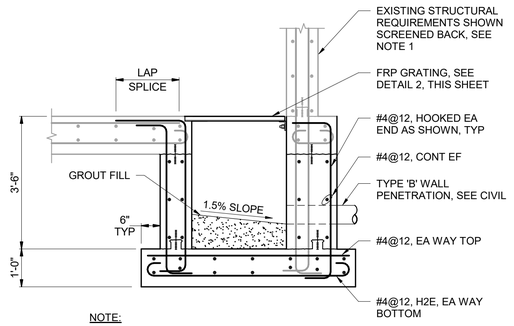


Biofilter Plan
1/2" = 1'-0"

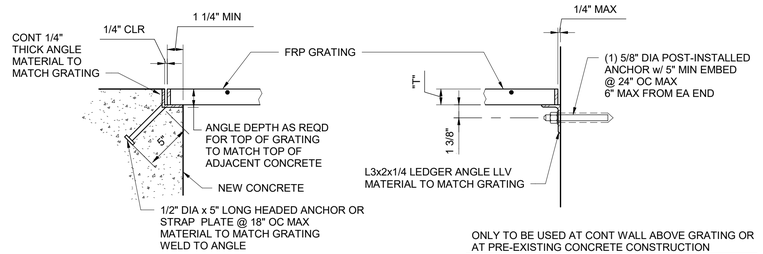


NOTE:

1. SEE SHEET S02 FOR REINFORCING REQUIREMENTS NOT SHOWN.

SECTION 1/S04

SCALE: 1/2" = 1'-0"

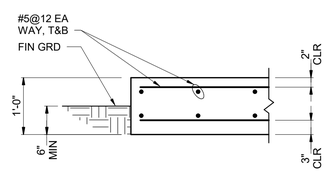


NOTES:

1. GRATING SIZE PER CONTRACT DOCUMENTS.
2. ALL ENDS AND OPENINGS SHALL BE BANDED, SEE SPECIFICATION.
3. ATTACH GRATING TO ALL SUPPORT ANGLES WITH BOLTED CLIPS, SPACED AT 2'-0" MAX CENTERS.
4. CONTRACTOR TO DESIGN FRP GRATING AND SUPPORTS PER SPECIFICATIONS.

GRATING AND SUPPORT
DETAIL 2

SCALE: NTS



EQUIPMENT SLAB ON GRADE
DETAIL 3

SCALE: NTS

1

FOR CITY OF PHOENIX USE ONLY - REFERENCE CID NUMBER:

REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS

4/25/2024 4:54:37 PM
J:\COMMON\Chris Yarn_Project Files\XXXXX - LS 76 CA&I\Revit\XXXXX_STRUC.rvt

WILSON ENGINEERS

Registered Professional Engineer (Civil) CERTIFICATE NO. 54664 CHRISTOPHER YARN Date Signed 04/25/24 ARIZONA, U.S.A.
EXPIRES 06/30/2025

REVISIONS				
NO.	BY	DATE	CKD	REMARKS
1	CWY	04/25/24	PJN	ADDENDUM NO. 3

DES CWY
DWN CWY
CKD PJN

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

STRUCTURAL

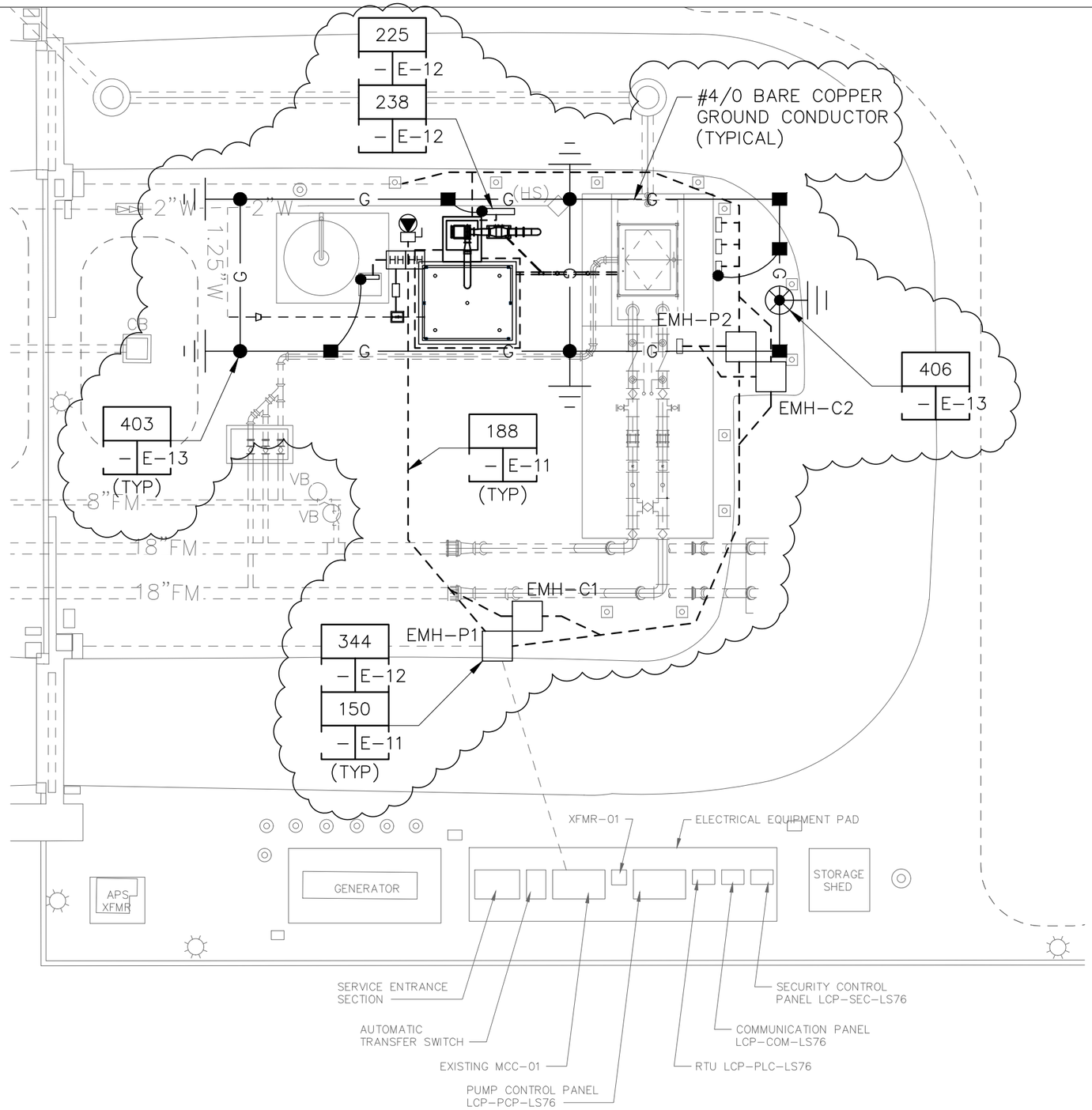
SUMP PLAN, SECTION AND DETAIL

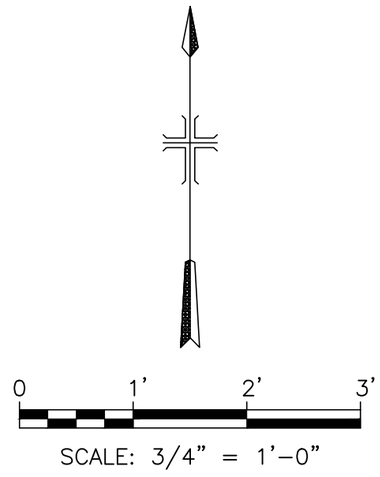
CITY PROJECT NO.WS90400067

DATE: APRIL 2024

S04 SHEET 24

BIM FILE: S04.rvt



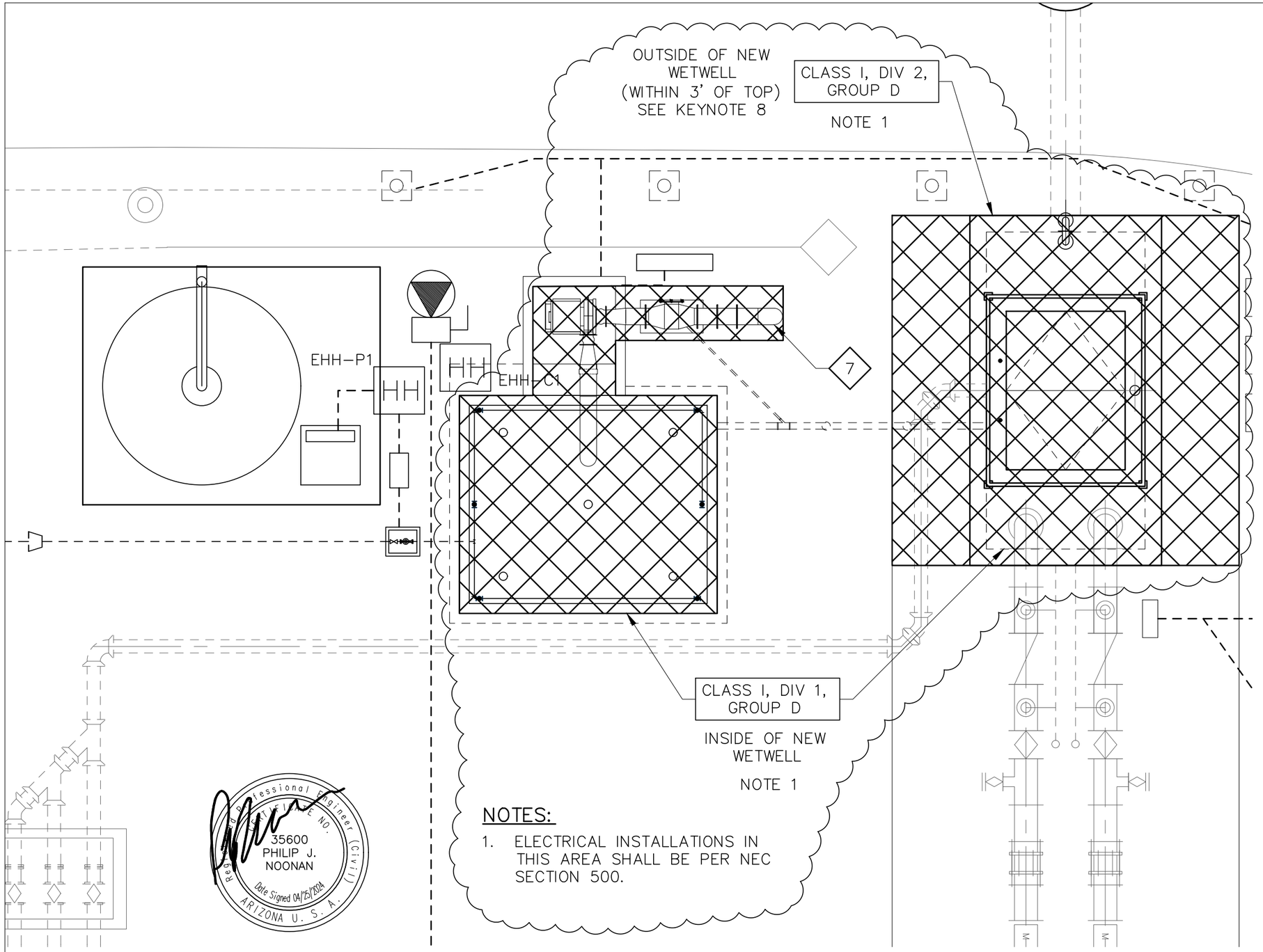


SCALE: 3/4" = 1'-0"

WILSON ENGINEERS

LIFT STATION 76 PHASE II EXPANSION
ADDENDUM 3
REMOTE FACILITIES SITE PLAN

E-SK1



KEY NOTES:

1. PROVIDE NEW CONDUIT TO EXISTING NORTH GATE FROM EXISTING SECURITY CONTROL PANEL.
2. RECONNECT NORTH GATE CONTROL ONCE PUMP SYSTEM HAS BEEN INSTALLED AND PUT BACK INTO SERVICE. UTILIZE EXISTING CONDUITS AS NEEDED.
3. RECONNECT SOUTH GATE CONTROL ONCE PUMP SYSTEM HAS BEEN INSTALLED AND PUT BACK INTO SERVICE. UTILIZE EXISTING CONDUITS AS NEEDED.
4. DISCONNECT AND RELOCATE EXISTING ITP'S AS SHOWN AT NEW WET WELL. PROVIDE NEW CONDUIT AND WIRE AS DETAILED ON CONDUIT BLOCK DIAGRAMS FOR ALL POWER AND CONTROL FOR PUMPS #1 AND #2.
5. TE'S AND GE'S ARE INTERNAL TO SUBMERSIBLE PUMPS WITHIN WET WELL.
6. LE'S ARE INTERNAL TO THE WET WELL.
7. ENVELOPE WITHIN 3 FT OF FA PIPING, BLOWER, AND ABOVE BIOFILTER IS C1D2 PER NFPA 820.
8. EXTENT OF CLASSIFIED AREA PER NFPA 820 IS AN ENVELOPE WITHIN 3 FT AROUND THE HATCH OPENING AND 18" ABOVE THE SLAB. AN ENVELOPE WITHIN 3 FT OF THE VENT IS CLASS I DIV 2 AND ANOTHER 2 FT OUTSIDE OF THAT ENVELOPE IS CLASS I DIV 2.
9. PROVIDE A QUANTITY OF 2 HAND HOLES TO SEPARATE BETWEEN AC AND DC WIRING.
10. BOND EXPOSED METAL PIPES AND WET WELL HATCH FRAME TO EXISTING GROUND GRID. EXPAND EXISTING GROUND GRID TO ENCAPSULATE AROUND NEW WET WELL.
11. SEE DETAIL ON SHEET E9 FOR MOUNTING OF PANEL/ELECTRIC DEVICES.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
35600
PHILIP J.
NOONAN
Date Signed 04/25/2024
ARIZONA U. S. A.

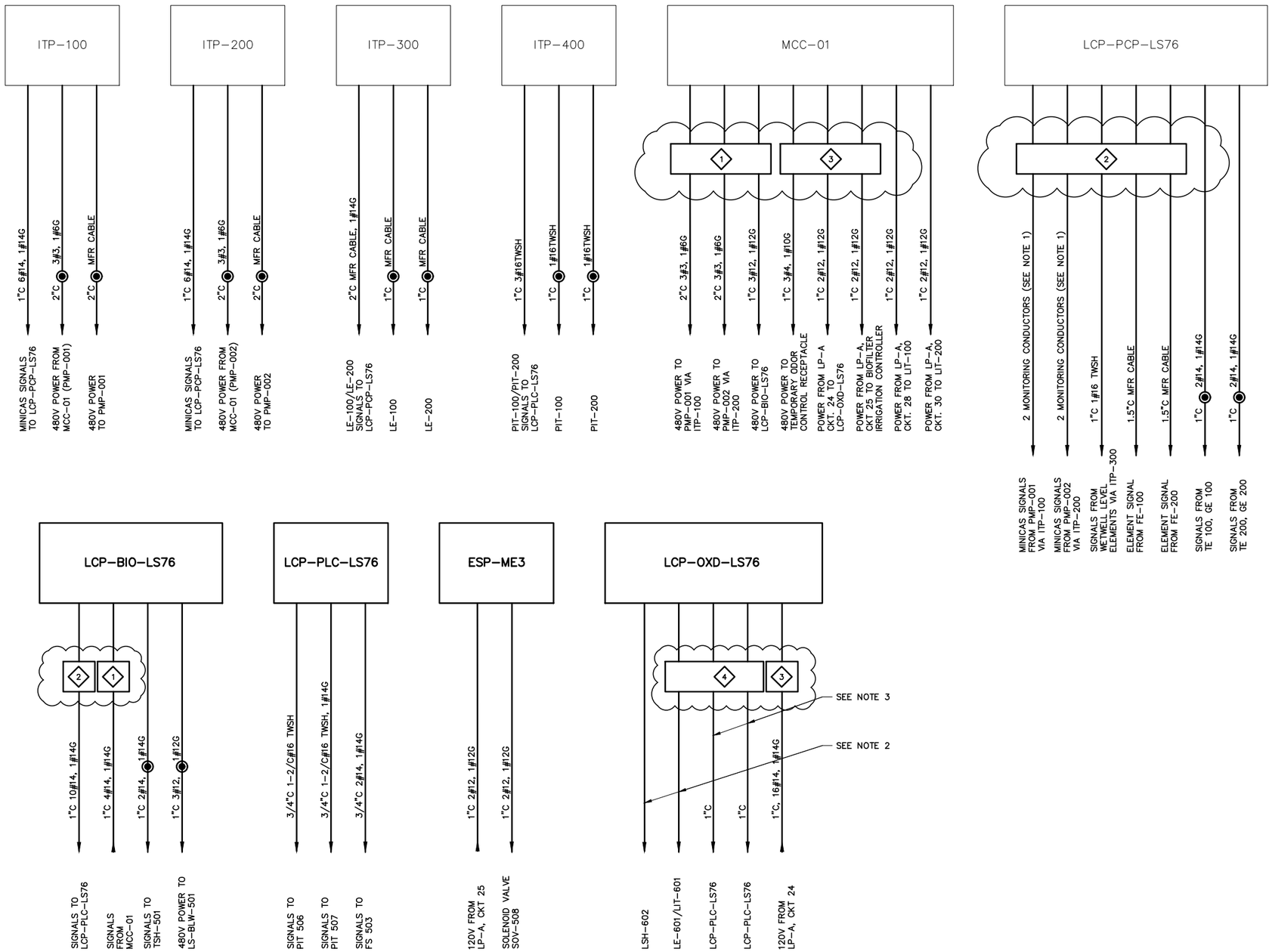
NOTES:

1. ELECTRICAL INSTALLATIONS IN THIS AREA SHALL BE PER NEC SECTION 500.

WILSON ENGINEERS

LIFT STATION 76 PHASE II EXPANSION
ADDENDUM 3
AREA CLASSIFICATIONS

E-SK2



NOTES

1. COORDINATE WITH PUMP MANUFACTURER FOR WIRING REQUIREMENTS FOR MINICAS COMPATIBLE MONITORING CONDUCTORS.
2. CONDUITS AND CABLES REQUIRED TO BE PROVIDED BY OTHERS.
3. UTILIZED CONDUITS PROVIDED, CABLES REQUIRED TO BE PROVIDED BY OTHERS.

KEY NOTES:

1. CONDUIT ROUTED VIA EMH-P1 AND EMH-P2
2. CONDUIT ROUTED VIA EMH-C1 AND EMH-C2
3. CONDUIT ROUTED VIA EMH-P1 AND EHH-P1
4. CONDUIT ROUTED VIA EMH-C1 AND EHH-C1

WILSON ENGINEERS

LIFT STATION 76 PHASE II EXPANSION
ADDENDUM 3
CONDUIT BLOCK DIAGRAM

E-SK3

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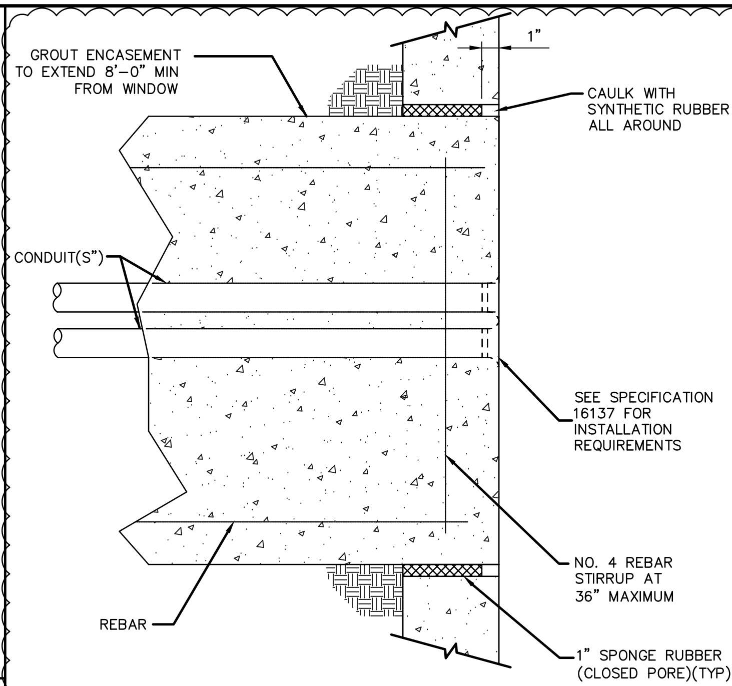
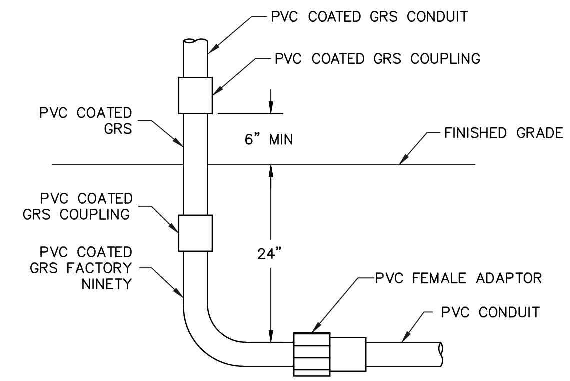


DUCTBANK TERMINATION AT MANHOLE OR STRUCTURE

DETAIL 150 / –|–

NOT TO SCALE



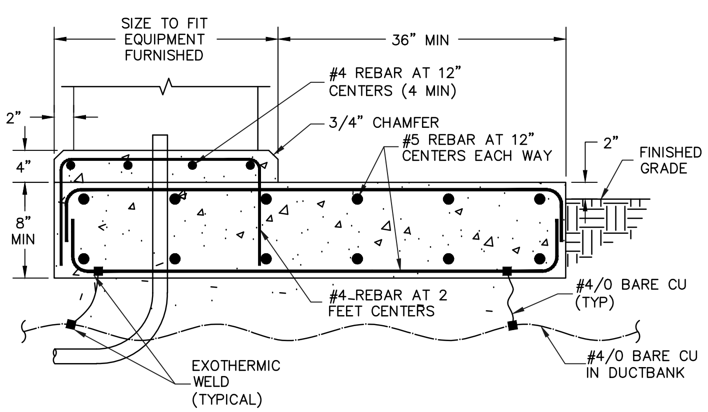
NOTES:

1. WHERE CONDUITS ARE INSTALLED IN A CONCRETE SLAB, THE 24" DIMENSION DOES NOT APPLY. CONDUITS SHALL BE INSTALLED BETWEEN REBAR MATS OR UNDER A SINGLE REBAR MAT.
2. IN CORROSIVE AREAS, PVC COATED GRS SHALL BE USED.

PVC COATED GRS STUB-UP

DETAIL 171 / –|–

NOT TO SCALE



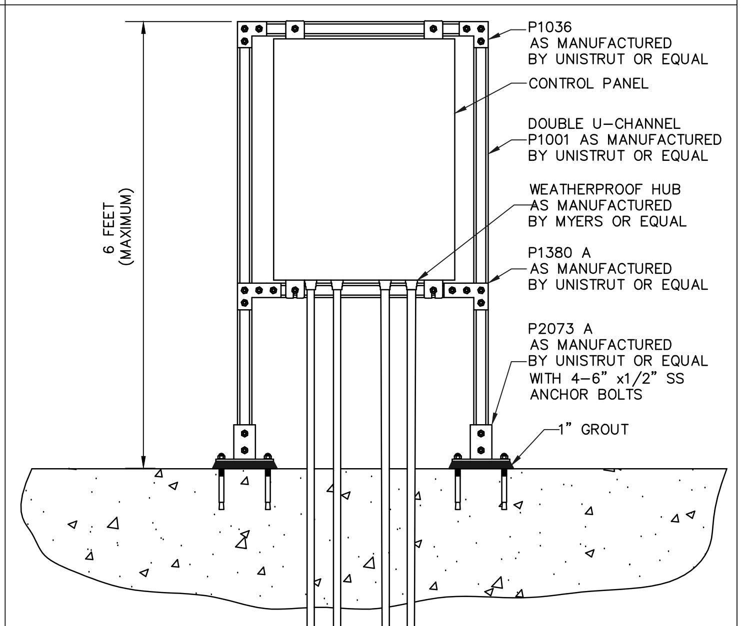
NOTES:

1. CONCRETE PAD MUST BE SIGNED AND SEALED BY STRUCTURAL ENGINEER.

EQUIPMENT PAD

DETAIL 204 / –|–

NOT TO SCALE



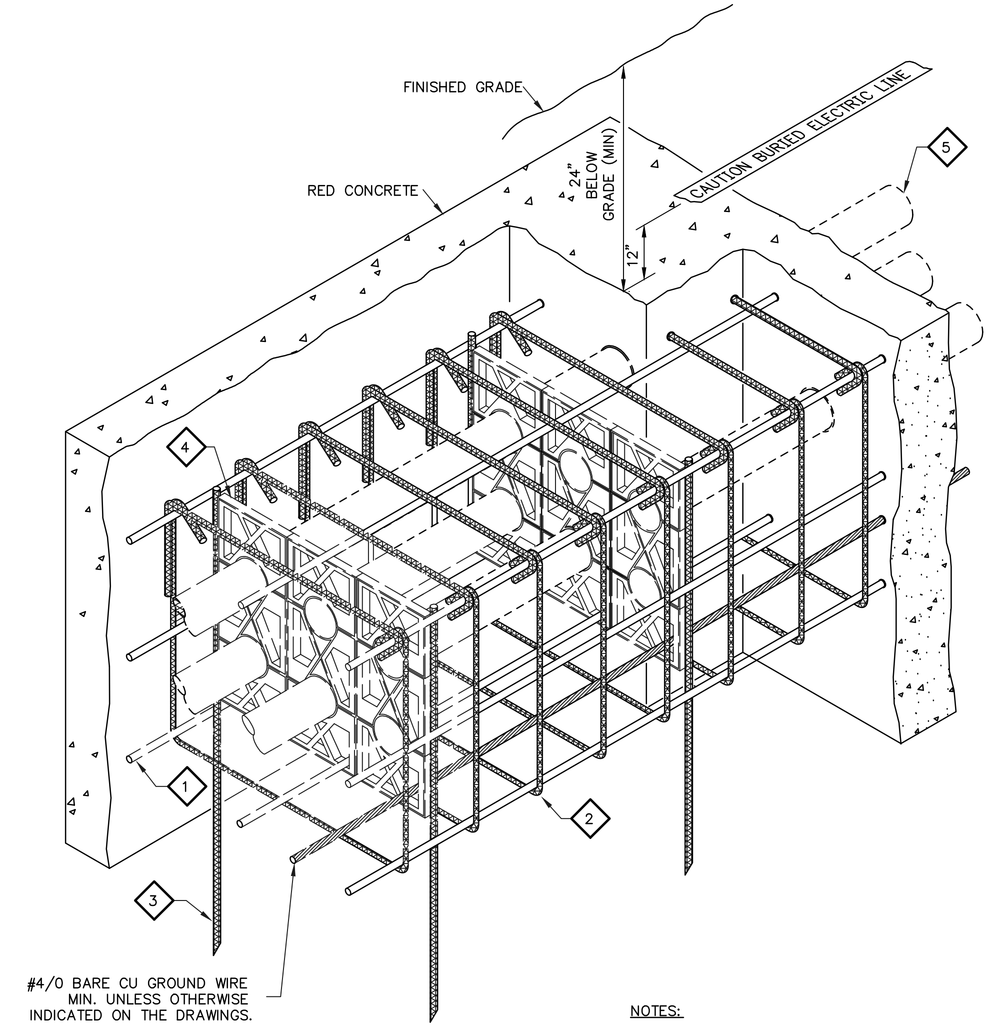
NOTES:

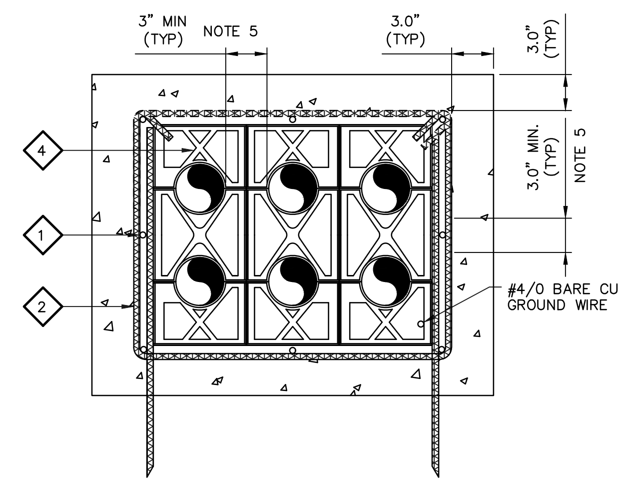
1. CONTROL PANEL SHALL BE LISTED. SEE SPECIFICATION 17260 FOR REQUIREMENTS.
2. FREE STAND PULL BOX ON STRUT. DO NOT ATTACH TO BUILDINGS.
3. ALL STRUT TO BE 316 SS.
4. SEAL AROUND STRUTS AND CONDUIT.

CONTROL PANEL MOUNTING

DETAIL 207 / –|–

NOT TO SCALE





NOTES:

1. DIMENSIONS SHOWN ARE MINIMUM.
2. ADJUST SIZE OF DUCT BANK BASED UPON THESE GUIDELINES AND SPECIFICATION SECTION 16137 TO ACCOMMODATE ACTUAL NUMBER OF CONDUITS WITHIN DUCT BANK. REFER TO DUCT BANK SECTIONS, AND CONDUIT SCHEDULE FOR NUMBER AND SIZE OF CONDUITS.
3. GROUND CONDUCTOR SHALL RUN CONTINUOUSLY THROUGH MANHOLES AND SHALL CONTINUE FROM DUCTBANK INTO SWITCHGEAR OR BUILDING GROUNDING SYSTEM AND SHALL BE BONDED TO EACH RIGID METAL CONDUIT. SIZE TO BE #4/0 UNLESS OTHERWISE INDICATED ON PLANS.
4. ALL DIMENSIONS ARE MINIMUM.
5. CONDUIT SPACING TO BE 7 1/2" MIN. CENTER TO CENTER ON ALL MV CONDUITS (TYP.).

KEY NOTES:

1. #4 REINFORCING STEEL 12" MAXIMUM ON CENTER AROUND ENTIRE PERIMETER OF DUCT BANK.
2. #3 REINFORCING STEEL HOOPS TRANSVERSELY PLACED AT 18" MAXIMUM LONGITUDINAL INTERVALS.
3. DRIVE #4 REINFORCING STEEL 36" MINIMUM INTO UNDISTURBED SOIL AT EVERY PVC CONDUIT SPACER LOCATION ALONG LENGTH OF DUCT BANK TO PREVENT DUCT BANK FROM FLOATING. PROVIDE A MINIMUM OF TWO (2) #4 REINFORCING STEEL UPRIGHTS PER PVC CONDUIT SPACER LOCATION. APPLY 20 MIL TAPE TO REBAR STAKES WHERE THEY CONTACT REBAR CAGE TO PREVENT CORROSION.
4. PVC CONDUIT SPACERS ON 8'-0" CENTERS (MAXIMUM) LOCATE 12" FROM HOOPS.
5. REFER TO SPECIFICATIONS 16137 AND 16131, AND CONDUIT BLOCK DIAGRAMS FOR INSTALLATION REQUIREMENTS.

DUCTBANK – REINFORCED CONCRETE ENCASED

DETAIL 188 / –|–

NOT TO SCALE

REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS

FOR CITY OF PHOENIX USE ONLY – REFERENCE CID NUMBER: #

WILSON ENGINEERS

35600 PHILIP J. NOONAN ARIZONA U.S.A.

REVISIONS				
NO.	BY	DATE	CKD	REMARKS
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DES ER
DWN ER
CKD PJN

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT
COLLECTION SYSTEMS
REMOTE FACILITIES

ELECTRICAL
LIFT STATION 76 PHASE II EXPANSION
ELECTRICAL DETAILS 1

CITY PROJECT NO. WS90400067-4
DATE: MAY 2023
E11 SHEET XX OF 40
CAD FILE: 04276.05_E11

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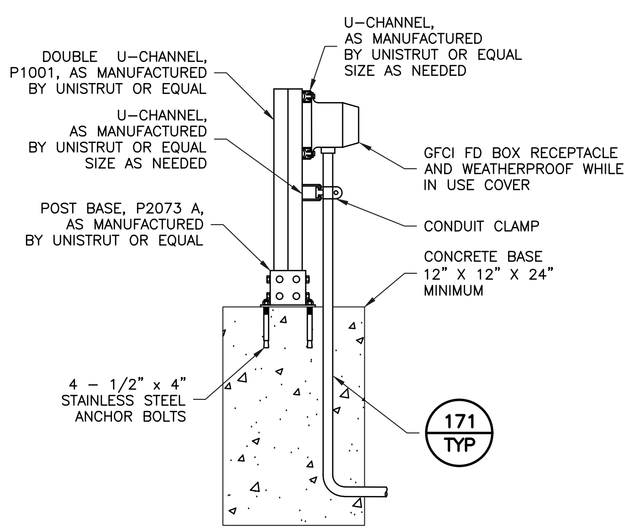
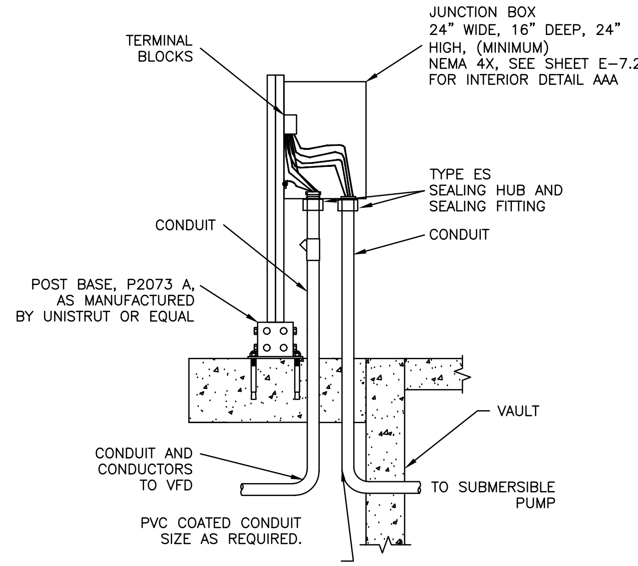


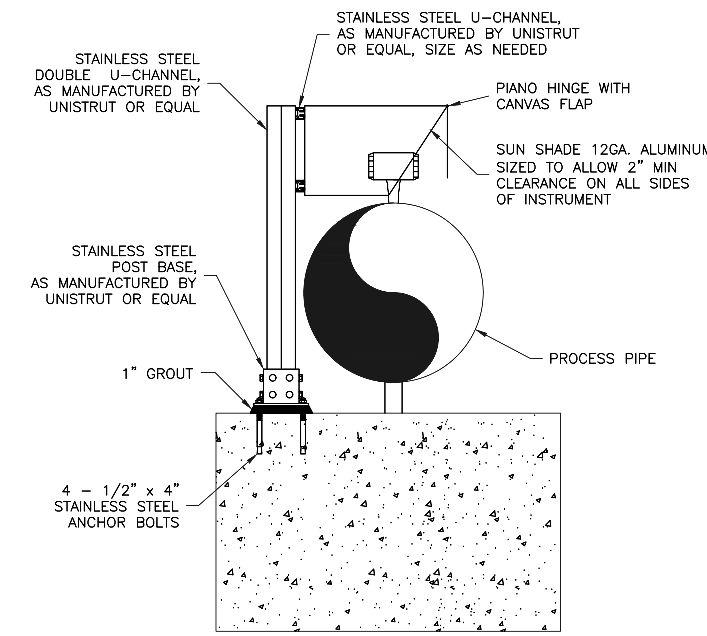
RECEPTACLE BOX MOUNTING DETAIL 211
NOT TO SCALE



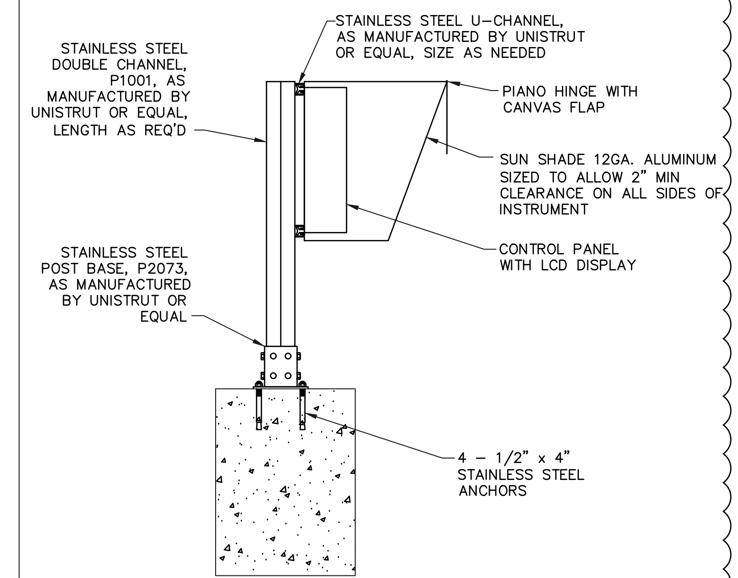
NOTES:

1. INSTALL CONDUIT AND CABLES AS REQUIRED FOR NUMBER OF PUMPS OR FLOAT SWITCHES.
2. BOTTOM OF THE JUNCTION BOX TO BE A MINIMUM OF 24-INCHES AFG.

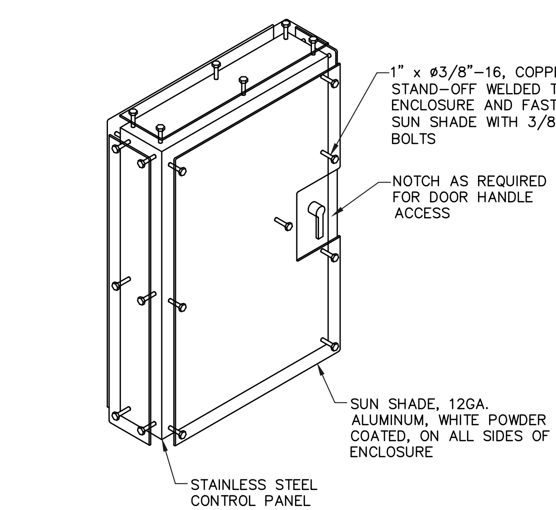
SUBMERSIBLE PUMP CABLE DETAIL 219
NOT TO SCALE



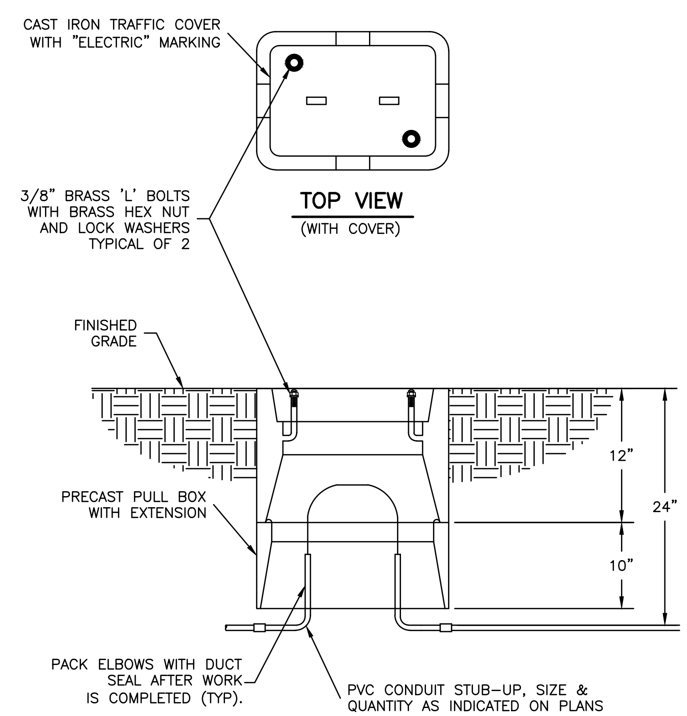
INSTRUMENT SUN SHADE DETAIL 221
NOT TO SCALE



SUN SHADE DETAIL 225
NOT TO SCALE

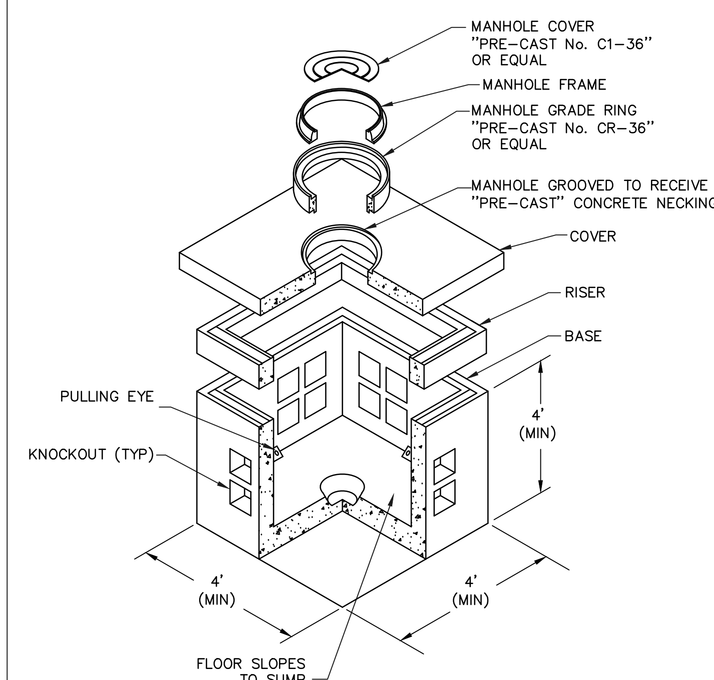


CONTROL PANEL SUN SHADE DETAIL 238
NOT TO SCALE



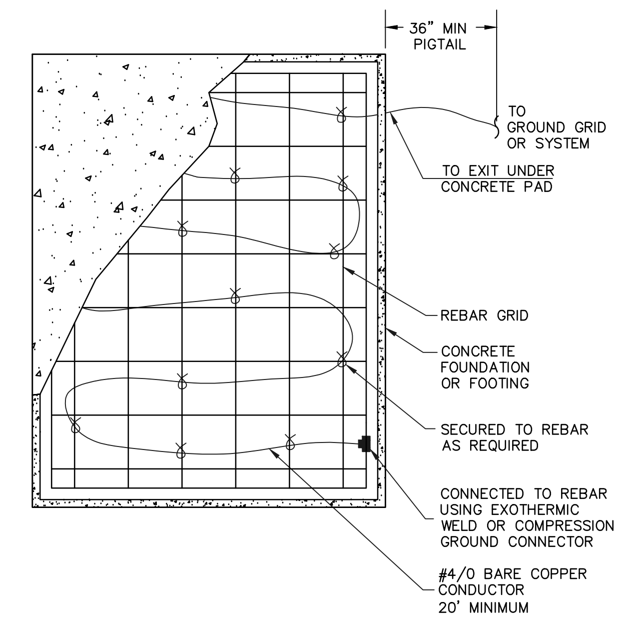
NOTE: ALL DIMENSIONS ARE MINIMUM

UNDERGROUND CONCRETE PULLBOX DETAIL 315
NOT TO SCALE



NOTE:
3'-11" x 3'-11" x 4'-1" MINIMUM INSIDE DIMENSIONS. INSTALL A GROUND ROD AND CONNECT TO DUCT BANK GROUND. TRAIN CABLES AROUND INTERIOR PERIMETER ON CABLE RACKS.

CONCRETE MANHOLE WITH ROUND COVER DETAIL 344
NOT TO SCALE



"UFER" GROUNDING DETAIL 402
NOT TO SCALE

FOR CITY OF PHOENIX USE ONLY – REFERENCE CID NUMBER: #

REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS
#	-	-	-	-	-	-	-
#	-	-	-	-	-	-	-
#	-	-	-	-	-	-	-

WILSON ENGINEERS

35600 PHILIP J. NOONAN ARIZONA U.S.A.

REVISIONS

NO.	BY	DATE	CKD	REMARKS
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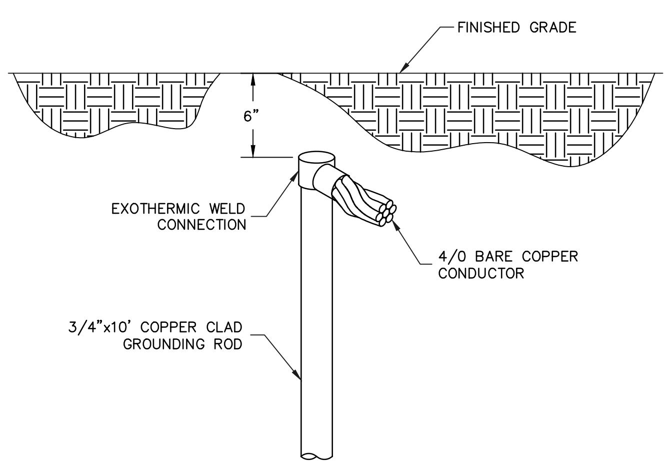
DES ER
DWN ER
CKD PJN

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT
COLLECTION SYSTEMS
REMOTE FACILITIES

ELECTRICAL
LIFT STATION 76 PHASE II EXPANSION
ELECTRICAL DETAILS 2

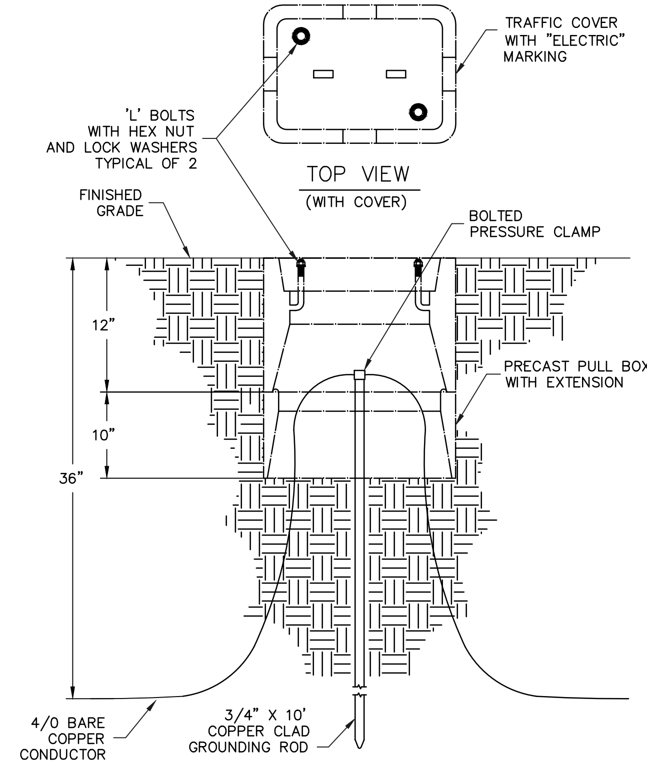
CITY PROJECT NO. WS90400067-4
DATE: MAY 2023
E12 SHEET XX OF 40
CAD FILE: 04276.05_E12



EXOTHERMIC GROUND ROD CONNECTION

DETAIL 403

NOT TO SCALE



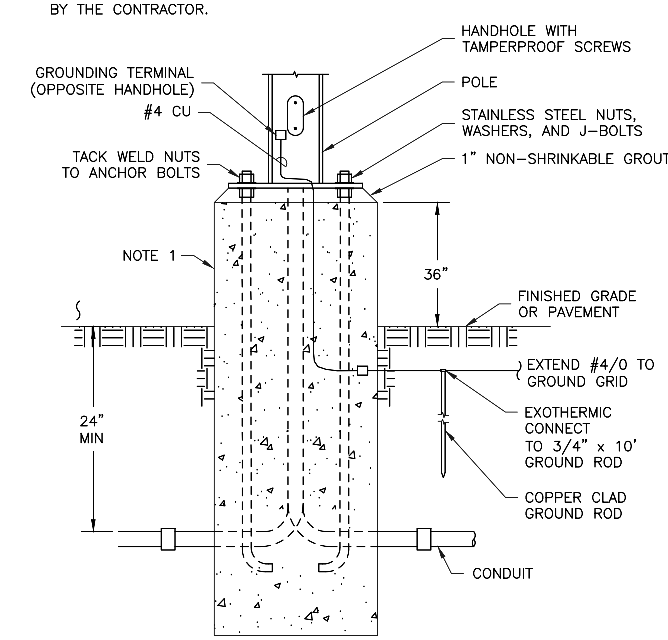
GROUND ROD WITH ACCESS WELL

DETAIL 406

NOT TO SCALE

NOTES:

1. CONCRETE BASE MUST BE SIGNED AND SEALED BY STRUCTURAL ENGINEER HIRED BY THE CONTRACTOR.



AREA LIGHTING POLE MOUNTING TALL BASE

DETAIL 502

NOT TO SCALE

THIS DRAWING MUST BE FIELD VERIFIED BEFORE USE
DRAWING NOT TO SCALE UNLESS SCALE BAR IS PRESENT

100% SUBMITTAL

"PER PHOENIX CITY CODE CHAPTER 2, SECTION 2-28, THESE PLANS ARE FOR OFFICIAL USE ONLY AND MAY NOT BE FURNISHED FOR INSPECTION OR COPYING, EXCEPT AS SPECIFICALLY STATED IN THE CITY CODE, OR AS REQUIRED BY LAW."
THIS DOCUMENT MUST BE KEPT SECURE AT ALL TIMES.

FOR CITY OF PHOENIX USE ONLY - REFERENCE CID NUMBER: #

REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS
#							
#							
#							

WILSON ENGINEERS

35600 PHILIP J. NOONAN ARIZONA U.S.A.

REVISIONS				
NO.	BY	DATE	CKD	REMARKS
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DES	ER
DWN	ER
CKD	PJN

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT
COLLECTION SYSTEMS
REMOTE FACILITIES

ELECTRICAL

LIFT STATION 76 PHASE II EXPANSION
ELECTRICAL DETAILS 3

CITY PROJECT NO. WS90400067-4

DATE: MAY 2023

E13 SHEET XX OF 40

CAD FILE: 04276.05_E13

RFI CONSULTANTS LLC

NACE Certified Coating Inspectors & Protective Coating Specialists
Veteran Owned & Operated

LIFT STATION 76 PROJECT

LIMITED LEAD & ASBESTOS SURVEY

PIONEER RD
PHOENIX, AZ 85086

NOVEMBER 17TH, 2023

PREPARED FOR
CITY OF PHOENIX

2225 West Speer Trail Phoenix, AZ 85086
Cell: 480-560-7182 /E-mail:eric@rficonsultants.net

RFI CONSULTANTS LLC

NACE Certified Coating Inspectors & Protective Coatings Specialists
Veteran Owned & Operated

Kyle Kraft
City of Phoenix
Water Services Department
Wastewater Engineering
2530 S. 52nd Ave,
Phoenix, AZ 85043

Attn: Mr. Kyle Kraft
Phone (602) 495-7685
Email: kyle.c.kraft@phoenix.gov

Re: Limited Asbestos & Lead Paint Survey
Lift Station 76 – Above ground piping demolition
N. Pioneer Rd.
Phoenix, Arizona 85086
COP Project No.

Mr. Kyle Kraft:

RFI Consultants, LLC, has recently completed the limited asbestos-containing material (ACM) and lead-containing paint (LCP) survey for the above referenced project located at Lift Station 76 (the site). The survey was conducted by RFI personnel on the17th of November 2023. RFI's survey was limited to suspect materials that may be impacted during the construction / demolition project at the site. The scope of work was requested by Mr. Kyle Craft, P.E. Civil Engineer III, City of Phoenix Water Services Department, Wastewater Engineering.

SUMMERY:

RFI's Sampling was conducted by Devon Carr. Devon Carr is an Environmental Protection Agency (EPA) – certified Asbestos Hazard Emergency Response Act (AHERA) building inspectors for asbestos. Devon Carr is also an Environmental Protection Agency (EPA) – certified lead supervisor and certified to conduct lead-based paint activities pursuant to 40 CFR part 745.226. A total of one hundred and twenty six (126) bulk samples of suspect ACM and thirty (30) paint chip samples were collected from the site for laboratory analysis.

The limited sampling was conducted using procedures like EPA AHERA regulations, 40 CFR 763. All samples were submitted to Fiberquant Analytical Services in Phoenix, Arizona on December 1st, 2023. Asbestos bulk samples were analyzed by Fiberquant Analytical Services who is accredited by the National Institute for Science and Technology

(NIST) under the National Voluntary laboratory Accreditation Program (NVLAP) for bulk asbestos sample analysis administered by NIST. A Copy of the Fiberquant Analytical Services (NVLAP) certification is attached to this report.

All samples were delivered to Fiberquant by Devon Carr and chain of custody forms are attached to each report.

The purpose of this survey is to investigate the condition of accessible suspect asbestos and lead containing paint prior to the construction / demolition project at Lift Station 76. The project is for removal of the above ground force main piping. Asbestos was reportedly not detected in the samples collected and analyzed. As such, the materials sampled at the site are not considered ACM.

The paint chip samples collected from the site collected from the site did not contain lead in concentrations above 0.5% by weight, or 5,000 parts per million (ppm). LBP is defined under the us department of Housing and Urban Development (HUD) and the Environmental Protection Agency (EPA) as paint or other surface coating with lead content equal to or greater than 1.0 mg/cm^2 of surface area by XRF or 0.5% by weight, 5,000 parts per million (PPM) by paint chip analysis.

SAMPLE ASSESSMENT AND COLLECTION:

Each suspect ACM was designated a distinct homogeneous area, which is defined as a single material, uniform in texture and appearance, installed at one time, and unlikely to consist of more than one type of formulation of material. At the time of the limited sampling, the suspect materials were physically contacted (touched) to determine friability

A sufficient value of samples were collected of the suspect material within the designated project area to satisfy the Occupational Safety and Health Administration (OSHA) and National Emission Standards for Hazardous Air Pollutant (NESHAP) requirements for the determination of asbestos content and Housing and Urban Development (HUD) guidelines form the determination of lead-based paint. The results of the limited sampling are not meant to apply to the site as a whole and are limited to the project area only.

FINDINGS AND RECOMMENDATIONS

The suspect asbestos material and paint chip samples analytical results are listed in the following pages.

RFI CONSULTANTS LLC

NACE Certified Coating Inspectors & Protective Coatings Specialists
Veteran Owned & Operated

INSPECTION INFORMATION					
Inspector:	**Devon Carr**	**Reviewer:**	**Eric Brackman**	**Date:**	**11/17/2023**
Client:	**City of Phoenix**				
Client Contact:	**Kyle Kraft**				
Contractor:	**N/A**				
Supervisor:	**N/A**				
Engineer:	**N/A**				
Supplier:	**N/A (Various)**				
Location:	**Pioneer Rd, Phoenix, AZ 85086**				
Project:	**Lift Station 76**				
Structure Description/ID:	**Lift Station 76 (The Site)**				
Specification / Division:	**N/A – 11/17/2023**				

WEATHER CONDITIONS

Instrument Manufacturer: Elcometer **Model / Serial Number: G319-T/ WF23545** **MFG. Re-Certification Due:6/28/24**

Day / Night	X	CONDITION	X	CONDITION	X	CONDITION	X
Night		Sunny	X	Clear	X	Snow	
Day	X	Cloudy		Rain		Fog	

ENVIRONMENTAL READINGS

Instrument Manufacturer: Elcometer **Model / Serial Number: G319-T/ SK21513** **MFG. Re-Certification Due:2/21/24**

Location	Time	Wind	RH%	Surface Temp	Air Temp	Dew Point	Surface to Dew Point
N. Pioneer Rd, Phoenix, AZ 85086	09:00	N (1 mph)	70.5%	67.8°F	67.8°F	57.9°F	+9.9°F
N. Pioneer Rd, Phoenix, AZ 85086	10:00	ESE (3 mph)	66.0%	71.6°F	71.6°F	59.6°F	+12.0°F
N. Pioneer Rd, Phoenix, AZ 85086	11:00	WSW (3 mph)	55.7%	75.2°F	75.2°F	58.3°F	+16.9 °F

Limited Asbestos Sampling
November 17th, 2023
Lift Station 76

Sample #	Material	Functional Space	Results (%)	NESHAP Category	Quantity	Condition
76-A-01A	Above Ground Force Main Piping & Appurtenances	Force Main Above Wet well	Non Detect	N/A	N/A	Good
76-A-02A						
76-A-02A						
Notes						

Laboratory analyses did not detect asbestos in the suspect materials sampled at the site. If new suspect materials are discovered that may be disturbed during the project all work should immediately stop and additional samples shall be collected. RFI recommends conducting a comprehensive asbestos survey at the site prior to renovation or demolition, and suspect materials present which have not been surveyed should be assumed to be ACM until sufficient sampling and analysis is performed to confirm the presence or absence of asbestos.

Limited Paint Chip Sampling
November 17th, 2023
Lift Station 76

Sample #	Component	Substrate	Color / Condition	Results (% by weight)
76-L-01A	Piping	Steel	Desert Sands	<0.0025
76-L-02B	Bollards	Steel	Safety Yellow	<0.0045
Notes				

The paint chip samples collected from the interior of building contained lead in concentrations above the laboratory detection limit. LBP is defined under the US Department of Housing and Urban Development (HUD) and the Environmental Protection Agency (EPA) as paint or other surface coating with lead content equal to or greater than 1.0mg/cm^2 of surface area by XRF or 0.5% by weight, or 5,000 parts per million (ppm) by paint chip analysis.

Lift Station 76
Force main piping
View from South gate facing Northeast

Lift Station 76
North gate & eye wash station
View from South gate facing North

Lift Station 76
Force main piping
View from center of site facing West

Lift Station 76
Force main piping

Lift Station 76
Force main piping

FIBERQUANT ANALYTICAL SERVICES

Polarized Light Microscope (PLM) Analysis for Asbestos in Bulk Sample

JobNumber:	**202311337**

Client: **RFI CONSULTANTS LLC**

2225 W SPEER TRAIL

PHOENIX, AZ 85086-0000

Office Phone: (480) 560-7182

FAX:

 # Samples: 3 PLM **Rec:** 12/1/2023 **Method:** EPA 600/R-93/116 The "New" Method; see below

Client Job: Lift Station 76 **PO Number:**

Report Date: 12/7/2023 **Date Analyzed:** 12/7/2023 **Routing Number:** -

Method and Analysis Information: **Fiberquant Internal SOP:** PLMn

Each bulk sample is first dissected under a 7-30x magnification stereo-microscope. This examination is used to determine the general type of sample, how many and what type of layers it has, and initial estimates of fiber types and quantities. Second, liquid media mounts are made of each layer - such mounts may be of selected fibers (used solely for identification purposes) or may be representative of the layer as a whole (used for quantitation purposes). The mounts may be made in a synthetic Canadian balsam, one of several solvents, or in refractive index oils (media of known refractive index). Generally, a variety of different mounts are made: some optimized for fiber visibility, some optimized for fiber identification, and some optimized for fiber quantitation. The mounted slides are then examined at 50-400x magnification on a Nikon Labphot-pol microscope. Optical characteristics are used to identify each observed fiber type; the optical data are contained for each sample on its detail analysis sheet, attached.

Current EPA and NESHAP regulations designate a result of ≤1 % asbestos as "negative" or "non-regulated"and >1 % asbestos as "positive" or "regulated." Samples containing layers that have been determined to be "positive" may have to be handled differently during a renovation or demolition than samples whose layers have been determined to be "negative." OSHA under CFR 1926.1101 regulates work done involving any detectable concentration of asbestos.

The method of fiber identification and quantitation is the "Standard Operating Procedures for the Analysis of Asbestos in Bulk Samples using Polarized Light Microscopy", Chapter 7 of the Quality Assurance and Management Manual. This SOP and its associated reporting have been designed to satisfy all requirements in both EPA Method 600/M4-82-020 (The Interim Method) and EPA Method 600/R-93/116 (The New Method). The Interim Method is the required method for AHERA (US EPA 40 CFR Pt. 763), but this method calls for the reporting of composited results of multi-layered samples that is no longer an acceptable reporting practice in most circumstances. Current EPA rules, such as NESHAP (US EPA 40 CFR Pt. 61), as well as NVLAP accreditation policies, call for separate reporting for each layer of multi-layered samples. The New Method contains the same procedures for identification and quantification of asbestos as does the Interim Method, except that multi-layered samples are reported to comply with the latest US EPA rule. Fiberquant not only reports the asbestos content of each layer of multi-layered samples separately (satisfying current EPA and NVLAP reporting requirements), but Fiberquant also reports what percentage of the sample each layer comprises. Therefore, the results may be arithmetically composited to satisfy the reporting requirements of the Interim Method. The method of fiber quantitation is an estimation technique in which the analysts quantitation is routinely calibrated by reference quantitation standards, and which has been shown to be equivalent in precision and accuracy to point counting. Friability is estimated for the purposes of deciding when to point count. Friabilities determined in the field take precedence over those determined in the laboratory. Those sample layers which are friable and estimated by the analyst to contain <= 1% asbestos are point counted using 400 points. Such point counting is required by NESHAP (National Emission Standards for Hazardous Air Polutants, Nov. 1990) in order to rely on analytical results that are ≤ 1%. The coefficient of variation for the estimation quantitation technique is 100% in the range 0-5%. This means that PLM analysis is not capable of conclusively determining whether a layer containing close to 1% asbestos is actually "positive" or "negative". For this reason, Fiberquant refers to results where asbestos was detected but ≤ 1% as "borderline negative", and results where asbestos was >1 % but <= 2% as "borderline positive" to indicate the uncertainty in assigning a "positive" or "negative" label. In the sample summary, "ND" means that no asbestos was detected during the analysis. A "Tr" or "Trace" of asbestos reported is defined for our purposes as the detection of several asbestos fibers during the analysis; this level would be right at the limit of detection for the method. Trace is only reported on the analysis detail - in the summary a trace would be reported as <=1%. The limit of detection (the smallest % of asbestos that can be detected) varies greatly depending on the matrix in which the asbestos is found. As little as 0.001% asbestos can be detected in favorable samples, while detection in unfavorable samples may approach the detection limit of 1% stated in the method. During the analysis, the analyst, for Fiberquant identification purposes only, determines the "apparent sample type" and "apparent layer types." It must be emphasized that these types are only what is apparent. Often, different materials appear similar or identical after sampling, so the analyst may assign a type other than what was sampled.

Floor tiles present a special problem for PLM asbestos analysis. Floor tile can contain chrysotile fibers so thin that they cannot be resolved by optical methods. In such a case, we may observe a percentage of asbestos which is lower than the actual percentage, or not observe asbestos at all when some is present. For this reason, floor tiles reported as negative should be confirmed to be negative using transmission electron microscope (TEM) analysis. Likewise, vermiculite insulation materials containing traces of asbestiform asbestos present a problem for routine PLM analysis - the amphiboles are sometimes present in trace amounts inhomogeneously distributed. For this reason, loose vermiculite samples reported as negative should be confirmed to contain no amphibole using hydroseparation techniques.

The samples were analyzed under the following ongoing quality assurance program: Blank samples are routinely analyzed to maintain contamination-free materials. Each analyst has at least a bachelor's degree in physical science, and has also completed extensive training specific to asbestos analysis for 1-3 months before being allowed to analyze client samples. Qualitative reference samples are routinely analyzed to assure that analysts

can identify asbestos and asbestos-look-alike fibers. Quantitative reference samples are routinely analyzed to calibrate and characterize the estimation procedure. Microscope alignment is checked each day. Refractive index oils are calibrated at least quarterly. At least 10% of client samples are re-analyzed from scratch by a different analyst than the original, and any discrepancies are resolved for the sample and similar sample types before the results are reported. All quality checks performed for these samples were in control except as detailed in the "Analytical Notes" below. All analysts participate in interlab round robins and proficiency testing to assure competence. Fiberquant is accredited by NVLAP (Lab code #101031) for the analysis of bulk samples for asbestos using PLM. Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full, without the approval of Fiberquant Analytical Services.

Some results may have been calculated using client supplied data, such as volume or area sampled, for which Fiberquant assumes no liability for accuracy.

Job Analysis Notes:

PLM Analysis Summary: **Job Number: 202311337** Lift Station 76

Sample Number / Layer	Color	Apparent Layer Type *	Lab Number / *Asbestos Results*	Apparent Sample Type *	Asbestos Detected Yes or No
Sample # **76-A-01A**			2023-11337- 1	Surfacing	Asbestos Detected? No
Layer # 1	various	paint	*no asbestos detected*		
Layer # 2	blue	miscellaneous	*no asbestos detected*		
Sample # **76-A-02A**			2023-11337- 2	Surfacing	Asbestos Detected? No
Layer # 1	various	paint	*no asbestos detected*		
Sample # **76-A-03A**			2023-11337- 3	Surfacing	Asbestos Detected? No
Layer # 1	various	paint	*no asbestos detected*		

* Apparent Sample Types and Apparent Layer Types are as they appeared to the analyst. Since many types of materials appear similar after sampling damage, the apparent type of material may not be the actual type of material.

Sample 76-A-01A **Lab Number** 2023-11337- 1 **Sampled:** 11/17/2023 **Condition:** acceptable

Analyzed By GV 12/7/2023 **An?** OK **Apparent Smp Type** Surfacing Non-fibrous Solid

Homogeneous No **# Layers** 2 **Asbestos Detected?** No

Non-Fibrous Components (in approx. decreasing order): polymer, filler,

Layers

#	Layer Type	%	Color	Friability	Calibrated Visual Estimate of Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	paint	20	various	1	n.d.	-	-	-	-	-
2	miscellaneous	80	blue	1	n.d.	-	-	-	-	-
	Total %	100		**Overall %**	n.d.	-	-	-	-	-
				Fiber Identification:	none					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	none												
2													
3													
4													
5													
6													

Sample Analytical Note

Note: layer 1 was a mixture of several thin paint layers; there was no way to separate them. Analyzed as a single layer. Procedure: tweased apart using forceps. Procedure: dissolution of polymer matrix using solvent.

Sample 76-A-02A **Lab Number** 2023-11337- 2 **Sampled:** 11/17/2023 **Condition:** acceptable

Analyzed By GV 12/7/2023 **An?** OK **Apparent Smp Type** Surfacing Non-fibrous Solid

Homogeneous Yes **# Layers** 1 **Asbestos Detected?** No

Non-Fibrous Components (in approx. decreasing order): polymer, filler,

Layers

#	Layer Type	%	Color	Friability	Calibrated Visual Estimate of Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	paint	100	various	1	n.d.	-	-	-	-	-
	Total %	100		**Overall %**	n.d.	-	-	-	-	-
				Fiber Identification:	none					

Fibers

		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	none												
2													
3													
4													
5													
6													

Sample Analytical Note

Note: layer 1 was a mixture of several thin paint layers; there was no way to separate them. Analyzed as a single layer. Procedure: tweased apart using forceps. Procedure: dissolution of polymer matrix using solvent.

Sample 76-A-03A **Lab Number** 2023-11337- 3 **Sampled:** 11/17/2023 **Condition:** acceptable

Analyzed By GV 12/7/2023 **An?** OK **Apparent Smp Type** Surfacing Non-fibrous Solid

Homogeneous Yes **# Layers** 1 **Asbestos Detected?** No

Non-Fibrous Components (in approx. decreasing order): polymer, filler,

Layers

#	Layer Type	%	Color	Friability	Calibrated Visual Estimate of Percents of Each Fiber: Fib 1	Fib 2	Fib 3	Fib 4	Fib 5	Fib 6
1	paint	100	various	1	n.d.	-	-	-	-	-
	Total %	100		**Overall %**	n.d.	-	-	-	-	-
				Fiber Identification:	none					

Fibers		Color	Mrph	Iso	Pleo	Bi	Elg	Ext	Refractive Index Determinations: Oil	Col Par	Col Per	RI Par	RI Per
1	none												
2													
3													
4													
5													
6													

Sample Analytical Note

Note: layer 1 was a mixture of several thin paint layers; there was no way to separate them. Analyzed as a single layer. Procedure: tweased apart using forceps. Procedure: dissolution of polymer matrix using solvent.

Fr=Friability: 1=very non-friable; 2= non-friable; 3=friable; 4=highly friable
Colors: B=black;BL=blue;BR=brown;CL=clear;G=Green;GY=gray;OR=orange;OW=off-white;PN=pink;PU=purple;R=red;TN=tan;W=white;Y=yellow;V=various
Fiber Morphology: A=fine fibers/bundles, white, sinewy, flexible; B=fine fibers/bundles, w-br, straight, broomed ends; C=fine fibers/bundles, blue, straight, broomed ends; D=fine to coarse fibers, CL-B, brittle; E=coarse fibers,CL or dyed, striated; F=coarse fibers or splinters, W-BR, ribbon-like; G=lath-like or shards, low aspect ratio, may taper
Iso=isotropism - may be yes or no; Pleo=pleochroism - may be yes or no; Bi=birefringence - may be None, Low, Medium or High
Elg=sign of elongation - may be +, - or B (both); Ext=extinction - may be Parallel, Oblique, None or Undulating; Oil=medium used to for dispersion staining
Col Par=dispersion staining colors parallel to the fiber (fiber/halo): b/w=black/white; dg/py=dark gray/pale yellow; vg/y=violet gray/yellow; db/ly=dark blue/lemon yellow; vb/g= vivid blue/gold; sb/o=sky blue/orange; pb/r=pale blue/red; gb/dr=gray blue/dark red; w/b=white/black. Col Perp=same only perpendicular to fiber.
RI Par=refractive index parallel to fiber; RI Perp=refractive index perpendicular to fiber

Galina B. Volkova

Analyst: GALINA B. VOLKOVA

Printed: 07-Dec-23

Original Print Date: 07-Dec-23

Larry S. Pierce

Larry S. Pierce, Approved Accreditation Signatory

FIBERQUANT ANALYTICAL SERVICES

Fiberquant Analytical Services 5025 S. 33rd St.;
Phoenix, AZ 85040; Phone: 602-276-6139; FAX: 602-276-4558;
info@fiberquant.com

Analysis Request/Chain-of-Custody Form

Submitted by (Company)	
RFI Consultants LLC	
Address	
2225 W. Speer Trail	
City, State, Zip Code	
Phoenix, AZ 85086	
Phone	FAX
(480) 868 - 8523	N/A
Email	
Devon_RFI@Yahoo.com	

Invoice to (Company)	
RFI Consultants LLC	
Address	
2225 W. Speer Trail	
City, State, Zip Code	
Phoenix, AZ 85086	
Phone	FAX
(480) 560 - 7182	N/A

Contact (print)	
Devon Carr	
Sampled by (signature)	
Job Number or Project Name	~~[illegible] Improvements~~ Lift Station 76
PO Number	
N/A	

<Analysis Method Requested> ONLY ONE METHOD per COC			Turn-around-time (circle one)			
			Rush		Norm	Ext.
Asbestos by PLM	Method > Improved Interim		Urgent Rush <3 hrs	<6 hrs	(1-3 days)	15-30 days
	Analyze > All ATPF					
	If ATPF then > by Layer by Sample					
	Single Layer Protocol > Yes No					
Fibers by PCM	Method > 7400 (Area) ORM (Personal)		<4 hrs		24 hrs	-
Asbestos by TEM	in Air > AHERA Mod. AHERA		<6 hrs		24 hrs	3-5 days
	in Water* > Water Sludge		1-2 days		3-5 days	N/A
	in Bulk (Annex2) > Chatfield Full Quant.					
	in Dust > ASTM D5755		3-5 days		5-10 days	N/A
Pb by FLAA	Analyte > Pb Other		<6 hrs		2-3 days	N/A
	Matrix > Filter > MCE FG					
	Paint > by Area (mg/cm²) by Weight (ppm)					
	Soil >					
	Wipe >					
	Initial here certifying wipes used are ASTM E1792 compliant _____					
Fungi	Air Sample > Zefon Aller Other		<6 hrs		1-2 days	N/A
	Bulk > Sample Swab					
	Tape Lift > Qualitative (% & type)					
	Quantitative (type/cm2)					
Soot	ASTM D6602-03b	Optical	<6 hrs		1-2 days	N/A
		Optical & TEM	1-2 days		3-5 days	N/A
Other			Call		Call	

Sample # (1 per line)	Description/Location	Sample Date	Sample Time	Vol. or Area
1) 76-A-01A	piping Cahave ground	11-17-2023	10:00	
2) 76-A-02A	"	"	"	
3) 76-A-03A	"	"	"	
4)				
5)				
6)				
7)				
8)				
9)				
10)				
11)				
12)				
13)				
14)				
15)				
16)				
17)				
18)				
19)				
20)				

1)Relinquished by:	Date:	Time:	3)Relinquished by:	Date:	Time:
Devon Carr	12-01-2023	14:45			
2)Received by:	Date:	Time:	4)Received by:	Date:	Time:
	12-1-23	14:48			
* TEM Water: Sampler's name Required by State of Arizona	Print Name		Fiberquant assigned Job Number>		
Review of Analysis Request (Initials):				Page of	

Important: By signing above you as Fiberquant's customer are agreeing to payment within 30 days unless other arrangements are made in writing.
Note: Data completed by client (including number and identity of samples) is assumed to be correct until it is verified at time of sample preparation.

FIBERQUANT ANALYTICAL SERVICES

Atomic Absorption Spectrometer (AAS) Analysis of Paint

JobNumber:	**202311336**

Client: **RFI CONSULTANTS LLC**

2225 W SPEER TRAIL

PHOENIX, AZ 85086-0000

Office Phone: (480) 560-7182

FAX:

 # Samples: 2 AA **Rec:** 12/1/2023 **Method:** Modified SW 846 3050b/7000B Pb in paint by weight AA Analysis

Client Job: Lift Station 76 **PO Number:**

Report Date: 12/5/2023 **Date Analyzed:** 12/5/2023 **Routing Number:** -

Method and Analysis Information: **Fiberquant Internal SOP:** AApw

The received samples were analyzed for Pb (total) using "Test Methods for Evaluating Solid Waste" (SW 846, December 1996 updates). The extraction/digestion method was SW 3050b. The analytical method is "Flame Atomic Absorption Spectrophotometry", modified EPA method 7000B. Briefly the procedures are as follows. The incoming paint samples are first homogenized by mixing and crushing. A sub-sample is weighed to approximately 0.1 gm into a 50ml centrifuge tube. To the run stream are added the quality assurance samples described below. Six mls of concentrated HNO3 and one ml of 30% H2O2 are added to each container. The tubes are caped and heated for at least 1 hour at ~98 deg. C. After cooling, the contents of the centrifuge tube are brought up to exactly 25 mls, completing the digestion/extraction. The modification is that deionized water is used for the blanks (initial and continuing calibration) instead of an acid and matirx matched digestate.

The sample and quality assurance extractions are then analyzed on a Thermo ICE 3000 flame atomic absorption spectrometer or a Perkin Elmer Aanalyst 200. The wavelength and other instrumental settings are set according to the manufacturer's recommendations and as specified in the 7000B method. Absorptions are recorded from sample and standard solutions. A calibration curve is fitted to at least three standard solutions, and the concentrations of the sample extracts are calculated from the curve. The parts per million for each sample is calculated from the extract concentration and area of the sample in cm2.

The results from this analysis are generally compared to the HUD Guidelines standard of 5,000 parts per million (ref.). Paint sampling for compliance with OSHA 29 CFR 1926.62 is not recognized nor does 29 CFR 1926.62 define what lead-based paint is. The historical coefficient of variation for this method is approximately 20%. The results are reported to two significant figures. The Sample Reporting Limit (RL) listed below is twice the Sample Detection Limit, which is calculated for each sample from the experimentally determined Method Detection Limit. The limit of reliable quantitatiion is generally regarded as five to ten times the limit of detection. Therefore, smaller sample with masses less than 0.04 grams may give results too near the 5,000 ppm standard to be reliable. Problems in analysis or other information is provided in the "Analytical Notes" below. Blanks, if analyzed, are treated the same as samples and are not used for correcting non-blank results.

The following on-going quality assurance program was followed to ensure reproducible and dependable results: All analysts are degreed scientists trained extensively in-house for at least two months prior to un-supervised runs. Blank matrix samples are analyzed at a rate of 5% (at least one per run). Reference standards are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Spiked matrix samples are analyzed at a rate of 5% (at least one per run), and compared to statistical records via control charts. Duplicate samples are analyzed at a rate of 5% (at least one per run) if duplicates can be made from the sample (otherwise, twice the number of spikes are performed), and compared to statistical records via control charts. For each instrumental run, the spectrometer is checked for sensitivity and stability. The calibration standards are made fresh weekly, and checked each run against a calibration verification standard from another source. All calculations are performed twice - once in a calibration spreadsheet, and once during the report generation, and also checked by hand. All quality checks performed for these samples were in control except as detailed in the "Analytical Notes" below. Fiberquant participates in the Environmental Lead Proficiency Analytical Testing (ELPAT) program, is accredited by AIHA LAP, LLC for environmental lead samples (AIHA Lab #101593), and is recognized by the National Lead Laboratory Accreditation Program (NLLAP) for the analysis of Pb in paint. Accreditation does not imply endorsement by the EPA, any other United States governmental agency or any private agency or association. Each lab analysis refers only to the sample tested, and may not, due to the sampling process, be representative of the material sampled. This report may not be reproduced except in full, without the approval of Fiberquant Analytical Services.

Some results may have been calculated using client supplied data, such as volume or area sampled, for which Fiberquant assumes no liability for accuracy.

Job Analysis Notes:

Calibration Curve:

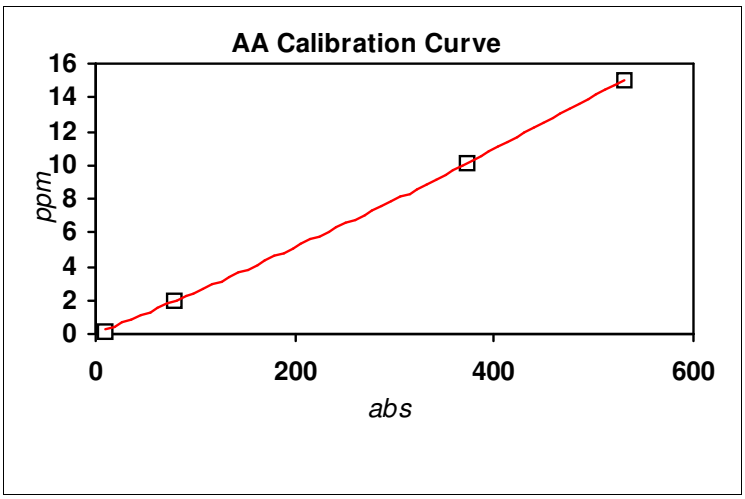
Pb

Run # 17326 ***12/4/2023***

Instrument: iCE 3000

Standards:	ppm	avg. mAbs.
1	0.2	9
2	2.008	80
3	10.04	372
4	15.06	530

ax2	0.00000862
bx	0.02381093
c	0.01082456
R2	0.99998235



Analysis Results:

Job Number:	202311336

AApw

Lab Number	Client Number	Date	Condition	Weight (gm)	ug/ml	ml	Dil
2023-11336- 1	76-L-01A	11/17/2023	acceptable	0.2004	0.0346	25	1
2023-11336- 2	76-L-02B	11/17/2023	acceptable	0.1106	0.0346	25	1

Analyte	wt %	ppm	RL(ppm)
Pb	<0.0025	<25	25
Pb	<0.0045	<45	45

Analyst: MARTIN A. ESQUER

Printed: 05-Dec-23

Original Print Date: 05-Dec-23

Larry S. Pierce, Approved Accreditation Signatory

FIBERQUANT ANALYTICAL SERVICES

Fiberquant Analytical Services 5025 S. 33rd St.; Phoenix, AZ 85040; Phone: 602-276-6139; FAX: 602-276-4558; info@fiberquant.com

Analysis Request/Chain-of-Custody Form

Submitted by (Company)	
RFI Consultants LLC	
Address	
2225 W. Speer Trail	
City, State, Zip Code	
Phone: (480) 868 - 8523	FAX: N/A
Email: Devon_RFI@Yahoo.com	

Invoice to (Company)	
RFI Consultants LLC	
Address	
2225 W. Speer Trail	
City, State, Zip Code	
Phone: (480) 560 - 7182	FAX: N/A

Contact (print): Devon Carr	
Sampled by (signature)	
Job Number or Project Name: [redacted] Lift Station 76	
PO Number: N/A	

<Analysis Method Requested> ONLY ONE METHOD per COC			Turn-around-time (circle one)			
			Rush		Norm	Ext
Asbestos by **PLM**	Method > Improved / Interim		Urgent Rush <3 hrs	<6 hrs	1-3 days	15-30 days
	Analyze > All / ATPF					
	If ATPF then > by Layer / by Sample					
	Single Layer Protocol > Yes / No					
Fibers by **PCM**	Method > 7400 (Area) / ORM (Personal)		<4 hrs		24 hrs	-
Asbestos by **TEM**	in Air > AHERA / Mod. AHERA		<6 hrs		24 hrs	3-5 days
	in Water* > Water / Sludge		1-2 days		3-5 days	N/A
	in Bulk (Annex2) > Chatfield / Full Quant.					
	in Dust > ASTM D5755		3-5 days		5-10 days	N/A
Pb by **FLAA**	Analyte > Pb / Other		<6 hrs		2-3 days	N/A
	Matrix > Filter > MCE / FG					
	Paint > by Area (mg/cm²) / by Weight (ppm)					
	Soil >					
	Wipe >					
	Initial here certifying wipes used are ASTM E1792 compliant _____					
Fungi	Air Sample > Zefon / Aller / Other		<6 hrs		1-2 days	N/A
	Bulk > Sample / Swab					
	Tape Lift > Qualitative (% & type)					
	Quantitative (type/cm2)					
Soot	ASTM D6602-03b	Optical	<6 hrs		1-2 days	N/A
		Optical & TEM	1-2 days		3-5 days	N/A
Other			Call		Call	

Sample # (1 per line)	Description/Location	Sample Date	Sample Time	Vol. or Area
1) 76-L-01A	Pitney	11-17-2023	10:00	
2) 76-L-02B	Bollards	11-17-2023	10:00	
3)				
4)				
5)				
6)				
7)				
8)				
9)				
10)				
11)				
12)				
13)				
14)				
15)				
16)				
17)				
18)				
19)				
20)				

1)Relinquished by: Devon Carr	Date: 12-01-2023	Time: 14:45	3)Relinquished by:	Date:	Time:
2)Received by: [signature]	Date: 12-1-23	Time: 14:48	4)Received by:	Date:	Time:
* TEM Water: Sampler's name Required by State of Arizona	Print Name		Fiberquant assigned Job Number>		
Review of Analysis Request (Initials): [initials]				Page of	

Important: By signing above you as Fiberquant's customer are agreeing to payment within 30 days unless other arrangements are made in writing.
Note: Data completed by client (including number and identity of samples) is assumed to be correct until it is verified at time of sample preparation.

MAYOR
THELDA WILLIAMS
CITY COUNCIL

DISTRICT 1 **THELDA WILLIAMS**
DISTRICT 2 **JIM WARING**
DISTRICT 3 **DEBRA STARK**
DISTRICT 4 **LAURA PASTOR**
DISTRICT 5 **VANIA GUEVARA**
DISTRICT 6 **SAL DICICCIO**
DISTRICT 7 **MICHAEL NOWAKOWSKI**
DISTRICT 8 **FELICITA MENDOZA**

CITY MANAGER
ED ZUERCHER

CITY ENGINEER
KINI L.E. KNUDSON, PE

WATER SERVICES DIRECTOR
KATHRYN SORENSEN

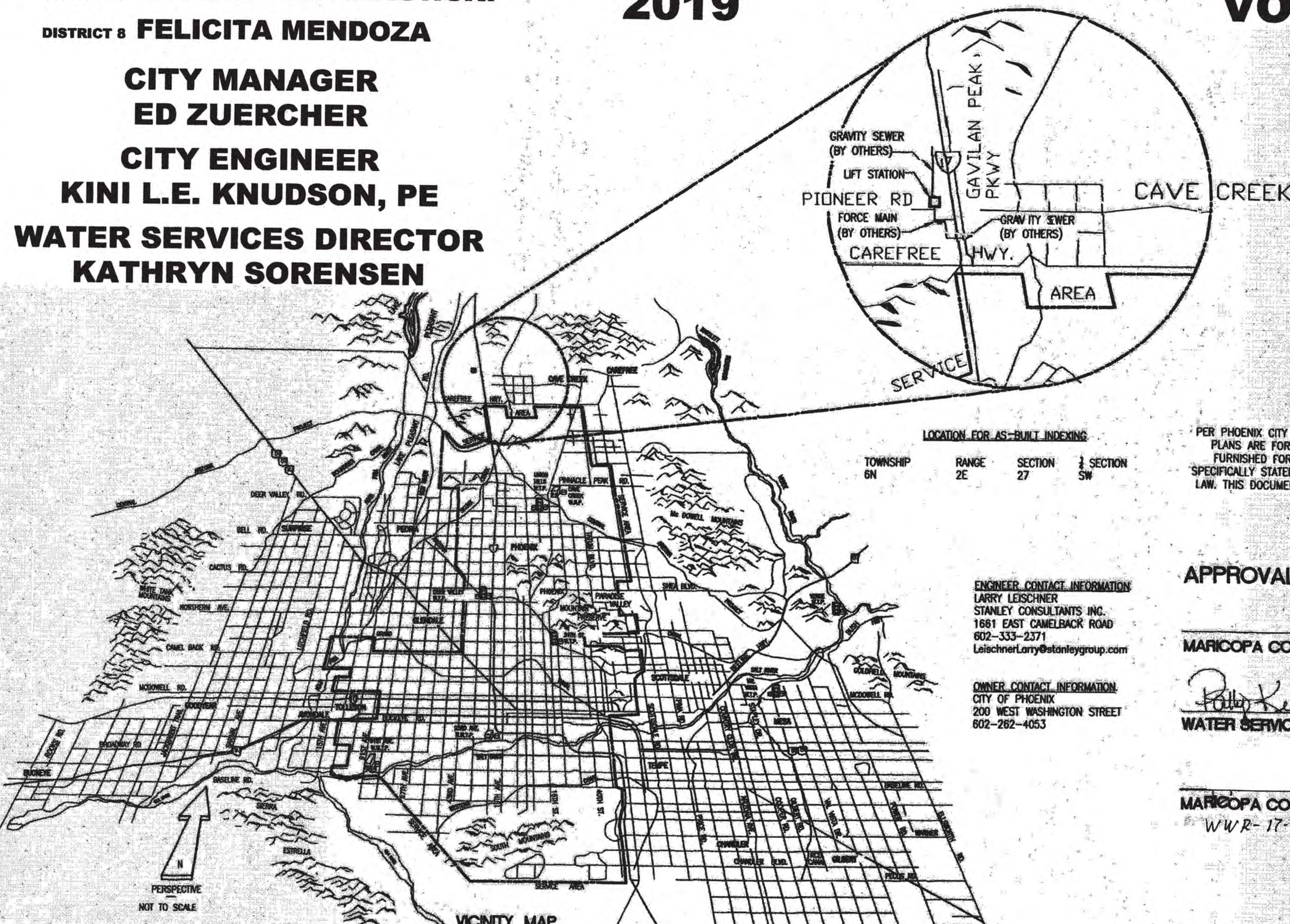
2019

City of Phoenix

WATER SERVICES DEPARTMENT

WEST ANTHEM LIFT STATION NO. 76
PROJECT NO. WS90400067
38107 NORTH PIONEER ROAD
VOLUME 4 OF 5

LPRR 1806173



VICINITY MAP

LOCATION FOR AS-BUILT INDEXING

TOWNSHIP	RANGE	SECTION	¼ SECTION
6N	2E	27	SW

PER PHOENIX CITY CODE CHAPTER 2, SECTION 2-28, THESE PLANS ARE FOR OFFICIAL USE ONLY AND MAY NOT BE FURNISHED FOR INSPECTION OR COPYING, EXCEPT AS SPECIFICALLY STATED IN THE CITY CODE, OR AS REQUIRED BY LAW. THIS DOCUMENT MUST BE KEPT SECURE AT ALL TIMES.

602 803 6681
CITY OF PHOENIX
Planning and Development
By [signature] DAVID SANCHEZ 3/17
DEC 4 2018
This set of plans has been reviewed for ELECTRICAL requirements and shall be kept on the site. Such review shall not prevent the correction of errors in the plans or during construction where such errors are subsequently found to be in violation of any law or ordinance.
AS MADE [initials]

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

I HEREBY CERTIFY THAT THE "AS-BUILT" MEASUREMENTS AS SHOWN HEREON WERE MADE UNDER MY SUPERVISION OR AS NOTED AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer (Civil) CERTIFICATE NO. 42745 JAY A. HORAK Date Signed 09-21-21 ARIZONA, U.S.A.

City of Phoenix
Planning and Development
Annual Facilities Inspection Program
This set of plans has been reviewed for PLUMBING/MECHANICAL requirements and shall be kept on the site. Such review shall not prevent the correction of errors in the plans or during construction where such errors are subsequently found to be in violation of any law or ordinance.
By [signature] Date 10/9/18
602-501-1580

CITY COPY

AS-BUILT CERTIFICATION

I HEREBY CERTIFY THAT THE "RECORD DRAWING" MEASUREMENTS AS SHOWN HEREON WERE MADE UNDER MY SUPERVISION OR AS NOTED AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

REGISTERED PROFESSIONAL ENGINEER (CIVIL) DATE

REGISTRATION NO.

CITY OF PHOENIX
Planning and Development
By 149 [signature]
OCT 1 1 2018
This set of plans has been reviewed for ARCHITECTURAL/STRUCTURAL requirements and shall be kept on the site.
FOR INSPECTIONS
HANS HARAMBASIC
602-501-1140

ENGINEER CONTACT INFORMATION
LARRY LEISCHNER
STANLEY CONSULTANTS INC.
1661 EAST CAMELBACK ROAD
602-333-2371
LeischnerLarry@stanleygroup.com

OWNER CONTACT INFORMATION
CITY OF PHOENIX
200 WEST WASHINGTON STREET
602-262-4053

APPROVALS

MARICOPA COUNTY PLANNING AND DEVELOPMENT DATE

[signature] 3/13/18
WATER SERVICES DEPARTMENT DATE

[signature] [signature] 2-4-2020
WWR-20-00043 01-25-2019
MARICOPA COUNTY ENVIRONMENTAL SERVICES DEPARTMENT DATE
WWR-17-00474

ARIZONA 811

AS BUILTS PREPARED BY:
RICK ENGINEERING
22425 N 16TH STREET, SUITE 1
PHOENIX, ARIZONA 85024

REGISTERED LAND SURVEYOR CERTIFICATE NO. 36561 RANDALL R. HAGER ARIZONA U.S.A.

Registered Professional Engineer 24001 LARRY J. LEISCHNER ARIZONA U.S.A.

CS1

SHEET 1 OF 44

THIS DRAWING MUST BE FIELD VERIFIED BEFORE USE
DRAWING NOT TO SCALE UNLESS SCALE BAR IS PRESENT

FOR CONSTRUCTION

"PER PHOENIX CITY CODE, CHAPTER 2, SECTION 2-28, THESE PLANS ARE FOR OFFICIAL USE ONLY AND MAY NOT BE FURNISHED, FOR INSPECTION OR COPYING, EXCEPT AS SPECIFICALLY STATED IN THE CITY CODE, OR AS REQUIRED BY LAW. THIS DOCUMENT MUST BE KEPT SECURE AT ALL TIMES."

LEGEND

- BENCHMARK
- SURVEY MONUMENT
- B1 — SOIL BORING LOCATION
- COMBINED CURB & GUTTER – M.A.G. DETAIL 220 TYPE "A"
- A / 50 — BACKFILL TYPE & SQ. YD. PVMT. REPLACEMENT – C.O.P. DETAIL P1200
- 1 — BACKFILL COMPACTION TYPE
- EXISTING PAVEMENT OR SIDEWALK
- NEW CONCRETE SIDEWALK – STD. DETAIL P1230
- EXISTING DITCH
- 12" DIP W — EXISTING WATER LINE W/SIZE & TYPE (12" AND SMALLER)
- 36" DIP W — EXISTING WATER LINE W/SIZE & TYPE (GREATER THAN 12")
- ADJUST EXIST. WATER VALVE BOX – C.O.P. DETAIL P1391
- 3/4" W — WATER SERVICE W/SIZE AND WATER METER BOX
- EXISTING FIRE HYDRANT
- NEW OR RELOCATED FIRE HYDRANT BY CONTRACTOR
- 8" VCP S — EXISTING SANITARY SEWER LINE W/SIZE & TYPE (12" AND SMALLER)
- 30" VCP S — EXISTING SANITARY SEWER LINE W/SIZE & TYPE (GREATER THAN 12")
- EXISTING MANHOLE
- NEW MANHOLE
- CATCH BASIN, GUTTER INLET (LENGTH TO SCALE)
- CATCH BASIN, CURB INLET (LENGTH TO SCALE)
- CATCH BASIN, CURB & GUTTER INLET (LENGTH TO SCALE)
- 30" SD (RCP) — EXISTING STORM DRAIN LINE W/SIZE & TYPE (GREATER THAN 12")
- NEW PIPE FOR STORM DRAIN OR IRRIGATION LINE
- 4"G — EXISTING GAS LINE W/SIZE
- UGE — EXISTING UNDERGROUND ELECTRIC CABLE OR SINGLE CONDUIT
- TEL — EXISTING TELEPHONE BURIED CABLE OR SINGLE CONDUIT
- CATV — EXISTING UNDERGROUND CABLE TV
- FO — EXISTING UNDERGROUND FIBER OPTIC LINE
- COMM — EXISTING UNDERGROUND TELECOMMUNICATIONS
- EXISTING TRAFFIC SIGNAL POLE W/MAST ARM & SIGNAL INDICATIONS
- EXISTING STREET OR TRAFFIC SIGN
- EXISTING UTILITY POLE W/LINE INDICATING WIRE DIRECTION
- EXISTING WIRE FENCE
- EXISTING BLOCK FENCE
- EXISTING POWER POLE DOWN GUY ANCHOR
- EXISTING STREET LIGHT & POLE
- EXISTING TREE OR STUMP TO BE REMOVED – MORE THAN 12" DIA.
- EXISTING TREE TO BE TRANSPLANTED BY CONTRACTOR
- EASEMENT LINE
- EXISTING OR NEW R/W LINE
- PAVEMENT CENTER LINE OR MONUMENT LINE
- EXISTING TREE OR STUMP TO BE REMOVED 12" DIA. OR LESS (NON PAY ITEM)
- EXISTING TREE TO REMAIN
- MICROSEAL
- SLURRY SEAL
- CONCRETE
- NATIVE SOIL
- ABC/ SELECT BACKFILL
- 1/2 SACK SAND CLSM
- 1/2 SACK ABC CLSM
- AC
- STEEL
- DECOMPOSED GRANITE

ABBREVIATIONS

A
A ARCHITECTURAL
AASHTO AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
AB ANCHOR BOLT
ABC AGGREGATE BASE COURSE
AC ASPHALT CONCRETE
ALT ALTERNATE
ALUM ALUMINUM
APPROX APPROXIMATELY
ASP ASPHALT PAVEMENT
ARV AIR RELEASE/ VACUUM VALVE
ASTM AMERICAN SOCIETY FOR TESTING AND MATERIALS

B
BF BLIND FLANGE
BHP BRAKE HORSEPOWER
BM BENCHMARK
BOT BOTTOM
BP BYPASS
BV BALL VALVE

C
C CIVIL/COVER
CC CENTER TO CENTER
℄ CENTER LINE
CISP CAST IRON SOIL PIPE
CLR CLEAR OR CLEARANCE
CMU CEMENT MASONRY UNIT
CN CALCIUM NITRATE
CO CLEAN OUT
CONC CONCRETE
CONN CONNECTION
CONT CONTINUOUS OR CONTINUATION
COP CITY OF PHOENIX
CPLG COUPLING
CV CHECK VALVE

D
DBL DOUBLE
DEGREE ANGULAR DEGREES
DG DECOMPOSED GRANITE
DI DUCTILE IRON
DIP DUCTILE IRON PIPE
DIA DIAMETER
D DRAIN/DESTROY
DTL DETAIL
DWG DRAWING

E
E ELECTRICAL/EAST
EA EACH
ECC ECCENTRIC
EFF EFFICIENCY
EJ EXPANSION JOINT
EL/ELEV ELEVATION
EMER EMERGENCY
EMH ELECTRICAL MANHOLE
EQUIP EQUIPMENT
EXIST EXISTING
EW EACH WAY

F
FA FOUL AIR
FC FLEXIBLE CONNECTOR
FE FLOW ELEMENT
FH FIRE HYDRANT
FIN FINISHED GRADE
FM FORCE MAIN
FT FOOT OR FEET

G
GA GAUGE
GAL GALLON
GALV GALVANIZED
GLV GLOBE VALVE
GND GROUND
GPH GALLONS PER HOUR
GPM GALLONS PER MINUTE
GSP GALVANIZED STEEL PIPE
GV GATE VALVE

H
H HIGH
HCP HORIZONTAL CONTROL POINT
HDPE HIGH DENSITY POLYETHYLENE
HORIZ HORIZONTAL
HPT HIGH POINT
HP HORSEPOWER
HZ HERTZ

I
ID INSIDE DIAMETER
I\O INPUT\OUTPUT
IN. INCH\INCHES
IE INVERT ELEVATION
IPS IRON PIPE SIZE
IRG IRRIGATION

J
JB JUNCTION BOX
JT JOINT

L
∠ ANGLE
LB POUND
LCP LOCAL CONTROL PANEL
LF LINEAR FEET
LGTH LENGTH
LI LEVEL INDICATOR
LP LOW POINT
LRFD LOAD AND RESISTANCE FACTOR DESIGN
LS LIFT STATION

M
M MECHANICAL
MAG MARICOPA ASSOCIATION OF GOVERNMENTS
MAX MAXIMUM
MCC MOTOR CONTROL CENTER
MCDOT MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION
MFT MANUFACTURER
MH MANHOLE
MIN MINIMUM
MINS MINUTES
MJ MECHANICAL JOINT
MV MILLIVOLT
MW MEGAWATT

N
N NORTH
NC NORMALLY CLOSED
NE NORTHEAST
NO NORMALLY OPEN
NOM NOMINAL
NPW NON-POTABLE WATER
NS NON SALVAGEABLE
NTS NOT TO SCALE
NW NORTHWEST

O
OC ON CENTER
OCD ODOR CONTROL DRAIN
OD OUTSIDE DIAMETER
OF OVERFLOW
OHE OVERHEAD ELEC. POWER LINES

P
PCU PROCESS CONTROL UNIT
PB PULL BOX
PE PLAIN END
PF POWER FACTOR
PI PRESSURE INDICATOR
PL/ ℙ PLATE/PROPERTY LINE
PLC PROGRAMMABLE LOGIC CONTROLLER
PMP PUMP
PRESS PRESSURE
PS PRESSURE SWITCH
PV PLUG VALVE

Q
QTY QUANTITY

R
R RADIUS
REINF REINFORCING, REINFORCEMENT
REQ'D REQUIRED
RGS RIGID GALVANIZED STEEL
RIP REMAIN IN PLACE
RPM REVOLUTIONS PER MINUTE
RTU REMOTE TERMINAL UNIT
RWW RAW WASTEWATER

S
S STRUCTURAL/SOUTH/SALVAGEABLE/SALVAGE
SCH SCHEDULE
SE SOUTHEAST
SEC SECTION
SECS SECONDS
SH SHIELDED
SHT SHEET
SIM SIMILAR
SPECS SPECIFICATIONS
SQ SQUARE
SRP SALT RIVER PROJECT
SRV SURGE RELIEF VALVE
SRW SERVICE WATER
SS SANITARY SEWER/STAINLESS STEEL
SST STAINLESS STEEL
STA STATION
STD STANDARD
STDR STORM DRAIN
STL STEEL
SUB SUBSTATION
SW SOUTHWEST

T
T TELEPHONE
T/ TOP OF
TB TERMINATION BOX/ TOP AND BOTTOM
TEMP TEMPERATURE OR TEMPORARY
THK THICK
TMH TELEPHONE MANHOLE
TOC TOP OF CONCRETE
TOG TOP OF GRATING
TOW/TW TOP OF WALL
TOS TOP OF SLAB
TR TRANSDUCER
TYP TYPICAL

U
UG UNDERGROUND

V
V VENT
VAC VACUUM
VACBK VACUUM BREAKER
VB VALVE BOX
VCP VITRIFIED CLAY PIPE
VERT VERTICAL

W
W WATER/ WEST
W/ WITH
WC WATER COLUMN
WD WIDE
WS WATER SURFACE
WW WASTE WATER

X
XP EXPLOSION PROOF
XFER TRANSFER

SHEET NO. DRAWING LIST

SHEET NO.		DRAWING LIST
		GENERAL
1	CS1	COVER SHEET
2	G1	LEGEND, ABBREVIATIONS AND DRAWINGS LIST
3	G2	NOTES, DATUM AND HYDRAULIC PROFILE
4	G3	BORING LOG
		CIVIL
5	C1	GEOMETRIC PLAN
6	C2	SITE GRADING PLAN
7	C3	SITE PIPING PLAN
8	C4	TYPICAL TRENCH DETAILS
9	C5	CIVIL DETAILS AND SECTIONS
		MECHANICAL
10	M1	FORCE MAIN PLAN AND LIFT STATION PLAN
11	M2	LIFT STATION SECTION
12	M3	MECHANICAL SCHEDULES
13	M4	MECHANICAL DETAILS AND SECTION
14	M5	MECHANICAL DETAILS
15	M6	MH1 SECTIONAL PLAN AND SECTIONS
16	M7	MECHANICAL DETAIL AND SECTION
		NATIVE PLANT INVENTORY
17	N1	NATIVE PLANT INVENTORY
18	N2	NATIVE PLANT INVENTORY
19	N3	NATIVE PLANT INVENTORY
		STRUCTURAL
20	S1	SITE WALL ELEVATIONS AND STRUCTURAL DETAIL
21	S2	STRUCTURAL DETAILS 1
22	S3	STRUCTURAL DETAILS 2
23	S4	STRUCTURAL DETAILS 3
		ELECTRICAL
24	E1	SYMBOLS AND LEGEND 1
25	E2	SYMBOLS AND LEGEND 2
26	E3	ELECTRICAL DETAILS 1
27	E4	ELECTRICAL DETAILS 2
28	E5	ELECTRICAL SITE PLAN
29	E6	GROUNDING PLAN
30	E7	ELECTRICAL SINGLE LINE/ EQUIPMENT ELEVATION
31	E8	PANEL AND LOAD SCHEDULES
32	E9	CONDUIT BLOCK DIAGRAM
33	E10	COMMUNICATIONS CABINET-LCP-COM-LS76 EXTERIOR ELEVATION
34	E11	COMMUNICATIONS CABINET-LCP-COM-LS76 INTERIOR ELEVATION/BOM
35	E12	PUMP CONTROL PANEL-LCP-PCP-LS76 FRONT ELEVATION/EXTERIOR LAYOUT
36	E13	PUMP CONTROL PANEL-LCP-PCP-LS76 SWING-PANEL INTERIOR LAYOUT
37	E14	PUMP CONTROL PANEL-LCP-PCP-LS76 INTERIOR ELEVATION
38	E15	REMOTE TELEMETRY UNIT CONTROL PANEL-LCP-PLC-LS76
39	E16	APS UTILITY DESIGN
		INSTRUMENT AND CONTROL
40	I1	INSTRUMENT TAGGIN AND LABELING SYMBOLS AND LEGEND 1
41	I2	SYMBOLS AND LEGEND 2
42	I3	SYMBOLS AND LEGEND 3
43	I4	P&ID SHEET 1
44	I5	P&ID SHEET 2

ENVIRONMENTAL NOTES:

1. CONTRACTOR, SUBCONTRACTORS, AND ALL FIELD PERSONNEL SHALL BE PROVIDED THE ATTACHED MIGRATORY BIRD TREATY ACT FLYER. IF TREES OR SHRUBS WILL BE TRIMMED OR REMOVED BETWEEN FEBRUARY 1 AND AUGUST 31, OR IF AN ACTIVE BIRD NEST IS PRESENT IN THE WORK AREA, WORK SHALL CEASE WITHIN 100 FEET AND THE CITY OF PHOENIX ENVIRONMENTAL QUALITY SPECIALIST (ED CHECKLEY [602-534-3366] OR GRETA HALLE [602-534-6030]) SHALL BE NOTIFIED IMMEDIATELY.
2. CONTRACTOR, SUBCONTRACTORS, AND ALL FIELD PERSONNEL SHALL BE PROVIDED THE WESTERN BURROWING OWL FLYER. IF BURROWING OWLS OR POTENTIALLY ACTIVE BURROWS (NATURAL OR MAN-MADE HOLES 3 INCH DIAMETER OR GREATER) ARE OBSERVED DURING CONSTRUCTION, WORK SHALL CEASE WITHIN 100 FEET AND THE CITY OF PHOENIX ENVIRONMENTAL QUALITY SPECIALIST (ED CHECKLEY [602-534-3366] OR GRETA HALLE [602-534-6030]) SHALL BE NOTIFIED IMMEDIATELY.
3. IF THERE IS A CHANGE IN SCOPE OR THE PROJECT LIMITS, THE CITY OF PHOENIX ENVIRONMENTAL QUALITY SPECIALIST (ED CHECKLEY [602-534-3366] OR GRETA HALLE [602-534-6030]) SHALL BE CONTACTED TO EVALUATE POTENTIAL IMPACTS.
4. IF ANY ARCHAEOLOGICAL MATERIALS ARE ENCOUNTERED DURING CONSTRUCTION, THE CONTRACTOR SHALL CEASE ALL GROUND-DISTURBING ACTIVITIES WITHIN 10 METERS OF THE DISCOVERY AND THE CITY OF PHOENIX ARCHAEOLOGY OFFICE (602-534-1573) AND CITY OF PHOENIX ENVIRONMENTAL QUALITY SPECIALIST (ED CHECKLEY [602-534-3366] OR GRETA HALLE [602-534-6030]) SHALL BE NOTIFIED IMMEDIATELY AND ALLOWED TIME TO PROPERLY ASSESS THE MATERIALS.

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200
PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS ON THIS SHEET
REGISTERED PROFESSIONAL ENGINEER
Registered Professional Engineer — 42745 JAY A. HORAK — Date Signed 09-21-18 — ARIZONA, U.S.A.

Registered Land Surveyor — Certificate No. 36581 — RANDALL R. HAGER — Date Signed 7-2-18 — ARIZONA U.S.A.

AS BUILTS PREPARED BY:
RICK ENGINEERING
22425 N 16TH STREET, SUITE 1
PHOENIX, ARIZONA 85024

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ARIZONA 811 Call 811 or click Arizona811.com

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS

Registered Professional Engineer — Certificate No. 24001 — LARRY J. LEISCHNER — Date Signed 06-30-18 — ARIZONA U.S.A. — EXPIRES 06/30/2018

Stanley Consultants

REVISIONS				
NO.	BY	DATE	CKD	REMARKS
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DES MTL
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CKD LJL

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT
COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76
WEST ANTHEM LIFT STATION
LEGEND, ABBREVIATIONS AND DRAWING LIST

CITY PROJECT NO. WS90400067
DATE 03/2018
G SHEET 1 (2 OF 44)
CAD FILE: LS76-G001

USER: 9274 FILE: Z:\26866\11-CADD\General\LS76-G001.dwg DATE: 1/17/19 TIME: 01:32pm

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FOR CONSTRUCTION

"PER PHOENIX CITY CODE, CHAPTER 2, SECTION 2-28 , THESE PLANS ARE FOR OFFICIAL USE ONLY AND MAY NOT BE FURNISHED FOR INSPECTION OR COPYING, EXCEPT AS SPECIFICALLY STATED IN THE CITY CODE, OR AS REQUIRED BY LAW. THIS DOCUMENT MUST BE KEPT SECURE AT ALL TIMES."

GENERAL NOTES:

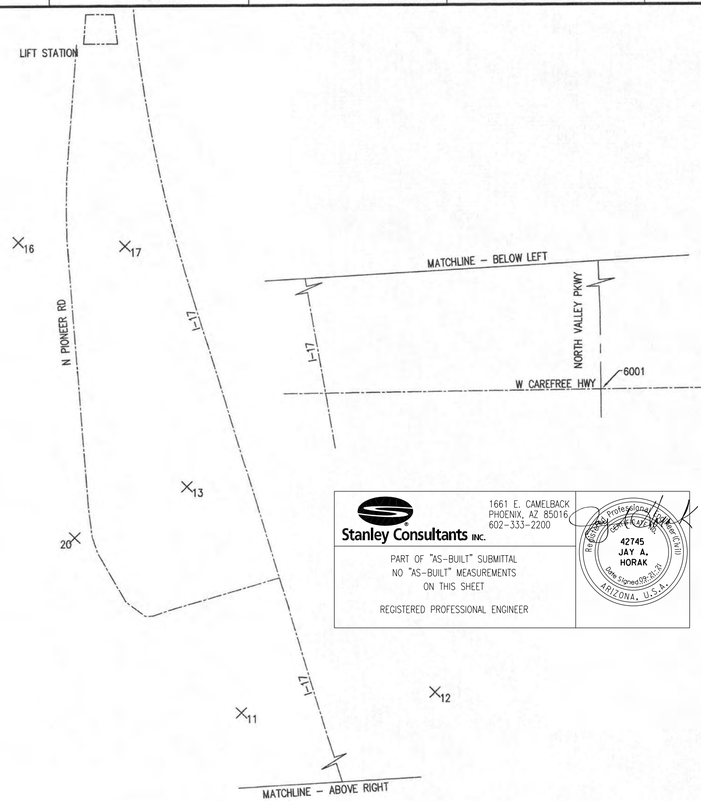
1. APPROVAL OF THESE PLANS SHALL NOT PREVENT THE CITY FROM REQUIRING CORRECTION OF ERRORS IN THE PLANS WHERE SUCH ERRORS ARE SUBSEQUENTLY FOUND TO BE IN VIOLATION OF ANY LAW, ORDINANCE OR OTHER HEALTH/SAFETY ISSUE.
2. ALL CONSTRUCTION SHALL CONFORM TO MAG (MARICOPA ASSOCIATION OF GOVERNMENTS) SPECIFICATIONS AND DETAILS AND THE CITY OF PHOENIX SUPPLEMENTS TO MAG SPECIFICATIONS AND DETAILS, UNLESS MODIFIED ON THE PLANS OR IN THE PROJECT SPECIFICATIONS.
3. A SIX (6) FOOT MINIMUM HORIZONTAL SEPARATION FROM ANY UNDERGROUND UTILITY SHALL BE PROVIDED FOR SEWER MAINS, SEWER SERVICES, WATER MAINS, AND WATER SERVICES. THE MINIMUM HORIZONTAL SEPARATION IS MEASURED FROM OUTSIDE OF SEWER MAIN, SEWER SERVICE, WATER MAIN, OR WATER SERVICE TO OUTSIDE OF UNDERGROUND UTILITY.
4. A ONE (1) FOOT MINIMUM VERTICAL SEPARATION FROM ANY DRY UNDERGROUND UTILITY CROSSING SHALL BE PROVIDED FOR SEWER MAINS AND WATER SERVICES. THE MINIMUM VERTICAL SEPARATION IS MEASURED FROM OUTSIDE OF SEWER MAIN, SEWER SERVICE, WATER MAIN, OR WATER SERVICE TO OUTSIDE OF DRY UNDERGROUND UTILITY.
5. A TWO (2) FOOT MINIMUM VERTICAL SEPARATION SHALL BE PROVIDED BETWEEN ANY SEWER MAIN OR STORM DRAIN CROSSING A WATER MAIN. THE MINIMUM VERTICAL SEPARATION IS MEASURED FROM OUTSIDE OF WATER MAIN TO OUTSIDE OF SEWER MAIN OR STORM DRAIN MAIN. SEE MAG STANDARD DETAIL 404 FOR ADDITIONAL INFORMATION AND/OR PROVISIONS FOR CLEARANCE.
6. EXCEPTIONS OR DEVIATIONS FROM THE ABOVE MINIMUM CLEARANCES MUST BE APPROVED AND SHOWN ON THE APPROVED WATER AND SEWER PLANS. WHEN UTILITY CONFLICTS ARE FOUND DURING CONSTRUCTION, ALL CHANGES AND REVISIONS MUST BE PRECEDED BY AN APPROVED PLAN REVISION.
7. ANY AND ALL MORE STRINGENT SEPARATION REQUIREMENTS REQUIRED BY FEDERAL, STATE, COUNTY OR LOCAL CODES OR ORDINANCES TAKE PRECEDENCE.
8. TRAFFIC REGULATIONS: ALL WORK MUST COMPLY WITH REQUIREMENTS OF THE CURRENT CITY OF PHOENIX "MCDOT TRAFFIC BARRICADE MANUAL".
9. TRENCH EXCAVATION, BACKFILLING AND COMPACTION SHALL COMPLY WITH MAG SECTION 601 AND COP SUPPLEMENTS.
10. CONCRETE OR ASPHALT DAMAGED DURING THE COURSE OF CONSTRUCTION SHALL BE REMOVED AND REPLACED IN KIND PRIOR TO FINAL INSPECTION.
11. "PER CITY OF PHOENIX ORDINANCE G-4396, THESE PLANS ARE FOR OFFICIAL USE ONLY AND MAY NOT BE SHARED WITH OTHERS EXCEPT AS REQUIRED FOR THE CONSTRUCTION OF THE PUBLIC WORKS FACILITIES SHOWN HEREON. THE PROJECT OWNER AND THE OWNER'S LENDERS CONSULTANTS, CONTRACTORS AND SUBCONTRACTORS ARE PROHIBITED FROM DISCLOSING THE PLANS AND SPECIFICATIONS TO ANY PERSONS OTHER THAN THOSE WHO HAVE A NEED TO KNOW THE INFORMATION FOR THE PURPOSE OF THE PROJECT".
12. CONTRACTOR WILL NOT PAINT ANY EXPOSED PVC OR CPVC PIPING.
13. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL PERMITS REQUIRED FOR CONSTRUCTION EXCEPT AS DEFINED IN THE SPECIFICATIONS.

ENGINEERING NOTES:

1. A THOROUGH ATTEMPT HAS BEEN MADE TO SHOW THE LOCATIONS OF ALL UNDERGROUND CONSTRUCTION AND UTILITY LINES IN THE WORK AREA. HOWEVER THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF UTILITIES IN ADVANCE OF TRENCHING.
2. THE CONTRACTOR SHALL THOROUGHLY SATISFY HIMSELF AS TO THE ACTUAL CONDITIONS, REQUIREMENTS OF THE WORK.
3. THE ENGINEER WILL NOT BE RESPONSIBLE FOR CONSTRUCTION MEANS, METHODS, TECHNIQUES, SEQUENCES, PROCEDURES FOR SAFETY PRECAUTIONS OR PROGRAMS UTILIZED IN CONNECTION WITH THE WORK AND WILL NOT BE RESPONSIBLE FOR THE CONTRACTORS FAILURE TO CARRY OUT THE WORK IN ACCORDANCE WITH THE CONTRACT DOCUMENTS.
4. THE ENGINEER SHALL NOT BE RESPONSIBLE FOR COORDINATING THE RELOCATION OF UTILITIES, POWER POLES, ETC.
5. THE CONTRACTOR SHALL MAKE NO CLAIM AGAINST THE OWNER OR THE ENGINEER REGARDING ALLEGED INACCURACY OF CONSTRUCTION STAKES SET BY THE ENGINEER UNLESS ALL SURVEY STAKES SET BY THE ENGINEER ARE MAINTAINED INTACT AND CAN BE VERIFIED AS TO THEIR ORIGIN, IF IN THE OPINION OF THE ENGINEER THE STAKES ARE NOT MAINTAINED INTACT AND CANNOT BE VERIFIED AS TO THEIR ORIGIN, ANY REMEDIAL WORK REQUIRED TO CORRECT ANY ITEM OR IMPROPER CONSTRUCTION WORK SHALL BE PERFORMED AT THE SOLE EXPENSE OF THE RESPONSIBLE CONTRACTOR OR SUBCONTRACTOR.
6. NOTHING CONTAINED IN THE CONTRACT DOCUMENTS SHALL CREATE NOR SHALL BE CONSTRUED TO CREATE ANY CONTRACTUAL RELATIONSHIP BETWEEN THE ENGINEER AND THE CONTRACTOR OR ANY SUBCONTRACTOR.
7. THE ENGINEER WILL MAKE FIELD AS-BUILT MEASUREMENTS OF THE WORK UPON NOTIFICATION OF THE OWNER OR OWNER'S REPRESENTATIVE THAT THE PIPE WORK IS COMPLETE AND READY FOR AS-BUILT SURVEY. IF THE CONTRACTOR DOES NOT LEAVE THE TRENCHES OPEN SO THAT THE ACTUAL PIPE LINES AND SERVICES CAN BE OBSERVED, THE CONTRACTOR WILL EXPOSE THE LINES AND SERVICES TO ALLOW FOR ACCURATE AS-BUILTING. IF THE TRENCHES ARE BACKFILLED AND OBSCURED TO THE POINT THAT THE AS-BUILT MEASUREMENTS CANNOT BE PERFORMED, THE ENGINEER WILL NOT BE RESPONSIBLE FOR PROVIDING ACCURATE AS-BUILT MEASUREMENTS.

MARICOPA COUNTY DEPARTMENT OF TRANSPORTATION (MCDOT) GENERAL NOTES FOR RIGHT-OF-WAY PERMITS:

1. ALL WORK SHALL CONFORM TO THE REVISED EDITION OF THE UNIFORM STANDARD SPECIFICATIONS AND DETAILS FOR PUBLIC WORKS CONSTRUCTION PUBLISHED BY THE MARICOPA ASSOCIATION OF GOVERNMENTS (MAG) AS AUTHORIZED AND MODIFIED BY THE MOST CURRENT MCDOT SUPPLEMENT TO THE MAG UNIFORM STANDARD SPECIFICATIONS AND DETAILS AND NON-CONFLICTING PROJECT SPECIAL PROVISIONS. ALL WORK MUST ALSO COMPLY WITH RESOLUTION 2001-01 MARICOPA COUNTY RESOLUTION FOR PERMITS TO WORK IN DEDICATED RIGHT-OF-WAY AND RESOLUTION 2001-02 MARICOPA COUNTY RESOLUTION FOR STREET IMPROVEMENTS, INSTALLATION OF UTILITIES AND TRAFFIC CONTROL. ANY EXCEPTIONS MUST RECEIVE EXPLICIT APPROVAL FROM MCDOT AND SHALL BE IDENTIFIED ON THE PLANS AS HAVING EXPLICIT APPROVAL FROM MCDOT. ALL CLEAR ZONE HAZARDS SHALL BE MITIGATED IN A MANOR APPROVED BY MCDOT AT NO COST TO THE COUNTY.
2. THE ENGINEERING DESIGNS ON THESE PLANS ARE ONLY APPROVED BY MCDOT IN CONCEPT AND NOT IN DETAIL. CONSTRUCTION QUANTITIES ON THESE PLANS ARE NOT VERIFIED BY MCDOT. APPROVAL OF THESE PLANS ARE FOR PERMIT PURPOSES ONLY AND SHALL NOT PREVENT MCDOT FROM REQUIRING CORRECTION OF ERRORS IN THE PLANS WHERE SUCH ERRORS ARE SUBSEQUENTLY FOUND TO BE IN VIOLATION OF ANY LAW, ORDINANCE, HEALTH, SAFETY, THE MCDOT ROADWAY DESIGN MANUAL, OR OTHER DESIGN ISSUES.
3. AN APPROVED SET OF PLANS SHALL BE ON THE SITE DURING CONSTRUCTION AND AVAILABLE TO MCDOT AND OTHER INSPECTORS.
4. ALL BOX CULVERTS CONSTRUCTED IN THE PUBLIC RIGHT-OF-WAY SHALL COMPLY WITH ARIZONA DEPARTMENT OF TRANSPORTATION (ADOT) LATEST DESIGN SPECIFICATIONS AND STANDARDS. MINIMUM CLEAR HEIGHT OF BOX CULVERT SHALL BE 4 FEET.
5. CONTRACTOR TO OBTAIN MCDOT PERMITS PRIOR TO CONSTRUCTION WITHIN COUNTY RIGHT-OF-WAY, AND ALL NECESSARY PERMITS FROM OTHER AGENCIES AND FROM LOCAL GOVERNMENTS FOR WORK WITHIN THEIR JURISDICTION.
6. CONTRACTOR SHALL NOTIFY THE MCDOT INSPECTION DEPT. AT LEAST 24 HOURS IN ADVANCE OF ANY CONSTRUCTION AT (602) 506-8606.
7. CONTRACTOR PERFORMING CONSTRUCTION OR EXCAVATING OPERATIONS IS RESPONSIBLE FOR LOCATING AND RELOCATING ALL UTILITIES IN CONFLICT AT NO EXPENSE TO MARICOPA COUNTY. THE CONTRACTOR SHALL CONTACT "BLUE STAKE" AT (602) 263-1100 PRIOR TO BEGINNING CONSTRUCTION.
8. THE CONTRACTOR IS RESPONSIBLE FOR OBTAINING ANY REQUIRED PERMITS FOR EARTH MOVING FROM MARICOPA COUNTY AIR QUALITY DEPARTMENT'S DUST COMPLIANCE DIVISION (602) 506-6010 PRIOR TO CONDUCTING EXCAVATION OPERATIONS. A COPY OF THE PERMIT AND DUST CONTROL PLAN SHALL BE SUBMITTED TO THE COUNTY ENGINEER PRIOR TO COMMENCEMENT OF ANY EARTHMOVING ACTIVITIES.
9. PRIOR TO CONDUCTING EXCAVATION OPERATIONS, THE CONTRACTOR SHALL OBTAIN FROM THE ARIZONA STATE HISTORICAL PRESERVATION OFFICER (602) 542-4009, RECOMMENDATIONS REGARDING THE NEED FOR CULTURAL RESOURCES (ARCHAEOLOGICAL) CLEARANCE. ALL DISCOVERIES OF HUMAN REMAINS, CULTURAL ARTIFACTS, OR PALEONTOLOGICAL REMAINS SHALL BE REPORTED TO THE ARIZONA STATE MUSEUM AND MCDOT. UPON DISCOVERY, CONTRACTOR SHALL CEASE OPERATIONS IN THE VICINITY OF THE FIND AND PROTECT THE DISCOVERY AREA FROM FURTHER DISTURBANCE UNTIL THE FIND CAN BE PROFESSIONALLY INVESTIGATED BY THE ARIZONA STATE MUSEUM AND MCDOT.
10. EXCEPT UNDER EMERGENCY CONDITIONS, ROADS SHALL NOT BE CLOSED FOR CONSTRUCTION ACTIVITY UNLESS PRIOR APPROVAL IS OBTAINED FROM THE MCDOT TRANSPORTATION DIRECTOR OR HIS REPRESENTATIVE.
11. PRIOR TO MOVING OR DESTROYING PROTECTED NATIVE PLANT SPECIES, THE CONTRACTOR SHALL FILE A FORMAL NOTICE OF INTENT WITH THE ARIZONA DEPARTMENT OF AGRICULTURE NATIVE PLANTS (602) 542-6408.
12. PRIOR TO INSTALLATION OF CURB, GUTTER, SIDEWALK, BASE COURSE AND WEARING SURFACE, SUBMIT SOIL TEST(S) OF SUBGRADE AND REVISED PAVEMENT DESIGN/CALCULATIONS TO MCDOT FOR REVIEW AND APPROVAL. IF SUBGRADE STABILIZATION IS REQUIRED, THE AREA STABILIZED SHALL BE FROM BACK OF SIDEWALK TO BACK OF SIDEWALK AND MATCH THE STABILIZATION DEPTH OF THE PAVEMENT STRUCTURE.
13. ASPHALT MIX DESIGN SHALL BE SUBMITTED TO MCDOT A MINIMUM OF 48 HOURS PRIOR TO PLACING ANY ASPHALT COURSES. (TRENCH WORK EXCLUDED.) ALL PAVED TURNOUTS SHALL HAVE THE SAME ASPHALT AND BASE REQUIREMENTS AS THE ADJACENT ROADWAY UNLESS NOTED OTHERWISE.
14. ALL COMPACTION AND BACKFILL WITHIN COUNTY RIGHT-OF-WAY SHALL CONFORM TO THE MCDOT SUPPLEMENT TO MAG SPECIFICATION SECTION 601. BACKFILL UNDER EXISTING PAVEMENT, CURB AND GUTTER, ROADWAY SHOULDERS, AND UNPAVED ROADWAYS SHALL CONSIST OF ONE-HALF (1/2) OR ONE SACK CLSM. UNPAVED ROADWAY AREAS INCLUDE THE TRAVELED WAY PLUS FIVE FEET BEYOND THE TRAVELED WAY.
15. PAVEMENT WIDENING AND PAVEMENT REPLACEMENT SHALL CONFORM TO REQUIREMENTS OF SPECIFICATION SECTION 336. PAVEMENT CUTS SHALL NOT BE LOCATED WITHIN A LANE WHEEL PATH. THE LANE WHEEL PATH IS THE ENTIRE LANE WIDTH EXCEPT THE AREA WITHIN ONE FOOT OF A LANE LINE STRIPE AND EXCEPT THE CENTER TWO FEET OF THE TRAVEL LANE.
16. ALL EXISTING PAVEMENT MARKINGS, TRAFFIC SIGNS AND SIGNAL EQUIPMENT THAT NEED TO BE REMOVED, REPLACED, RELOCATED OR REPAIRED BECAUSE OF CONTRACTOR'S WORK WILL BE DONE BY THE CONTRACTOR AT HIS EXPENSE. ALL SALVAGED SIGNS SHALL BE DELIVERED TO THE TRAFFIC OPS BUILDING AT 2909 W. DURANGO ST. ARRANGEMENTS CAN BE MADE FOR DELIVERY BY CALLING (602) 506-8662. ALL NEW STREET NAME SIGNS SHALL BE PROVIDED AND INSTALLED BY PERMITTEE AT NO EXPENSE TO MARICOPA COUNTY.
17. PAVEMENT MARKING, SIGNING AND SIGNAL WORK WILL BE INSPECTED AND SHALL MEET COUNTY STANDARDS BEFORE RELEASE OF BOND.
18. THE CONTRACTOR SHALL RESTORE ALL DISTURBED AREAS WITHIN THE RIGHT-OF-WAY TO A CONDITION EQUAL TO OR BETTER THAN PRIOR EXISTING CONDITIONS PER MAG 107.9. DISPOSAL OF ALL WASTE MATERIAL WILL BE THE RESPONSIBILITY OF THE CONTRACTOR.



SURVEY POINT DATA TABLE				
POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
11	1025083.930	631571.150	1739.13	AERIAL MAPPING PANEL
12	1025221.480	632890.760	1737.79	AERIAL MAPPING PANEL
13	1026631.260	631205.400	1750.11	AERIAL MAPPING PANEL
16	1028309.300	630062.350	1728.76	AERIAL MAPPING PANEL
17	1028279.900	630789.670	1745.22	AERIAL MAPPING PANEL
20	1026284.680	630441.280	1731.79	AERIAL MAPPING PANEL
6001	1018214.333	635517.697	0.00	CALCULATED POSITION

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REGISTERED LAND SURVEYOR CERTIFICATE NO. 36581 RANDALL R. HAGER DATE SIGNED 09-21-18 ARIZONA U.S.A.

AS BUILTS PREPARED BY:
RICK ENGINEERING
22425 N 16TH STREET, SUITE 1
PHOENIX, ARIZONA 85024

SURVEYOR'S NOTES
1. COORDINATES WERE VERIFIED IN THE FIELD USING REAL TIME KINEMATIC GPS OBSERVATIONS.
2. SURVEYED UNDER THE SUPERVISION OF DAVID FORNEY, RLS, CERTIFICATE NO. 27238, DURING THE MONTH OF OCTOBER 2016.
3. CONTRACTOR SHALL VERIFY HORIZONTAL AND VERTICAL CONTROLS IN THE FIELD PRIOR TO CONSTRUCTION.

HORIZONTAL DATUM:
STATE PLANE NAD83 (07EPOCH0 ARIZONA CENTRAL ZONE)

VERTICAL DATUM:
PROJECT ELEVATIONS PER CITY OF PHOENIX PUBLISHED BENCHMARKS. AS INDICATED BELOW.

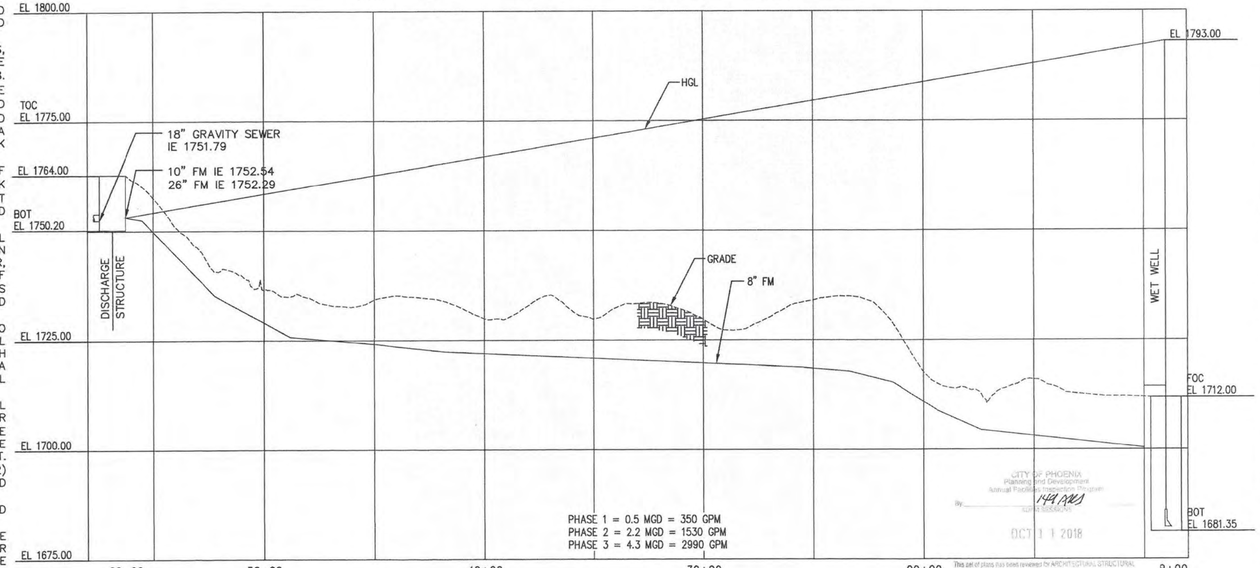
CITY OF PHOENIX BENCHMARK
W CAREFREE HIGHWAY AND N VIA PUZZOLA
3" BRASS CAP IN HANDHOLE
ELEVATION: 1682.24'

LEGEND
× AERIAL MAPPING PANEL

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER
42745 JAY A. HORAK
Date Signed 09-21-18
ARIZONA, U.S.A.



CITY OF PHOENIX
Planning and Development
Annual Plan Review Inspection Program
By
OCT 1 1 2018
This set of plans has been reviewed for ARCHITECTURAL, STRUCTURAL requirements and shall be kept on site. Such review does not prevent the correction of errors in the plans or during construction where such errors are subsequently found to be in violation of any law or ordinance.

HYDRAULIC GRADE LINE – PHASE 1

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER

REMARKS

REVISIONS				
NO.	BY	DATE	CKD	REMARKS
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Registered Professional Engineer (Civil) CERTIFICATE NO. 24001 LARRY L. LEISCHNER Date Signed 08-30-18 ARIZONA, U.S.A. EXPIRES 06/30/2018

Stanley Consultants

DES MTL
DWN NSJ
CKD LJL

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
NOTES, DATUM AND HYDRAULIC PROFILE

CITY PROJECT NO. WS90400067
DATE 03/2018
G SHEET 2 (3 OF 44)
CAD FILE: LS76-G002

USER: 9274 FILE: T:\General\LS76-G002.dwg DATE: 8/06/18 TIME: 01:33pm

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NOTES:

1. THIS BORING LOG REPRESENTS THE CONDITIONS ENCOUNTERED ON THE DATE OF DRILLING AT THIS PARTICULAR LOCATION. NO OTHER WARRANTY IS EXPRESSED OR IMPLIED TO THE ACTUAL CONDITIONS WHICH MAY EXIST WITHIN THE VICINITY OF THIS BORING LOCATION.
2. "THE BORING LOGS SHOWN ON THIS SHEET DO NOT CONSTITUTE A PART OF THE CONTRACT AND ARE INCLUDED FOR THE CONTRACTOR'S CONVENIENCE ONLY. IT IS NOT INTENDED TO IMPLY THAT THE CHARACTER OF THE MATERIAL IS THE SAME AS THAT SHOWN IN THE LOGS AT ANY POINT OTHER THAN WHERE THE BORING WAS MADE. THE CONTRACTOR SHALL SATISFY HIMSELF REGARDING THE CHARACTER AND AMOUNT OF ROCK, GRAVEL, SILT, CLAY, AND WATER TO BE ENCOUNTERED IN THE WORK TO BE PERFORMED." (ADMINISTRATIVE PROCEDURE 13, DATED AUGUST 1, 2004)

Rig Type: **CME-75**
Boring Type: **TubeX**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot
0 – 5.0	Medium Dense Light Brown WELL GRADED SAND with SILT (SW/SM-Dry) with Some Gravel and Moderate Calcareous Cementation; 1-5% Cobble	S-1	2.5	NT	NT	
		BS-2	5.0	NT	NT	
5.0 – 13.0	Medium Dense Light Brown SILTY GRAVEL (GM-Dry) with 1-5% Cobble and Moderate Calcareous Cementation; Very Dense, 5-15% Cobble	S-3	6.5	NT	NT	
		S-4	11.5	NT	NT	84/12"
13.0 – 25.0	Hard Reddish Brown SANDY LEAN CLAY (CL-Dry) with Little Gravel	S-5	15.8	NT	NT	80/9"
		S-6	21.5	NT	NT	86/12"
25.0 – 30.0	Very Dense Brown CLAYEY SAND (SC-Dry) with Little Gravel	S-7	26.0	NT	NT	92/12"
30.0 – 40.0	Hard Brown SANDY LEAN CLAY (CL-Dry) with Little Gravel	S-8	30.5	NT	NT	50/6"
		S-9	35.5	NT	NT	50/6"
40.0 – 50.0	Very Dense Brown CLAYEY GRAVEL (GC-Dry) with 1-5% Cobble	S-10	40.3	NT	NT	50/3"
		S-11	45.5	NT	NT	50/6"
50.0 – 60.4	Hard Brown SANDY LEAN CLAY (CL-Dry) with Little Gravel and Trace Limestone; No Limestone; Dark Brown	S-12	50.4	NT	NT	50/5"
		S-13	55.5	NT	NT	50/6"
		S-14	60.4	NT	NT	50/5"

End of Boring

Boring Date: **11-30-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES
Log of Test Boring Number: **B-19**
West Anthem Wastewater Improvements
Pioneer Road to Carefree Highway
Anthem, Arizona
Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer (Civil) 42745 JAY A. HORAK, ARIZONA, U.S.A.

Registered Land Surveyor 36561 RANDALL R. HAGER, ARIZONA, U.S.A.

AS BUILTS PREPARED BY:
RICK ENGINEERING
22425 N 16TH STREET, SUITE 1
PHOENIX, ARIZONA 85024

CITY OF PHOENIX
OCT 3 1 2018

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS

Registered Professional Engineer (Civil) 37292 KEITH R. GRAVEL, ARIZONA, U.S.A., Expires 03/31/2020

Registered Professional Engineer (Civil) 24001 LARRY J. LEISCHNER, ARIZONA, U.S.A., EXPIRES 06/30/2018

Stanley Consultants

REVISIONS

NO.	BY	DATE	CKD	REMARKS

DES	MTL
DWN	MTL
CKD	LJL

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
BORING LOG

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CITY PROJECT NO. WS90400067

DATE 03/2018

G SHEET 3 (4 OF 44)

CAD FILE: LS76-G003

USER: 9274 FILE: T:\General\LS76-BL01.dwg DATE: 8/06/18 TIME: 01:31pm

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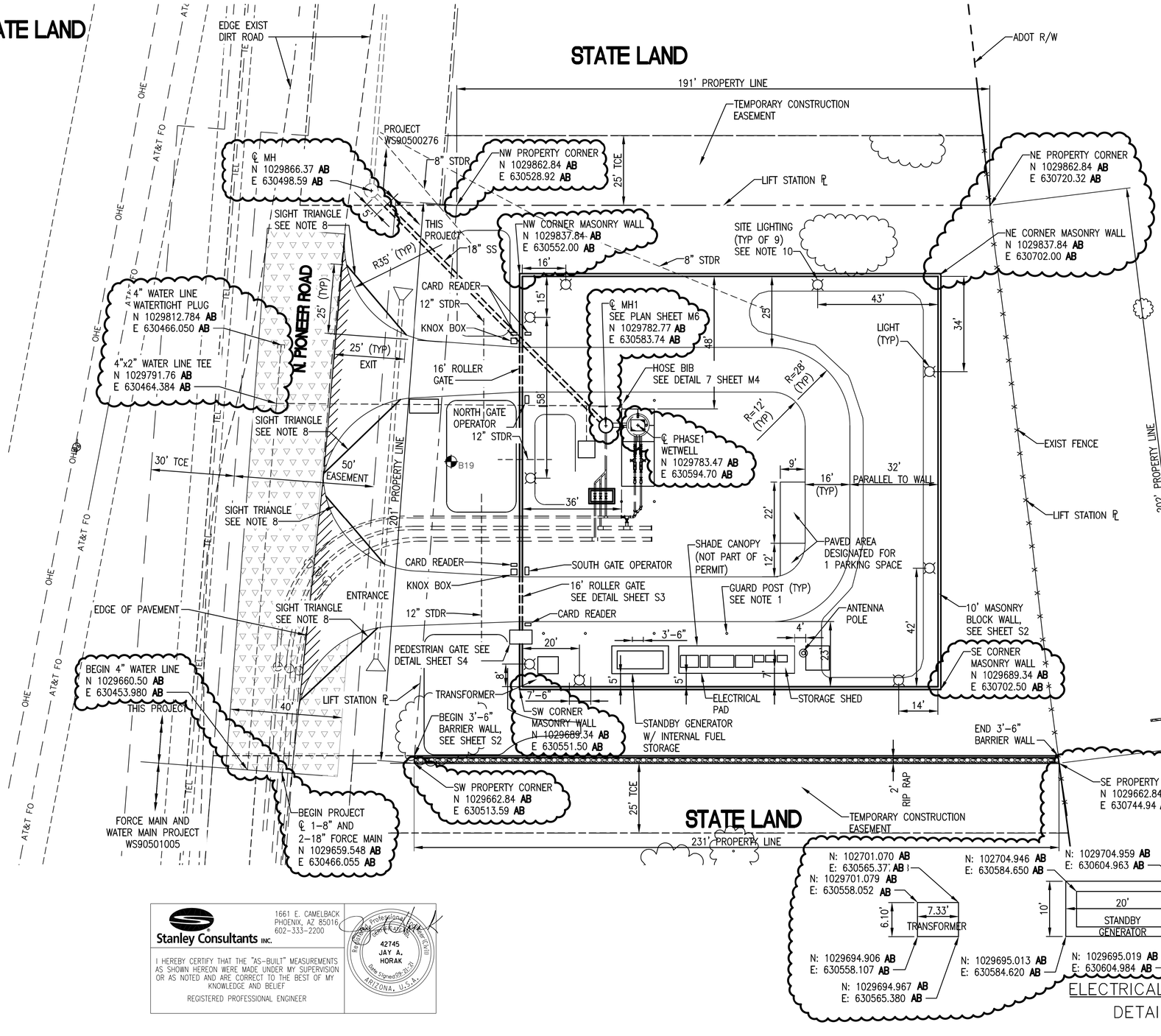

NOTES:

1. CONTRACTOR SHALL INSTALL 9 GUARD POSTS. LOCATE WHERE INDICATED ON DRAWINGS AND AS DIRECTED BY ENGINEER. SEE DETAIL 6 SHEET C5.
2. SEE STRUCTURAL DRAWING SHEET S1 FOR WALL PROFILES.
3. BUILDING CODE: INTERNATIONAL BUILDING CODE (IBC) 2012; PUBLISHED BY INTERNATIONAL CODE COUNCIL, INC..
4. ELECTRICAL CODE: NFPA70 – NATIONAL ELECTRICAL CODE (NEC) 2011; PUBLISHED BY NATIONAL FIRE PROTECTION ASSOCIATION (R).
5. NO PROPANE OR WATER TANKS LOCATED ON–SITE.
6. ELECTRICAL EQUIPMENT SHADE CANOPY WILL BE SUBMITTED SEPARATELY FOR BUILDING PERMIT DURING CONSTRUCTION.
7. CUT = 2,560 CY
   FILL = 145 CY
8. SIGHT TRIANGLES SHALL BE IN ACCORDANCE WITH MARICOPA COUNTY ZONING ORDINANCE ARTICLE 1111.4. NO STRUCTURE, LANDSCAPING, FENCE, WALL, TERRACE, OR OTHER OBSTRUCTION TO VIEW IN EXCESS OF TWO FEET IN HEIGHT, MEASURED FROM THE ESTABLISHED ELEVATION OF THE NEAREST STREET CENTERLINE, SHALL BE PLACED WITHIN THE TRIANGLE FORMED BY MEASURING ALONG STREET SIDE PROPERTY LINE AND DRIVEWAY LENGTH A DISTANCE OF 25 FEET FROM THEIR POINT OF INTERSECTION AND BY CONNECTING THE ENDS OF THE RESPECTIVE 25 FEET DISTANCES.
9. THOSE UTILITY COMPANIES WHICH ARE REGULATED BY THE ARIZONA CORPORATION COMMISSION MAY BE ALLOWED INCREASED FENCE HEIGHTS DUE TO NATIONAL, STATE OR LOCAL SAFETY STANDARDS.
10. SITE LIGHTING SHALL BE PLACED 6 FEET ABOVE FINISHED GRADE. SITE LIGHTING SHALL BE IN ACCORDANCE WITH LIGHTING STANDARDS FROM SECTION 507 TAB A.II.A.8 AND SECTION 23–100 OF THE CITY CODE.
11. FOR ELECTRICAL PAD LINE UP SEE DETAIL 17 THIS SHEET.

H-7

ELECTRICAL PAD LINE UP DETAIL 17 C1 C1

SCALE: NTS

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

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REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer (Civil) CERTIFICATE NO. 42745 JAY A. HORAK Date Signed 09-30-21 ARIZONA, U.S.A.

Registered Professional Engineer (Civil) CERTIFICATE NO. 24001 LARRY J. LEISCHNER Date Signed 09-30-21 ARIZONA, U.S.A. EXPIRES 12/31/2022

Stanley Consultants

REVISIONS					DES	CITY OF PHOENIX
NO.	BY	DATE	CKD	REMARKS	FLR	WATER SERVICES DEPARTMENT
					DWN	COLLECTION SYSTEMS
					NSJ	REMOTE FACILITES
					CKD	
					LJL	City of Phoenix

LS–76

WEST ANTHEM LIFT STATION GEOMETRIC PLAN

CITY PROJECT NO. WS90400067
DATE 03/2018
C SHEET 1 (5 OF 44)
CAD FILE: LS76–C001

FOR CITY OF PHOENIX USE ONLY – REFERENCE CID NUMBER: #

REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS

USER: 9402 FILE: Z:\26866\11-CADD\Civil\LS76-C001.dwg DATE: 9/17/21 TIME: 02:23pm

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FOR CONSTRUCTION

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1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

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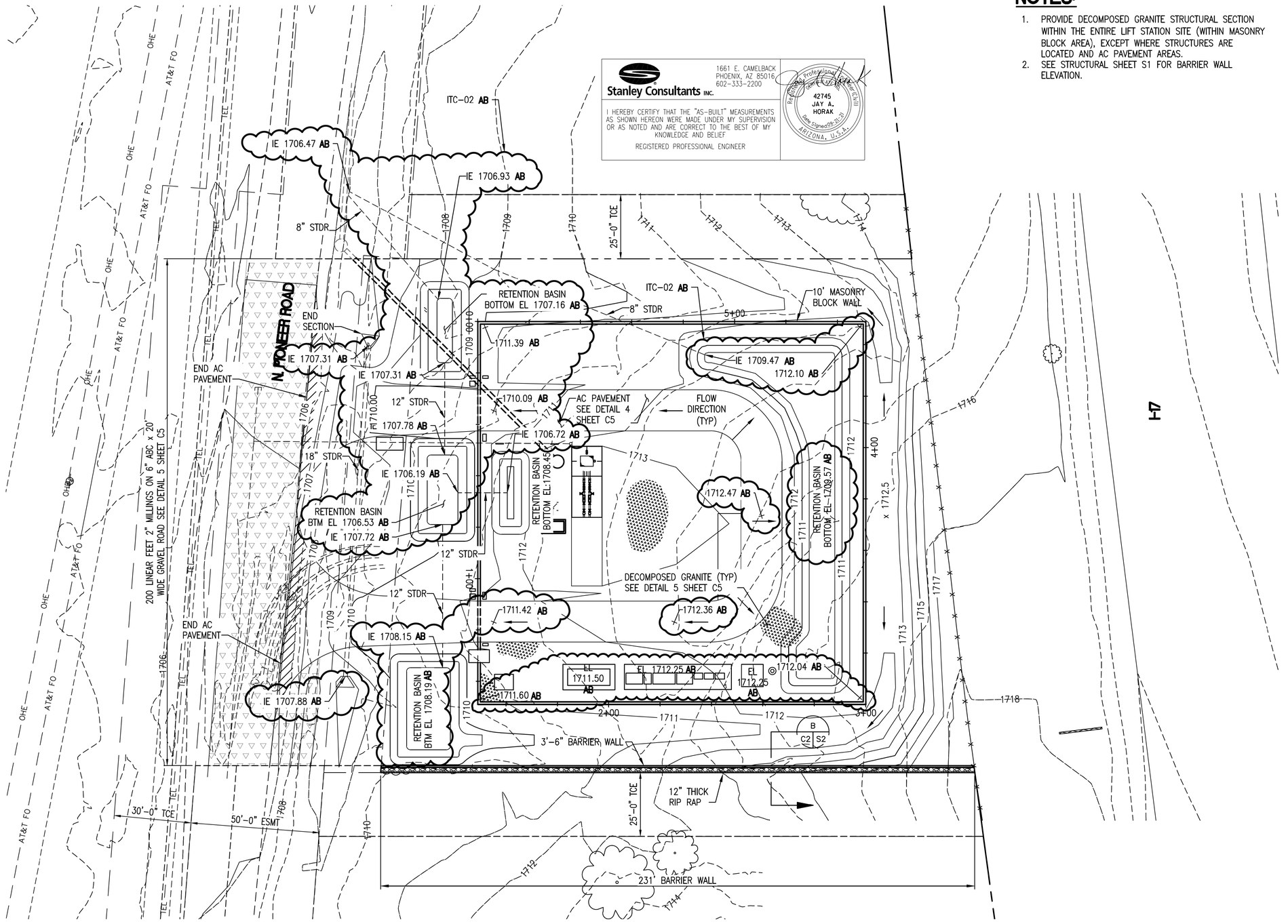
REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
CERTIFICATE NO.
42745
JAY A.
HORAK
Date Signed 09-30-21
ARIZONA, U.S.A.

NOTES:

1. PROVIDE DECOMPOSED GRANITE STRUCTURAL SECTION WITHIN THE ENTIRE LIFT STATION SITE (WITHIN MASONRY BLOCK AREA), EXCEPT WHERE STRUCTURES ARE LOCATED AND AC PAVEMENT AREAS.
2. SEE STRUCTURAL SHEET S1 FOR BARRIER WALL ELEVATION.



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ARIZONA811
Call 811 or click Arizona811.com

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Registered Professional Engineer
CERTIFICATE NO.
24001
LARRY J.
LEISCHNER
Date Signed 09-30-21
ARIZONA, U.S.A.
EXPIRES 12/31/2022

Stanley Consultants

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NO.	BY	DATE	CKD	REMARKS
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DES FLR
DWN NSJ
CKD LJL

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITES

LS-76

WEST ANTHEM LIFT STATION
SITE GRADING PLAN

CITY PROJECT NO. WS90400067
DATE 03/2018
C SHEET 2 (6 OF 43)
CAD FILE: LS76-C002

USER: 9402 FILE: Z:\26866\11-CADD\Civil\LS76-C002.dwg DATE: 9/30/21 TIME: 07:21am

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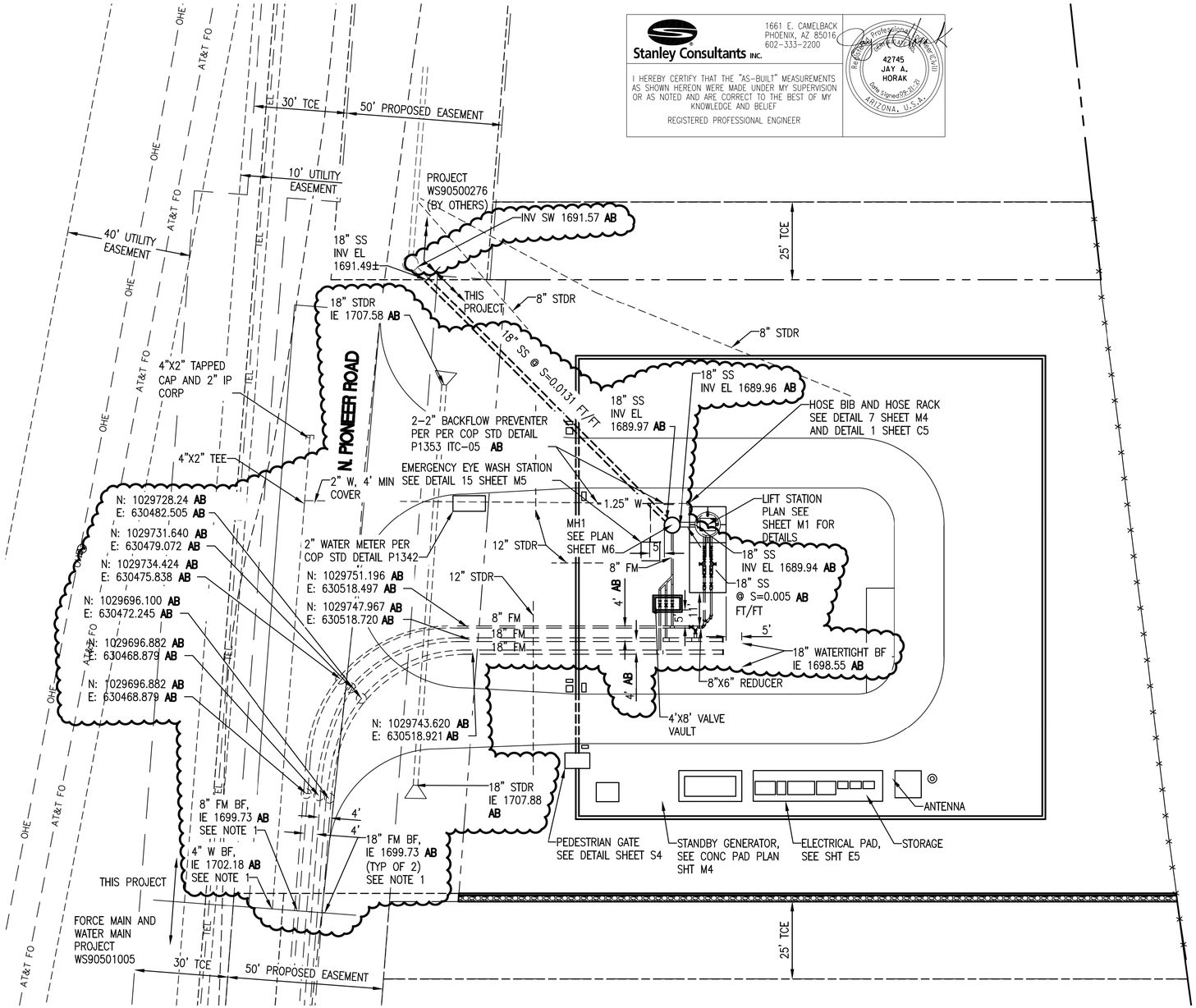

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1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

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REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer (Civil) CERTIFICATE NO. 42745 JAY A. HORAK Date Signed 09-30-21 ARIZONA, U.S.A.

NOTES:

1. PROVIDE CONSTANT SLOPE FOR UNDERGROUND PIPES.

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Registered Professional Engineer (Civil) CERTIFICATE NO. 24001 LARRY J. LEISCHNER Date Signed 09-30-21 ARIZONA, U.S.A. EXPIRES 12/31/2022

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NO.	BY	DATE	CKD	REMARKS
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DES FLR
DWN NSJ
CKD LJL

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITES

LS-76

WEST ANTHEM LIFT STATION
SITE PIPING PLAN

CITY PROJECT NO. WS90400067
DATE 03/2018
C SHEET 3 (7 OF 44)
CAD FILE: LS76-C003

DWG NUMBER

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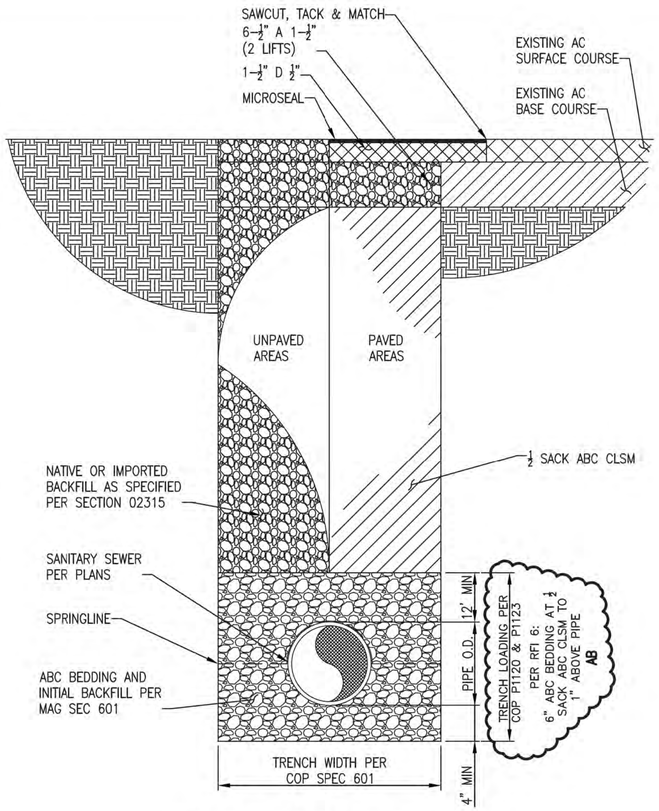
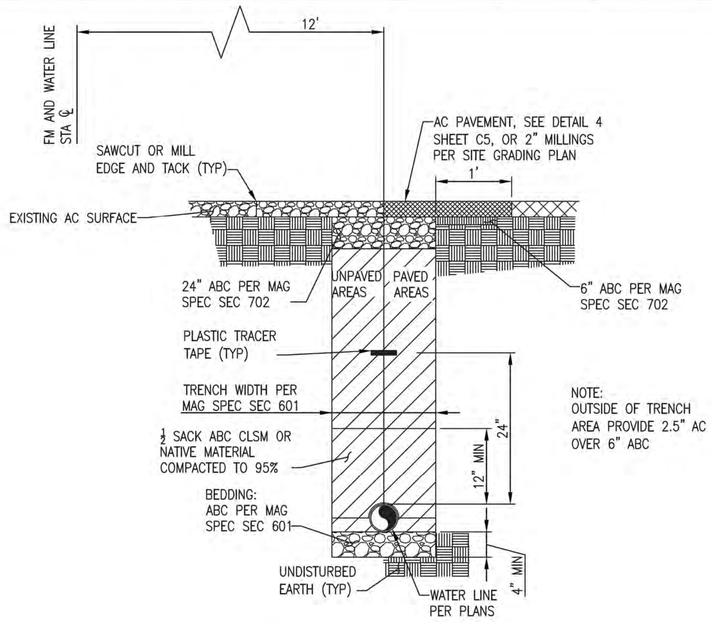


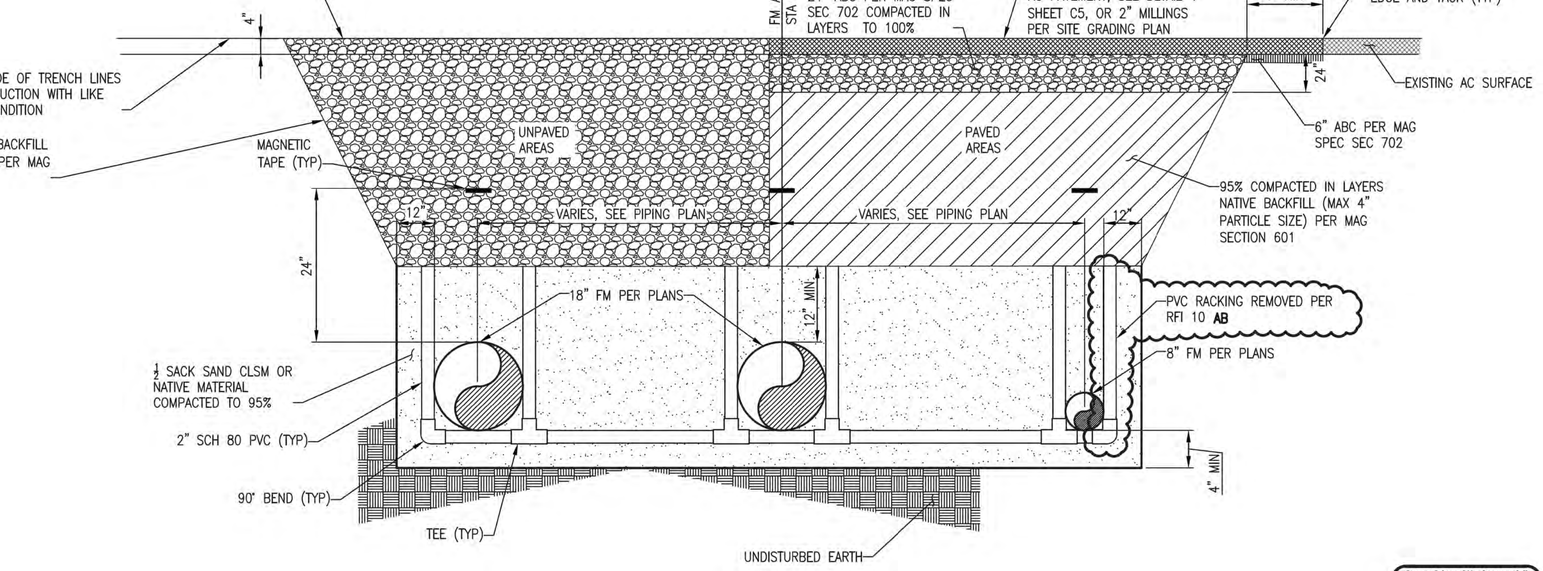
TYPICAL VCP TRENCH DETAIL
SCALE: NTS



TYPICAL WATERLINE TRENCH DETAIL
SCALE: NTS

NOTES:

1. PROVIDE ONE SCH 80 PVC RACKING SYSTEM EVERY 40 FEET TO MAINTAIN FORCE MAIN SPACING.
2. WHERE AC PAVEMENT ENDS ADJACENT TO UNPAVED AREAS, CONTRACTOR SHALL PROVIDE ASPHALT PAVEMENT EDGE IN ACCORDANCE WITH MAG STD DETAIL NO. 201 TYPE 'A'.
3. TRENCH IN PAVEMENT MUST BE T-TOP WITH ½ SACK CLSM PER MAG STANDARD DETAILS 200 AND 212, MAG SPECIFICATIONS 604, 728, AND MCDOT SUPPLEMENTS TO MAG SECTION 601.
4. LIFT STATION NO. 76 IS LOCATED IN MARICOPA COUNTY JURISDICTION.
5. OUTSIDE OF TRENCH AREA PROVIDE 2.5" AC OVER 6" ABC.
6. FOR MILLINGS OUTSIDE OF TRENCH AREA SEE DECOMPOSED GRANITE STRUCTURAL SECTION, DETAIL 5 SHEET C5.



TYPICAL FORCEMAIN TRENCH DETAIL
SCALE: NTS

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602-333-2200

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REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
CERTIFICATE NO.
42745
JAY A.
HORAK
Date Signed 09-30-21
ARIZONA, U.S.A.

Registered Professional Engineer (Civil)
CERTIFICATE NO.
24001
LARRY J.
LEISCHNER
Date Signed 09-30-21
ARIZONA, U.S.A.
EXPIRES 12/31/2022

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DWN MTL
CKD LJL

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
TYPICAL TRENCH DETAILS

CITY PROJECT NO. WS90400067
DATE 03/2018
C SHEET 4 (8 OF 44)
CAD FILE: LS76-C004

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS
#							

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USER: 9402 FILE: Z:\26866\11-CADD\Civil\LS76-C004.dwg DATE: 9/20/21 TIME: 12:43pm

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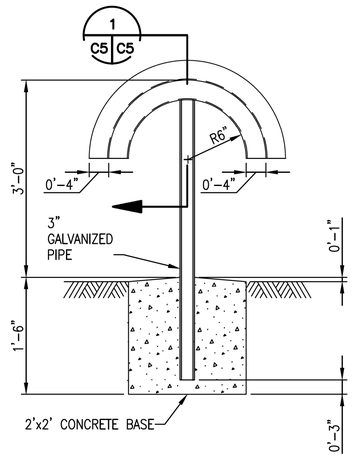
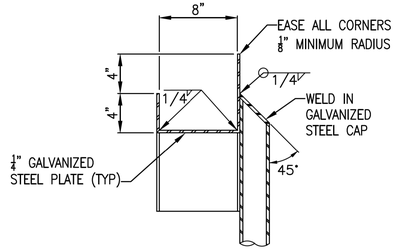
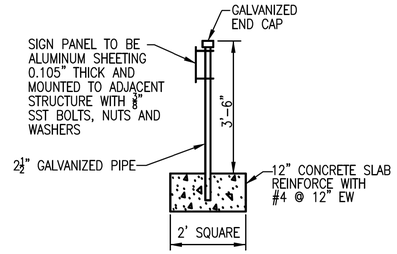


HOSE RACK
DETAIL 1 (C3 | C5)
SCALE: NTS

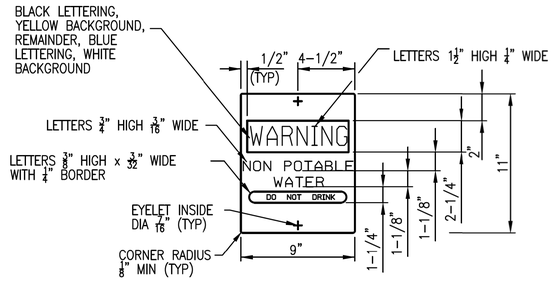


HOSE RACK
SECTION 1 (C5 | C5)
SCALE: NTS



NOTE:
SIGN SHALL BE PLACED ADJACENT TO EACH YARD HYDRANT. LOCATION SHALL BE DETERMINED BY ENGINEER

SIGN DETAIL
DETAIL 2 (C3 | C5)
SCALE: NTS



NON POTABLE WATER SIGN
DETAIL 3 (C5 | C5)
SCALE: NTS

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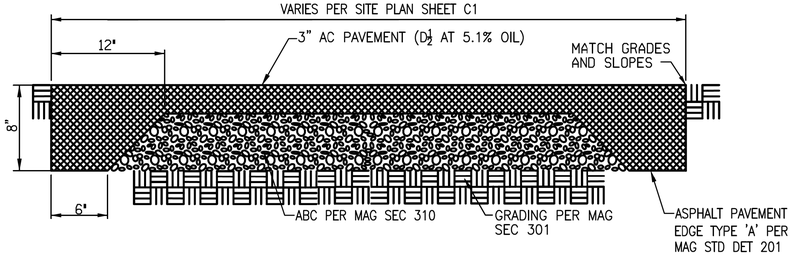
PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

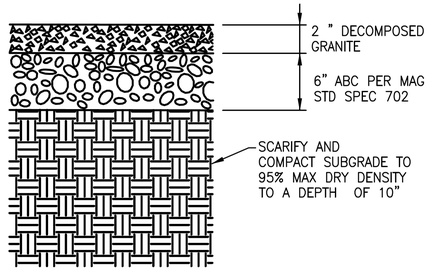
Registered Professional Engineer (Civil) Certificate No. 42745 JAY A. HORAK Date Signed 09-20-21 ARIZONA, U.S.A.



PAVEMENT NOTES:

1. SUBGRADE SHALL BE SCARIFIED AND LOOSENED TO A MINIMUM DEPTH OF 6 INCHES. THE INITIAL LAYER OF ABC MATERIAL SHALL BE SPREAD EVENLY ACROSS THE SCARIFIED SURFACE TO PROVIDE A GOOD BOND
2. SUBGRADE AND ABC MATERIAL SHALL BE COMPACTED TO A DENSITY OF 95% OF MAXIMUM IN ACCORDANCE WITH MAG SECTION 301.3

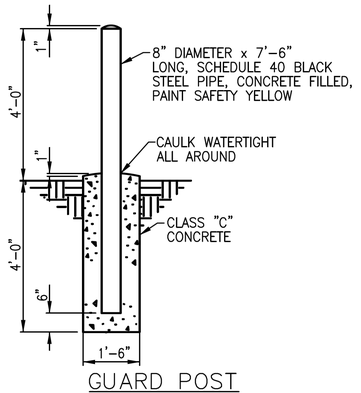
TYPICAL ASPHALT PAVEMENT SECTION
DETAIL 4 (C2 | C5)
SCALE: NTS



DECOMPOSED GRANITE STRUCTURAL SECTION
DETAIL 5 (C1 | C5)
SCALE: NTS

NOTES:

1. FOR PIONEER ROAD RIGHT-OF-WAY ONLY, PROVIDE 20' WIDE STRUCTURAL SECTION WITHOUT DECOMPOSED GRANITE AND REPLACE WITH 2" MILLING.
2. FOR MILLING REFER TO SPECIFICATION SECTION 02318, SUBPARAGRAPH 2.1.E.



GUARD POST
DETAIL 6 (C1 | C5)
SCALE: NTS

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REMARKS

Registered Professional Engineer (Civil) Certificate No. 24001 LARRY J. LEISCHNER Date Signed 09-20-21 ARIZONA, U.S.A. EXPIRES 12/31/2022

Stanley Consultants

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•					DWN MTL	COLLECTION SYSTEMS REMOTE FACILITIES
•					CKD LJL	City of Phoenix
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LS-76

WEST ANTHEM LIFT STATION
CIVIL DETAILS AND SECTIONS

CITY PROJECT NO. WS90400067
DATE 03/2018
C SHEET 5 (9 OF 44)
CAD FILE: LS76-C005

USER: 9402 FILE: Z:\26866\11-CADD\Civil\LS76-C005.dwg DATE: 9/20/21 TIME: 01:10pm

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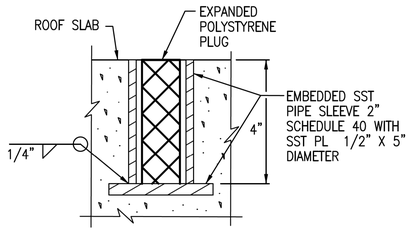
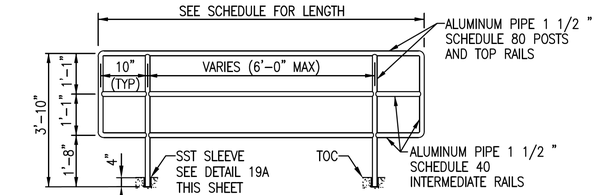


DETAIL 19A M1 M1 SLEEVE
SCALE: NTS

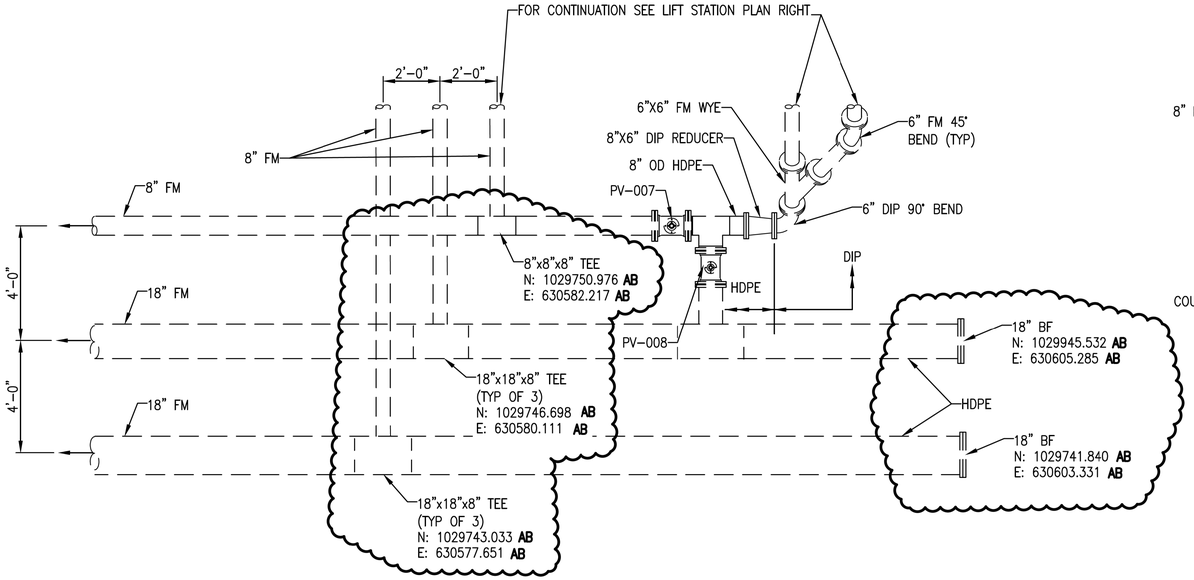


DETAIL 19 M1 M1 TEMPORARY HANDRAIL
SCALE: NTS

TEMPORARY HANDRAIL SCHEDULE		
NO. REQ'D	LENGTH	LOCATION
2	48	WET WELL
1	60	WET WELL

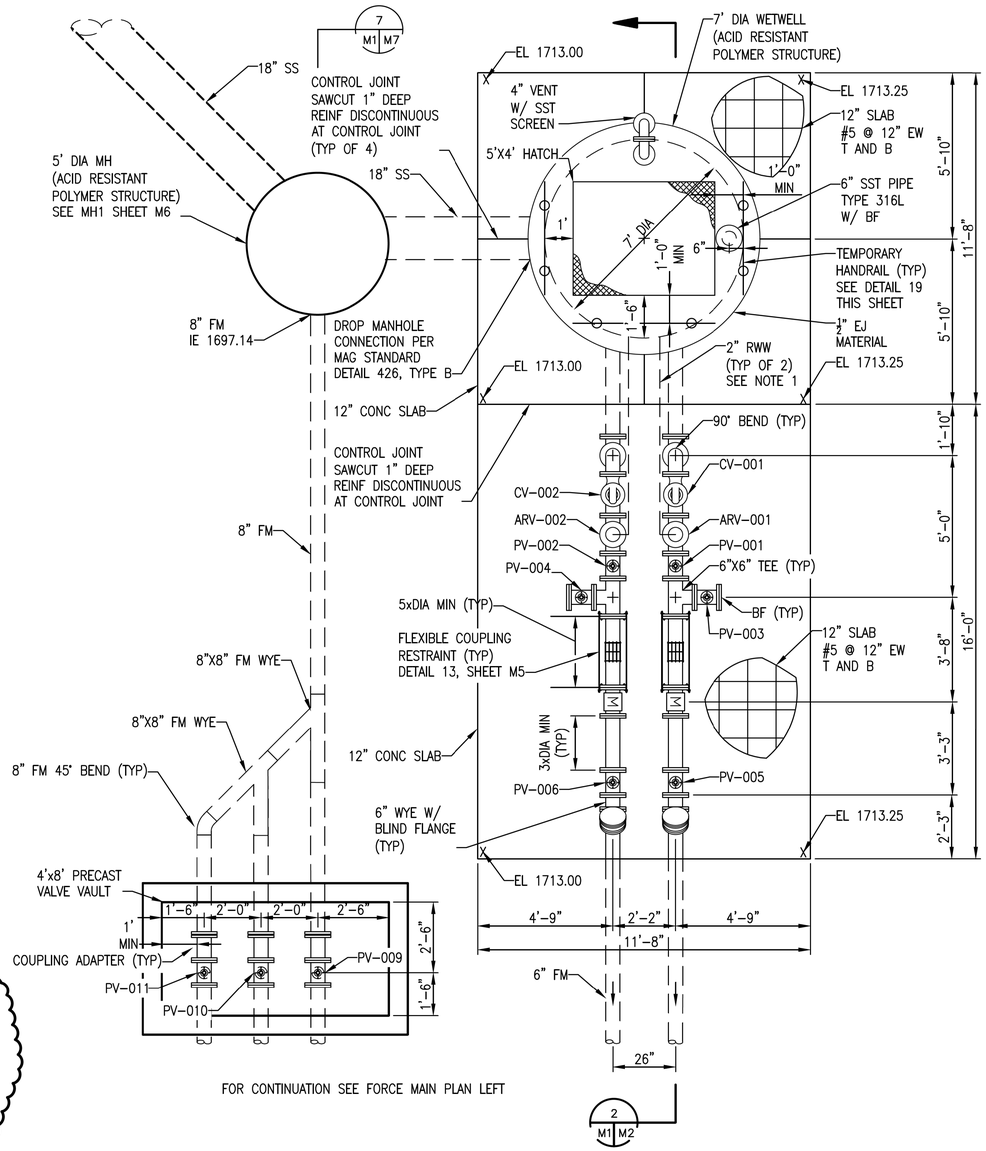
NOTES:

1. ADJUST ROOF REINFORCEMENT IF NECESSARY TO INSTALL SLEEVES.



7 M1 M7

FORCE MAIN PLAN
SCALE: 3/8"=1'-0"



LIFT STATION PLAN
SCALE: 3/8"=1'-0"

NOTES:

1. ENCASE ALL PIPING UNDER CONCRETE PAD, SEE DETAIL 9 SHEET M4.
2. THE 6" FM IS DUCTILE IRON PIPE AND CALLED OUT BASED ON INSIDE DIAMETER DIMENSION OF THE PIPE. THE 8" FM IS HDPE AND CALLED OUT BASED ON THE OUTSIDE DIAMETER DIMENSION OF THE PIPE. THE DRAWINGS DEPICT INSIDE DIAMETER DIMENSION OF PIPES.
3. HATCH SHALL BE HINGED ON THE EAST AND WEST SIDES.

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

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REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer (Civil) CERTIFICATE NO. 42745 JAY A. HORAK Date Signed 09-30-21 ARIZONA, U.S.A.

City of Phoenix
N
0 1 2 4
3/8" = 1'-0"

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Registered Professional Engineer (Civil) CERTIFICATE NO. 24001 LARRY J. LEISCHNER Date Signed 09-30-21 ARIZONA, U.S.A. EXPIRES 12/31/2022

Stanley Consultants

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DWN MTL
CKD LJL

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
FORCE MAIN PLAN AND LIFT STATION PLAN

CITY PROJECT NO. WS90400067
DATE 03/2018
M SHEET 1 (10 OF 44)
CAD FILE: LS76-M001

USER: 9402 FILE: Z:\26866\11-CADD\Mechanical\LS76-M001.dwg DATE: 9/16/21 TIME: 02:46pm

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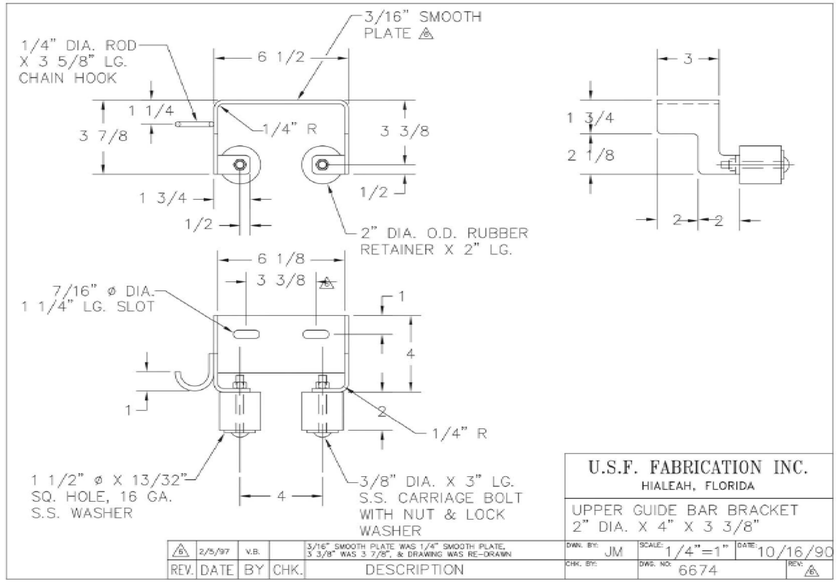


REV.	DATE	BY	CHK.	DESCRIPTION
A	2/5/97	V.B.		3/16" SMOOTH PLATE WAS 1/4" SMOOTH PLATE, 3 3/8" WAS 3 7/8", & DRAWING WAS RE-DRAWN

DWN. BY: JM | CHK. BY: | SCALE: 1/4"=1" | DWG. NO. 6674 | DATE: 10/16/90 | REV: A

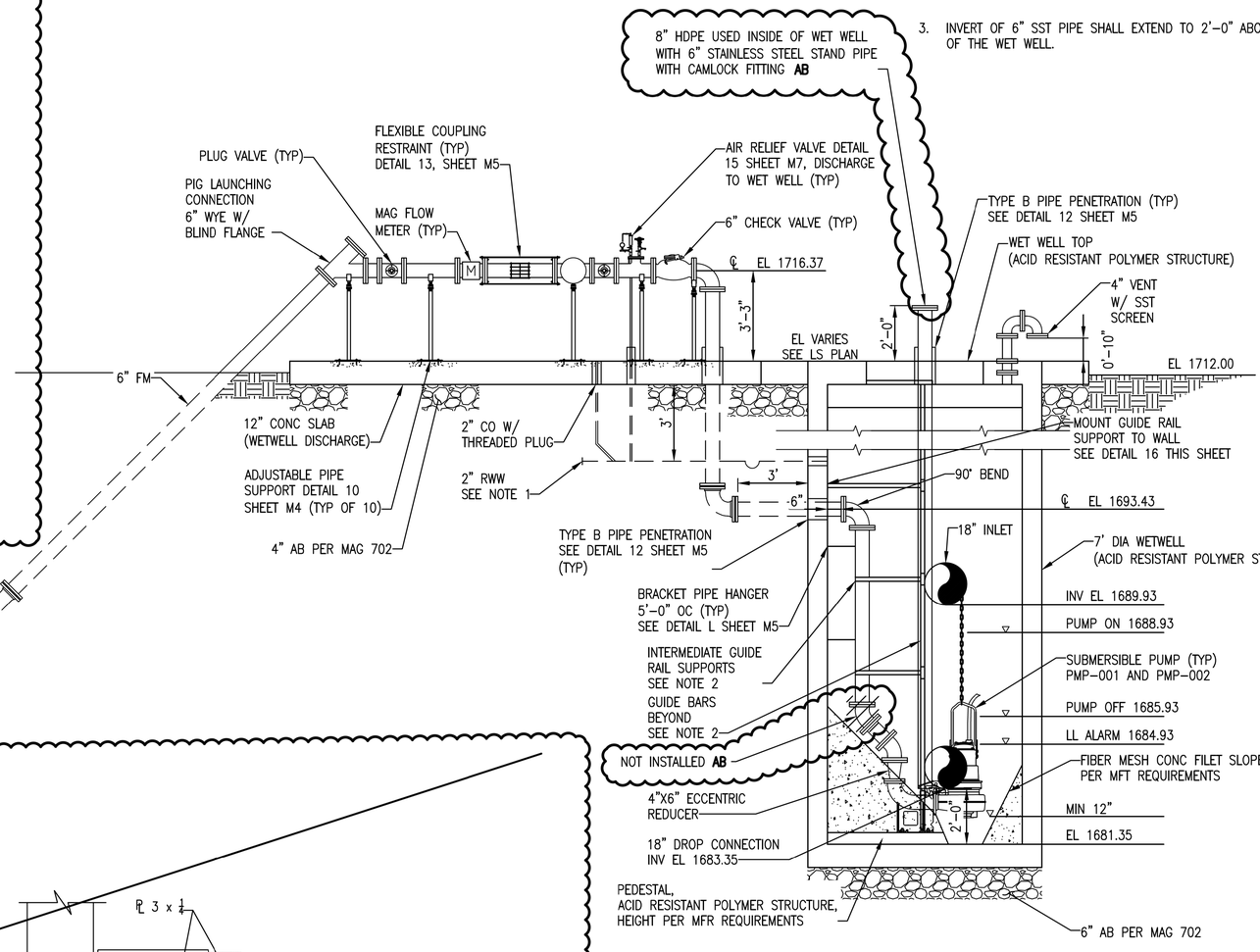
U.S.F. FABRICATION INC.
HIALEAH, FLORIDA

UPPER GUIDE BAR BRACKET
2" DIA. X 4" X 3 3/8"

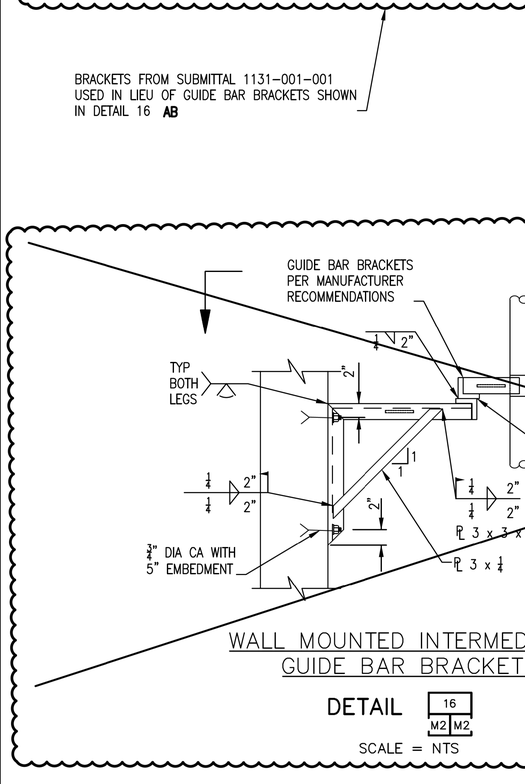
BRACKETS FROM SUBMITTAL 1131-001-001 USED IN LIEU OF GUIDE BAR BRACKETS SHOWN IN DETAIL 16 **AB**

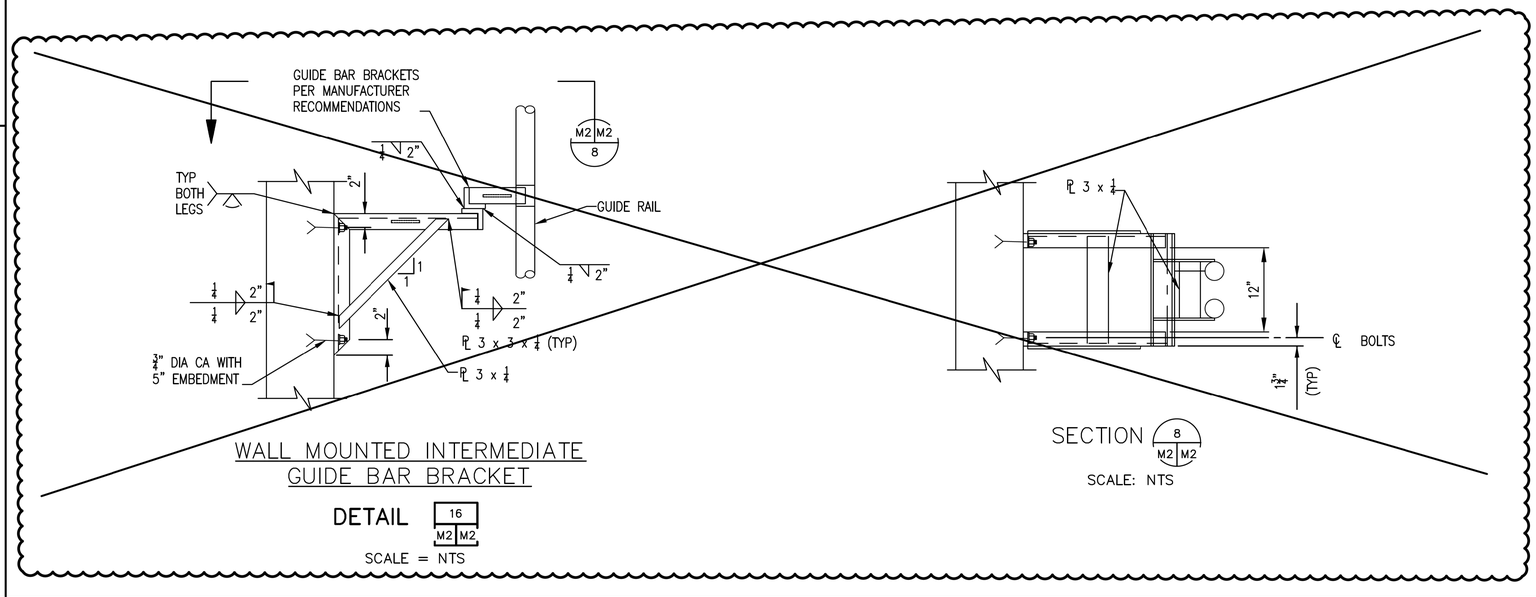
NOTES:

1. ENCASE ALL PIPING UNDER CONCRETE PAD, SEE DETAIL 9 SHEET M4.
2. PROVIDE GUIDE BAR SUPPORTS PER MANUFACTURER'S REQUIREMENTS. GUIDE BARS SHALL BE TYPE 316 SS SCHEDULE 40.
3. INVERT OF 6" SST PIPE SHALL EXTEND TO 2'-0" ABOVE THE BOTTOM OF THE WET WELL.



SECTION 2 (M1|M2)
SCALE = 3/8"=1'-0"





WALL MOUNTED INTERMEDIATE GUIDE BAR BRACKET

DETAIL 16 (M2|M2)
SCALE = NTS

SECTION 8 (M2|M2)
SCALE: NTS

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PHOENIX, AZ 85016
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REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer (Civil) CERTIFICATE NO. 42745 JAY A. HORAK Date Signed 09-21-21 ARIZONA, U.S.A.

0 1 2 4
3/8" = 1'-0"

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS

Registered Professional Engineer (Civil) CERTIFICATE NO. 24001 LARRY J. LEISCHNER Date Signed 09-30-21 ARIZONA, U.S.A. EXPIRES 12/31/2022

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NO.	BY	DATE	CKD	REMARKS

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CKD LJL

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
LIFT STATION SECTION

CITY PROJECT NO. WS90400067
DATE 03/2018
M SHEET 2 (11 OF 44)
CAD FILE: LS76-M002

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PUMP SCHEDULE

TAG NO.	TYPE	RATING POINT				MIN SHUTOFF HEAD (FT)	MIN. SUCTION/ DISCHARGE SIZE	PUMP RPM MIN	PUMP RPM MAX	SEAL TYPE	MOTOR DATA					SPECS
		CAPACITY (GPM)	HEAD (FT)	MIN. EFF. (%)	NPSH AVAILABLE						HP	RPM (MAX)	VOLTAGE	PHASES	MOTOR (HZ)	
PMP-001	SUBMERSIBLE	352	155	57.50	–	234	4 IN	–	3530	MECHANICAL	35	3530	460	3	60	11318
PMP-002	SUBMERSIBLE	352	155	57.50	–	234	4 IN	–	3530	MECHANICAL	35	3530	460	3	60	11318

VALVE SCHEDULE

VALVE NO.	VALVE TYPE AND SIZE	JOINT TYPE	ACTUATOR TYPE	SPECS
ARV-001	AIR RELIEF VALVE-2 IN	THREADED	NONE	15119
ARV-002	AIR RELIEF VALVE-2 IN	THREADED	NONE	15119
CV-001	CHECK VALVE-6 IN	FLANGED	NONE	15114
CV-002	CHECK VALVE-6 IN	FLANGED	NONE	15114
PV-001	PLUG VALVE-6 IN	FLANGED	MANUAL-HAND WHEEL	15112
PV-002	PLUG VALVE-6 IN	FLANGED	MANUAL-HAND WHEEL	15112
PV-003	PLUG VALVE-6 IN	FLANGED	MANUAL-HAND WHEEL	15112
PV-004	PLUG VALVE-6 IN	FLANGED	MANUAL-HAND WHEEL	15112
PV-005	PLUG VALVE-6 IN	FLANGED	MANUAL-HAND WHEEL	15112
PV-006	PLUG VALVE-6 IN	FLANGED	MANUAL-HAND WHEEL	15112
PV-007	PLUG VALVE-8 IN	FLANGED	MANUAL-BURIED TYPE W/ VB & C	15112
PV-008	PLUG VALVE-8 IN	FLANGED	MANUAL-BURIED TYPE W/ VB & C	15112
PV-009	PLUG VALVE-8 IN	FLANGED	MANUAL-BURIED TYPE	15112
PV-010	PLUG VALVE-8 IN	FLANGED	MANUAL-BURIED TYPE	15112
PV-011	PLUG VALVE-8 IN	FLANGED	MANUAL-BURIED TYPE	15112

EXPOSED PIPING SCHEDULE

ABBREV	SERVICE	SIZE	MATERIAL	JOINTS	SPECS
FM	RAW WASTEWATER	6IN	DIP THICKNESS CLASS 53	FLANGED	15050
RWW	RAW WASTEWATER	2 IN	CPVC SCHEDULE 80	PLAIN END/SOLVENT WELD/FLANGED	15050

BURIED PIPING SCHEDULE

ABBREV	SERVICE	SIZE	MATERIAL	JOINTS	SPECS
SS	RAW WASTEWATER	18 IN	VCP EXTRA STRENGTH	BELL AND SPIGOT	15050
FM	RAW WASTEWATER	6 IN	DIP	FLANGED	15050
FM	RAW WASTEWATER	8 IN (OD)	HDPE	WELDED/FLANGED	02530
FM	RAW WASTEWATER	18 IN (OD)	HDPE	WELDED/FLANGED	02530
RWW	RAW WASTEWATER	3 IN AND SMALLER	SST	THREADED	15050
SST	RAW WASTEWATER	LARGER THEN 3 IN	SST	FLANGED	15050
W	POTABLE WATER	3 IN AND SMALLER	COPPER	SOLDER TYPE WITH THREADED OR FLANGED ADAPTERS FOR VALVES	15050
W	POTABLE WATER	4 IN	DIP	RESTRAINED	15050
STDR	STORM DRAIN	8 IN	CISP	SPIGOT COMPRESSION OR IN ACCORDANCE WITH CISPI301	15050
STDR	STORM DRAIN	12 IN	CISP	SPIGOT COMPRESSION OR IN ACCORDANCE WITH CISPI301	15050
STDR	STORM DRAIN	18 IN	DIP	FLANGED OR MECHANICAL	15050

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PHOENIX, AZ 85016
602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
CERTIFICATE NO.
42745
JAY A.
HORAK
Date Signed 09-21-21
ARIZONA, U.S.A.

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS

Registered Professional Engineer
CERTIFICATE NO.
24001
LARRY J.
LEISCHNER
Date Signed 09-20-21
ARIZONA, U.S.A.
EXPIRES 12/31/2022

Stanley Consultants

REVISIONS

NO.	BY	DATE	CKD	REMARKS
1				
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City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

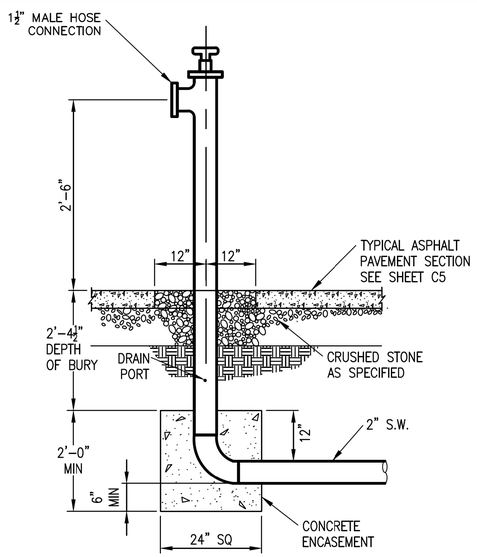
LS-76

WEST ANTHEM LIFT STATION
MECHANICAL SCHEDULES

CITY PROJECT NO. WS90400067
DATE 03/2018
M SHEET 3 (12 OF 44)
CAD FILE: LS76-M003

USER: 9402 FILE: Z:\26866\11-CADD\Mechanical\LS76-M003.dwg DATE: 9/20/21 TIME: 01:14pm

FOR CONSTRUCTION

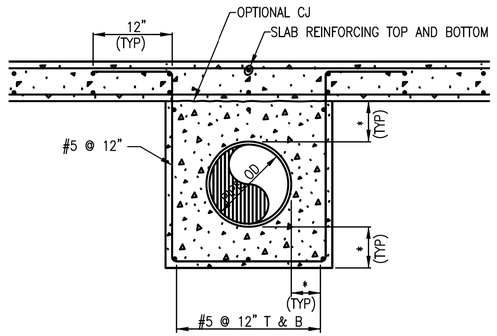


NOTES:
1. FIELD LOCATE.
2. GUARD POSTS FOR EACH HOSE BIB WHERE DIRECTED BY THE OWNER.

HOSE BIB DETAIL

7 | C1, C2 | M4

SCALE: NTS



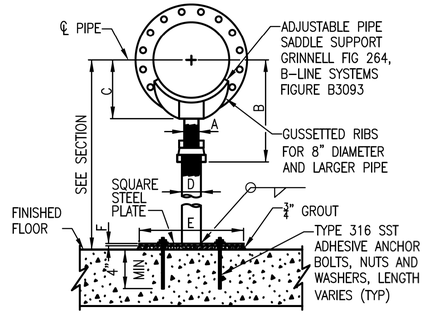
* 4" MIN FOR ALL 3" AND SMALLER DIA OD PIPE
6" MIN FOR ALL 4" TO 9" DIA OD PIPE
12" MIN FOR ALL 10" TO 23" DIA OD PIPE
16" MIN FOR ALL 24" AND LARGER DIA OD PIPE

NOTES:
1. PROVIDE SOLID CONCRETE BLOCK UNDER PIPE FOR SUPPORT (NOT SHOWN FOR CLARITY)
2. PROVIDE PIPE JOINT WITHIN 12" OF ENDING CONCRETE ENCASEMENT

UNDER SLAB PIPE AND CONDUIT ENCASEMENT DETAIL

9 | M1 | M4

SCALE: NTS



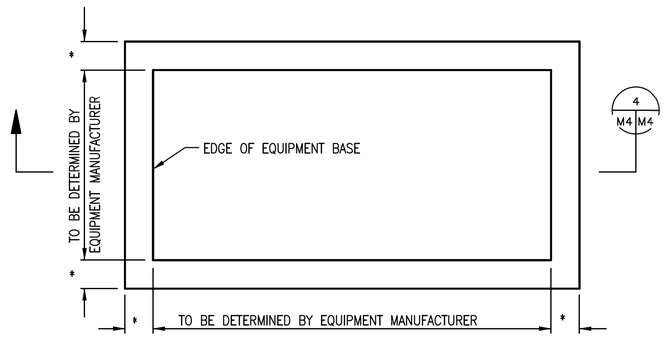
ADJUSTABLE PIPE SADDLE SUPPORT TABLE

NOMINAL PIPE SIZE	NOMINAL A	B MIN	B MAX	C	NOMINAL D	E	F
6"	2½"	10½"	15¼"	5½"	3"	10"	⅜"

ADJUSTABLE PIPE SUPPORT DETAIL

10 | M2 | M4

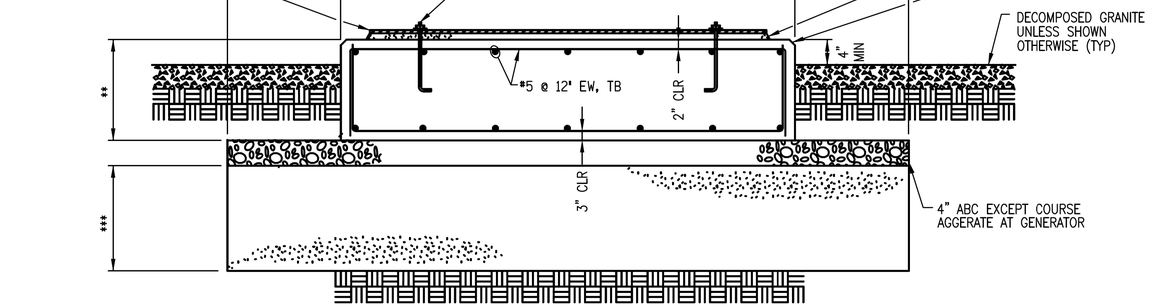
SCALE: NTS



CONCRETE PAD PLAN DETAIL

11 | C1 | M4

SCALE: NTS



NOTES:
* = 3'-6" FOR GENERATOR EQUIPMENT BASE, 4" FOR ALL OTHER TYPES OF EQUIPMENT
** = 1'-8" FOR GENERATOR EQUIPMENT BASE, 10" DEEP FOR ALL OTHER TYPES OF EQUIPMENT AND STORAGE SHED
*** = EXCAVATE 3'-0" DEEP AND 3'-0" ON EACH SIDE OF GENERATOR FOUNDATION AND REPLACE WITH SUITABLE EXCAVATED OR BORROW MATERIAL, COMPACTED PER SPECIFICATIONS

SECTION 4 | M4 | M4

SCALE =NTS

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ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer (Civil) CERTIFICATE NO. 42745 JAY A. HORAK Date Signed 9-20-21 ARIZONA, U.S.A.

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#							

Registered Professional Engineer (Civil) CERTIFICATE NO. 24001 LARRY J. LEISCHNER Date Signed 09-20-21 ARIZONA, U.S.A.
EXPIRES 12/31/2022

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City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
MECHANICAL DETAILS AND SECTION

CITY PROJECT NO. WS90400067
DATE 03/2018
M SHEET 4 (13 OF 44)
CAD FILE: LS76-M004

USER: 9402 FILE: Z:\26866\11-CADD\Mechanical\LS76-M004.dwg DATE: 9/20/21 TIME: 01:28pm

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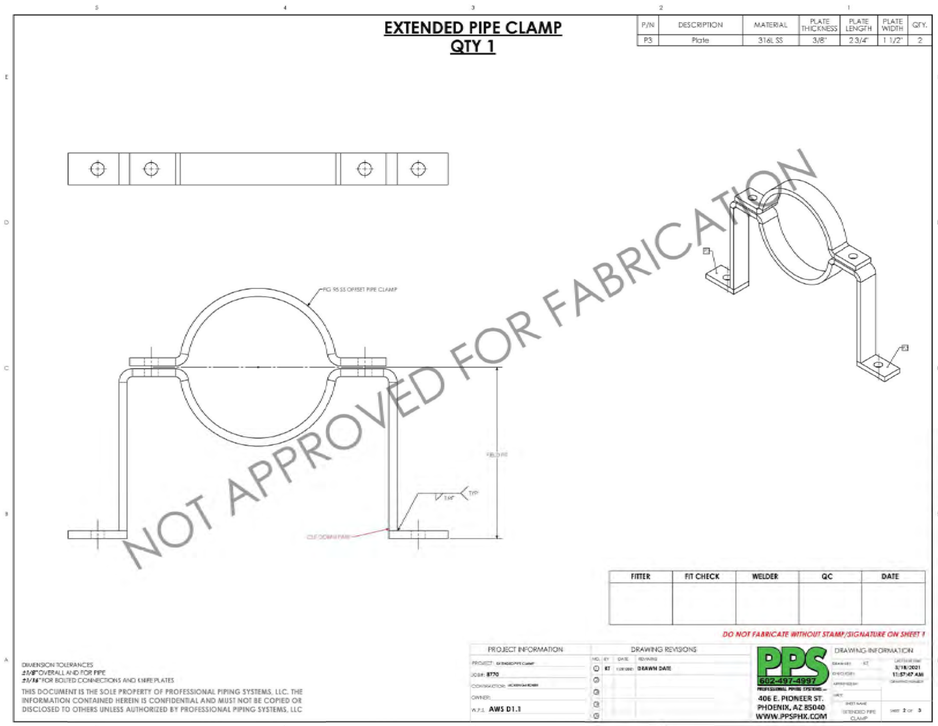


WATER AND SEWER PIPE HANGER DETAILS

DETAIL L (M2, M5)

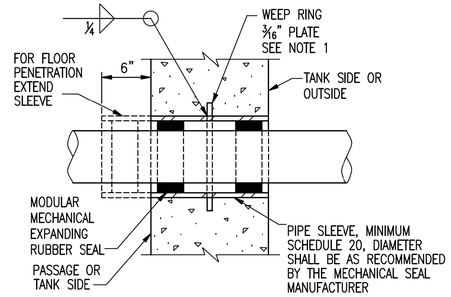
SCALE = NTS

1. 1"– U–BOLT PER GRINNELL CO #137
2. BRACKET SIMILAR TO GRINNELL CO #195 FOR LOAD NOT EXCEEDING 1,500 LBS AND SIMILAR TO #199 FOR LOADS OF 1,500–3,000 LBS. FOR LOADS EXCEEDING 3,000 LBS, BRACKETS MAY BE CONSTRUCTED OF CHANNELS OR ANGLES WITH REQUIRED STRENGTH. SUCH BRACKETS TO BE REVIEWED BY THE ENGINEER. WHEN LOADS ON BRACKETS ARE EXCESSIVE, FLANGES ARE TO BE INCREASED TO DISTRIBUTE THE LOAD OVER A LARGER AREA OF WALL.
3. ⅜" OR ½" U–BOLT PER GRINNELL COMPANY #137 FOR 2" AND 4" DIAMETER AIR RELIEF DRAINS AND 3" CARRIER PIPE DRAIN.

   LOCATION OF HANGERS AND BRACKETS TO BE APPROVED BY ENGINEER.

   ALL HANGERS, BRACKETS AND ANCHORS IN WETWELL, ODOR CONTROL FACILITY, CHEMICAL FEED SYSTEM AND VAULTS SHALL BE TYPE 316 STAINLESS STEEL.

PIPE HANGER BRACKETS FROM PPS AS SHOWN USED IN LIEU OF HANGER BRACKET ORIGINALLY INCLUDED IN DETAIL **AB**



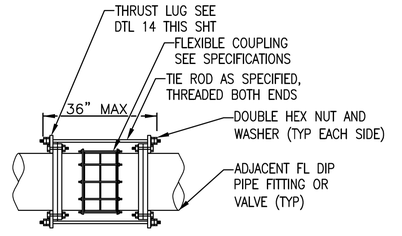
NOTES:

1. WEEP RING SHALL HAVE A MINIMUM DIAMETER 3" GREATER THAN THE OUTSIDE PIPE DIAMETER.
2. PIPE SLEEVE MATERIAL SHALL BE STAINLESS STEEL TYPE 316.

TYPE B WALL AND FLOOR PIPE PENETRATION

DETAIL 12 (M7, M5)

SCALE: NTS



PIPE SIZE	TIE ROD DIA	NO. TIE RODS REQ'D	TIE BOLT DIA
6"	3/4"	2	3/4"

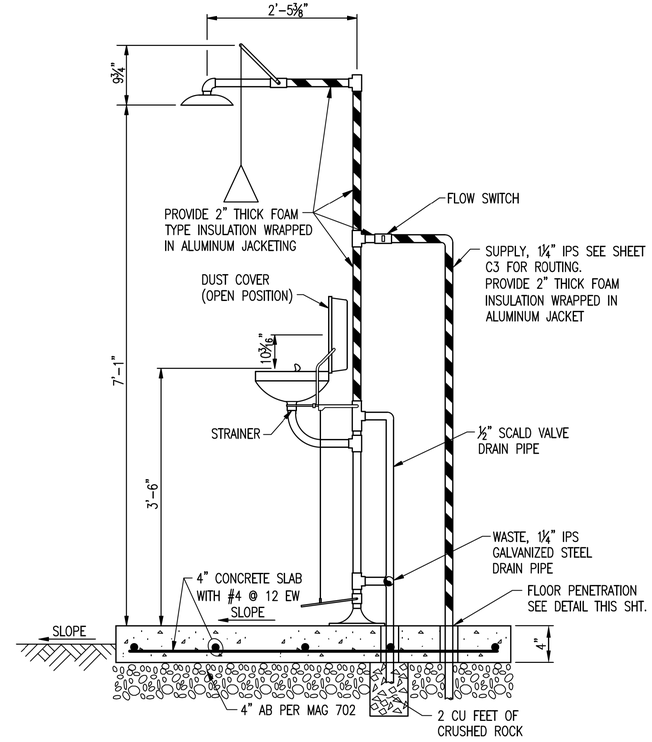
NOTES:

1. PROVIDE TIE RODS WHERE FLEXIBLE COUPLING RESTRAINTS ARE SPECIFIED AND AT ALL OTHER LOCATIONS INDICATED ON THE DRAWINGS
2. ORIENTATE AND SPACE TIE RODS AS REQUIRED TO EVENLY DISTRIBUTE PIPE PRESSURE.
3. PROVIDE SUFFICIENT SPACE SO COUPLING CAN BE SLIPPED AT LEAST ONE DIRECTION TO CLEAR JOINT

FLEXIBLE COUPLING RESTRAINT DETAIL

DETAIL 13 (M1, M2, M5)

SCALE: NTS



EMERGENCY EYEWASH/SHOWER DETAIL

DETAIL 15 (C3, M5)

SCALE: NTS

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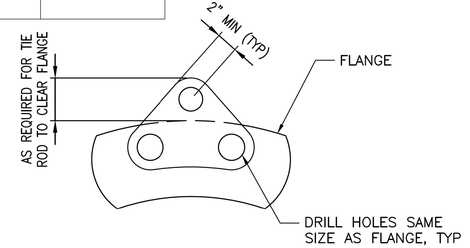
REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer — Certificate No. 42745 — JAY A. HORAK — Date Signed 09-30-21 — ARIZONA, U.S.A.



NOTES:

1. PLATE SHALL CONFORM TO ASTM A 283, GRADE D.

THRUST LUG

DETAIL 14 (M5, M5)

SCALE: NTS

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Registered Professional Engineer (C/M/I) — Certificate No. 24001 — LARRY J. LEISCHNER — Date Signed 09-30-21 — ARIZONA, U.S.A. — EXPIRES 12/31/2022

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CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS–76

WEST ANTHEM LIFT STATION
MECHANICAL DETAILS

CITY PROJECT NO. WS90400067
DATE 03/2018
M SHEET 5 (14 OF 44)
CAD FILE: LS76–M005

USER: 9402 FILE: Z:\26866\11–CADD\Mechanical\LS76–M005.dwg DATE: 9/30/21 TIME: 08:52am

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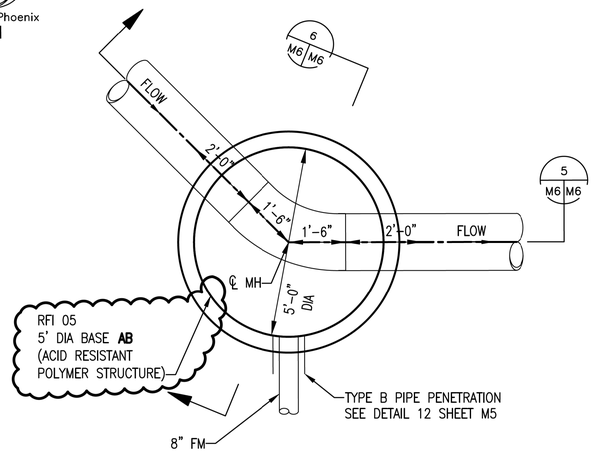
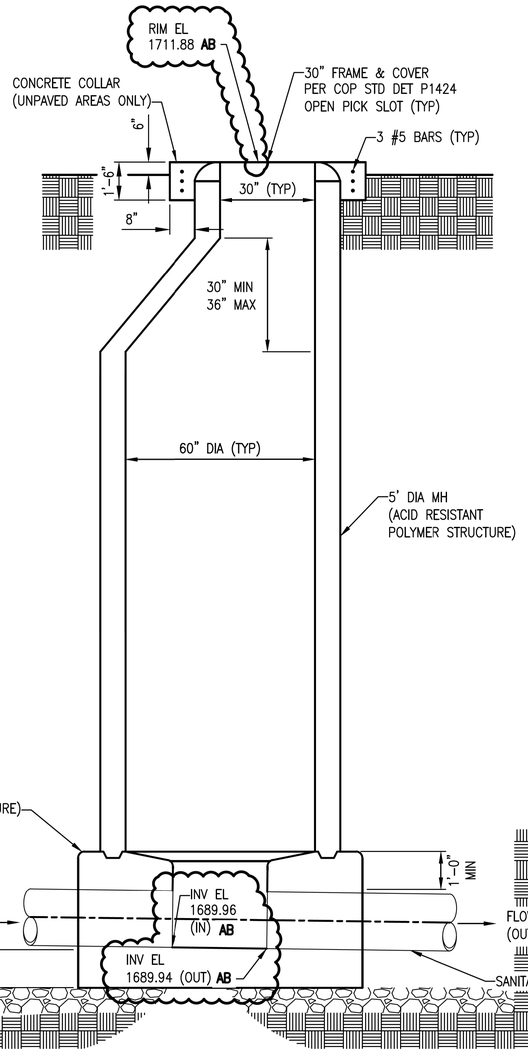
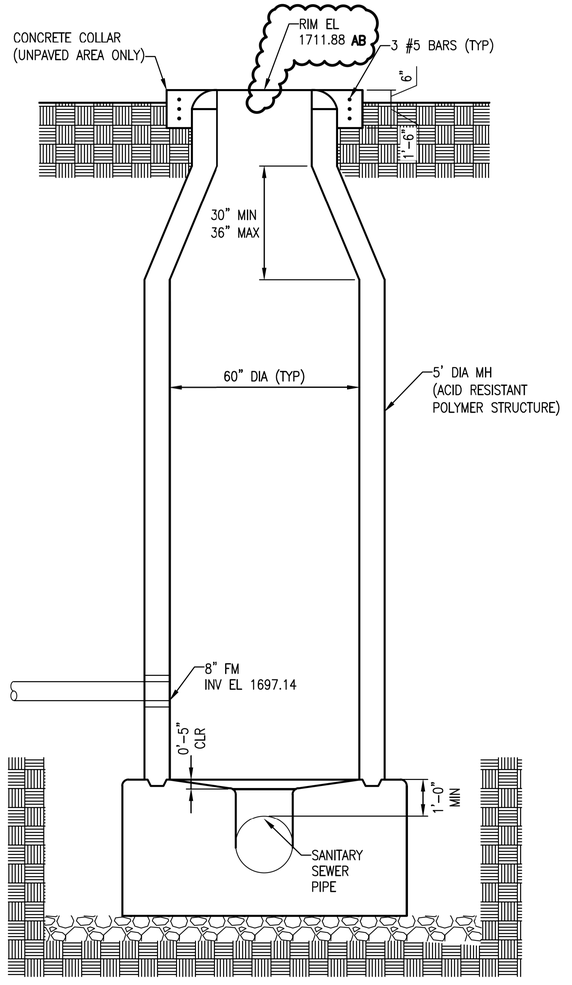


MH1 SECTIONAL PLAN
SCALE: NTS



SECTION 5 M6 M6
SCALE: NTS



SECTION 6 M6 M6
SCALE: NTS

NOTES:

1. FOR THE 18" SS, PROVIDE TWO BELL AND SPIGOT JOINTS AT EACH MANHOLE OPENING PER MAG DETAIL 420-2.

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REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer (Civil)
42745
JAY A. HORAK
Date Signed 09-20-21
ARIZONA, U.S.A.

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Registered Professional Engineer (Civil)
CERTIFICATE NO.
24001
LARRY J. LEISCHNER
Date Signed 09-20-21
ARIZONA, U.S.A.
EXPIRES 12/31/2022

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CITY OF PHOENIX
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COLLECTION SYSTEMS
REMOTE FACILITES

LS-76

WEST ANTHEM LIFT STATION
MH1 SECTIONAL PLAN AND SECTIONS

CITY PROJECT NO. WS90400067
DATE 03/2018
M SHEET 6 (15 OF 44)
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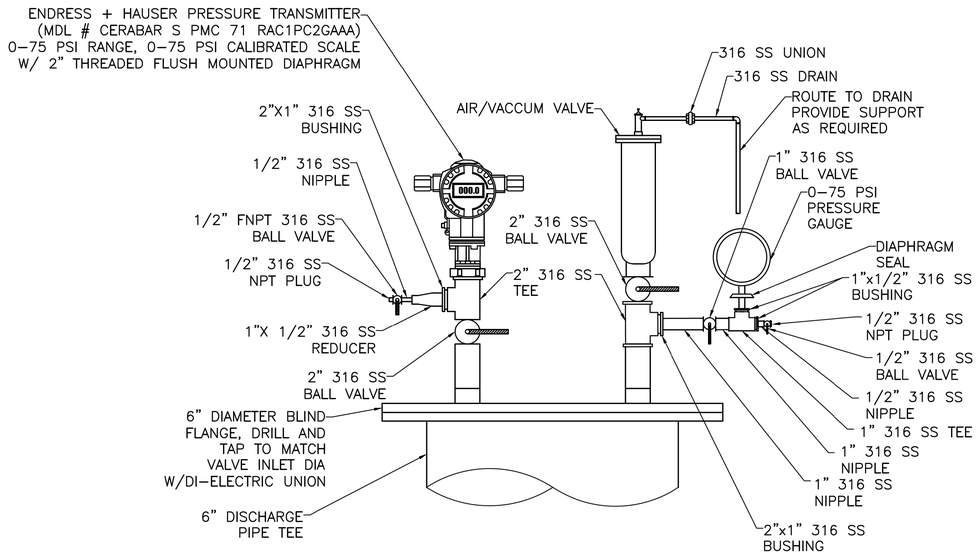
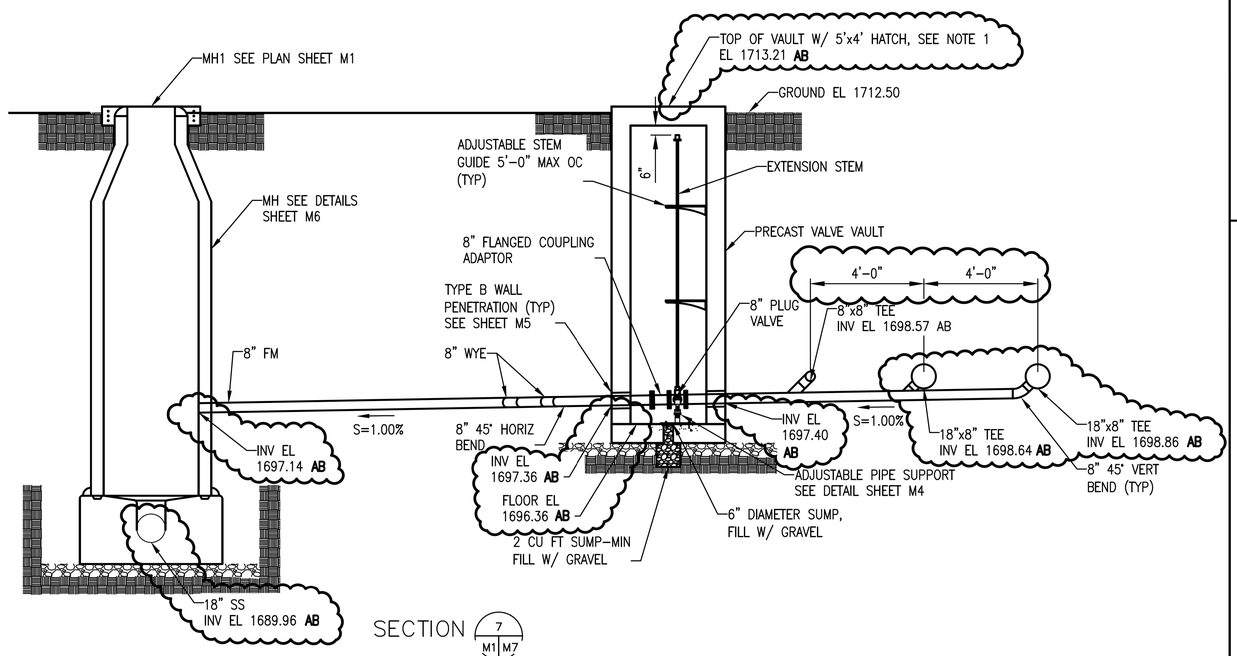


COMBINATION AIR/VACUUM RELEASE VALVE AND TRANSMITTER W/ MOUNTING DETAIL

DETAIL 15 (M2 | M7)

SCALE = NTS



SECTION 7 (M1 | M7)

SCALE: NTS

NOTE:

1. CENTER 5'x4' HATCH OVER VALVE WRENCH NUTS.

ARV CONFIGURATION AS SHOWN IN PICTURE **AB**

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PHOENIX, AZ 85016
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JAY A. HORAK
Date Signed 09-30-21
ARIZONA, U.S.A.

FOR CITY OF PHOENIX USE ONLY – REFERENCE CID NUMBER: #

REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	REMARKS

Contact Arizona 811 at least two full working days before you begin excavation
ARIZONA811 Call 811 or click Arizona811.com

Registered Professional Engineer
CERTIFICATE NO. 24001
LARRY J. LEISCHNER
Date Signed 09-30-21
ARIZONA, U.S.A.
EXPIRES 12/31/2022

Stanley Consultants

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NO.	BY	DATE	CKD	REMARKS
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DES MTL
DWN MTL
CKD LJL

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITES

LS–76

WEST ANTHEM LIFT STATION
MECHANICAL DETAIL AND SECTION

CITY PROJECT NO. WS90400067

DATE 03/2018

M SHEET 7 (16 OF 44)

CAD FILE: LS76–M007

USER: 9402 FILE: Z:\26866\11–CADD\Mechanical\LS76–M007.dwg DATE: 9/30/21 TIME: 09:10am

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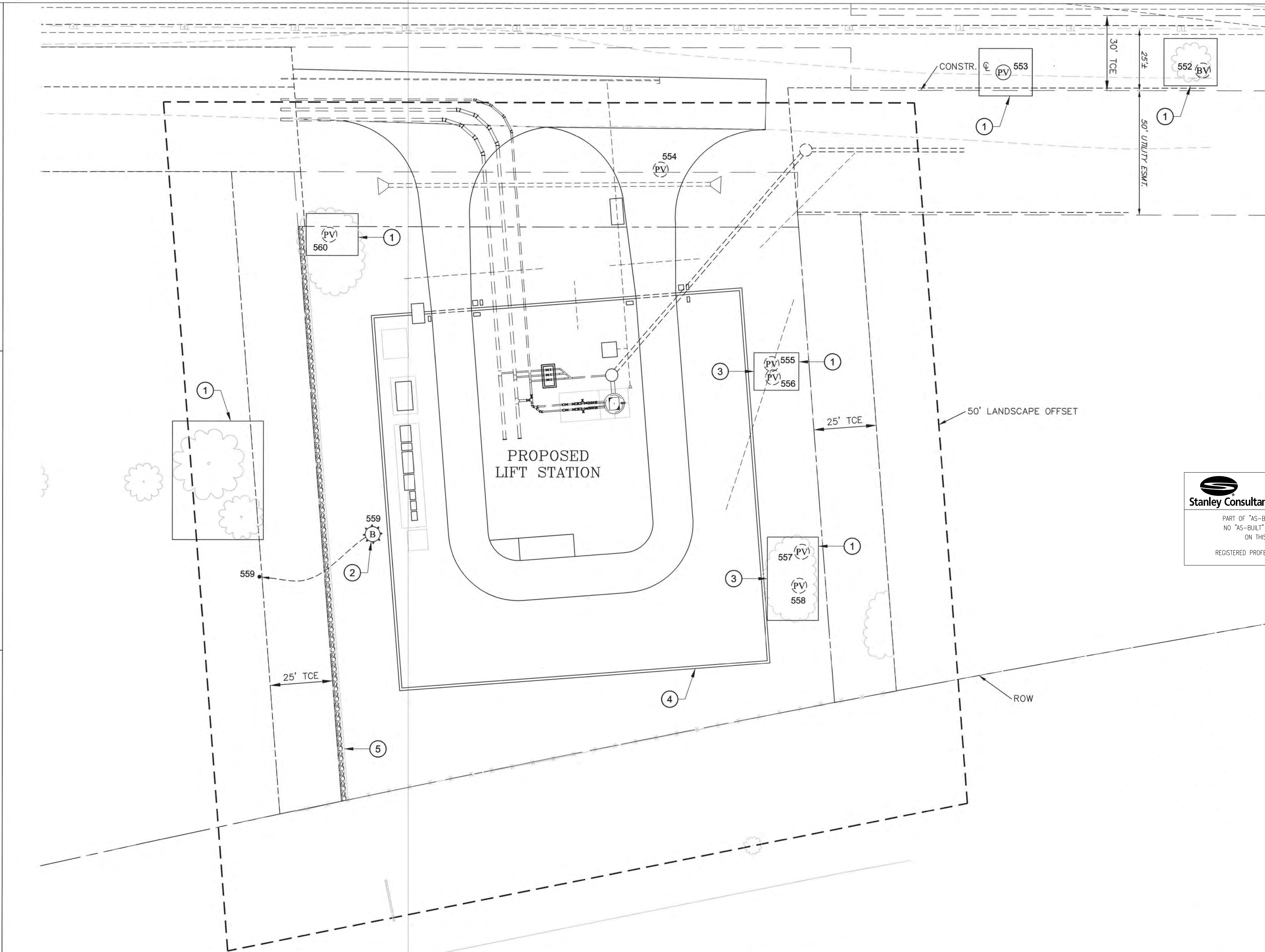

PLANT LEGEND

	Salvageable	Non Salvageable	Remain In Place	Move Once	Destroy
Blue Palo Verde *Parkinsonia floridum*		(BV)	1	0	0
Foothills Palo Verde *Parkinsonia microphyllum*	(PV)	(PV)	6	0	1
Barrel *Ferocactus spp.*	(B)		0	1	0
Not Surveyed	( )		2	0	0

KEYNOTES

1	See sheet NPI3 for Protect-in-Place fencing
2	'Move Once' to this location. All move once plants shall be protected by a protect-in-place fence once moved
3	Hand dig to avoid roots in the area as needed
4	New wall - see civil plans
5	New retaining wall - see civil plans

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer 42745 JAY A. HORAK ARIZONA, U.S.A.

REGISTERED LAND SURVEYOR 38581 RANDALL R. HAGER ARIZONA U.S.A.

AS BUILTS PREPARED BY:
RICK ENGINEERING
22425 N 16TH STREET, SUITE 1
PHOENIX, ARIZONA 85024

City of Phoenix
N

0 20' 40'

REMARKS | DWG NUMBER | CAD FILE NAME | DATE | PROJECT NAME | PROJECT NO. | ENGINEERING COMPANY | REVISION

FOR CITY OF PHOENIX USE ONLY - REFERENCE CID NUMBER:

REGISTERED LANDSCAPE ARCHITECT 21860 CARYN LOGAN HEAPS ARIZONA, U.S.A.

Del Sol Group

Stanley Consultants

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DWN SAS
CKD CLH

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITES

LS-76

WEST ANTHEM LIFT STATION
NATIVE PLANT INVENTORY

CITY PROJECT NO. WS90400067
DATE 03/2018
N SHEET 1 (17 OF 44)
CAD FILE: LiftSta_NPI01

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CITY OF PHOENIX GENERAL INVENTORY/SALVAGE NOTES

- The City of Phoenix General Notes are the only notes approved on this plan. Additional general notes generated by the sealant and placed on the plans are not approved as part of this plan and are noted as such on the plans.
- Plant materials must be individually tagged in the field at the time the Inventory Plans are submitted. Tagged material must be clearly marked with waterproof ink and include the number which corresponds to the number shown on the plan. A field review will not occur until clearly marked tags are in place on each plant to be included in the inventory.
- Tags must be attached so that they will remain on the plant for the duration of the salvage and nursery storage period. Plant materials without numbered tags in the nursery will not be counted toward the total requirement for the project.
- All salvageable material is to be clearly flagged with tape or plastic tags visible from all directions. Tags shall be numbered to correspond with the plant inventory plan and legend.

  Color code as follows: Red - Salvage and relocate. White - Preserve and protect in place. Blue - Destroy, not salvageable and cannot remain in place.
- Contact the Parks & Recreation Department, Forestry Supervisor, at 602-262-6862, to verify ownership of any plant material in the public R.O.W. prior to any plant re-locations or removals. Obtain written permission from the Parks and Recreation Department prior to the re-location or removal of any City plant material or equipment.
- Contact the Street Transportation Department. Horticulturist, at 602-262-6284, prior to the re-location or removal of existing plant material in the A.D.O.T. R.O.W. that is on the City's side of the sound wall. Obtain written permission from the Street Transportation Department prior to the re-location or removal of any plant material or equipment.
- A Salvage permit shall be obtained and completed prior to the Grading and Drainage permit being issued. No clearing or grubbing may occur prior to the purchase of the Salvage Permit, field approval of the construction fence, and all salvaged plants placed in the nursery and field inspected.
- All protective fencing shall be in place before any earth moving equipment is moved onto the site and before any salvage, clearing or grubbing takes place. Call 602-262-7811 to schedule an inspection of construction fence.
- All material to be salvaged shall be removed and placed in the designated nursery area before any clearing or grading takes place. Call 602-262-7811 to schedule an inspection after salvage is completed.
- All tagged materials must remain in nursery or on-site until nursery check is approved.
- No nails, wires or other objects that damage the cambium or cause injury to the tree may be used during the salvage process. All efforts shall be taken by using padding or other methods to preserve the integrity of the bark.
- Trees and protected plant material or material noted for salvage that are destroyed or die during the salvage, relocation, or maintenance period will be replaced with a plant of equal or greater size and type by the responsible party a minimum of 90 days before the completion of the project. No Certificates of Occupancy will be issued before all required material has been replaced. All replacement material shall be approved by the Planning & Development Landscape Architect. A maximum of 10% of the salvageable plant material will not be required to be replaced if lost.
- All requirements of the State of Arizona, including the "Notice of Intent to Clear Land," shall be met notwithstanding any approvals by the City of Phoenix.
- File Notice of Intent (NOI) to clear land with the State of Arizona, 602-542-6408. Provide a copy of the NOI Permit to the inspector. http://www.azda.gov/ESD/clearland.pdf
- Provide a copy of the County Dust Control Permit to the inspector.
- No salvage material shall be removed from the site without Planning & Development Landscape Architect approval.
- Knowingly or negligently providing false or misleading information to the City of Phoenix regarding salvageable materials may result in delays and/or suspension of permits and inspections.
- Plan approval is valid for 180 days. Prior to plan approval expiration, all associated permits shall be purchased or the plans shall be resubmitted for extension of plan approval. The expiration, extension, and reinstatement of Inventory/Salvage Combination plans and permits shall follow the same guidelines as those indicated in the Phoenix Building Construction Code Administrative Provisions Section 105.3 for Building permits.

Native Resources

Landscape Inventory Plan

West Anthem Infrastucture

West of I-17 between Opportunity Way & Pioneer Road

Phoenix, AZ

3/14/17

Plant #	Species	Common Name	Caliper (in)	Width (ft)	Height (ft)	Inventory Designation	Final Designation	Comments
552	*Parkinsonia floridum*	Blue Palo Verde	24	20	18	NS	RIP	Leaning / Cambium Damage
553	*Parkinsonia microphyllum*	Foothills Palo Verde	12	13	13	S	RIP	
554	*Parkinsonia microphyllum*	Foothills Palo Verde	7	12	12	NS	D	Exposed Roots / Leaning
555	*Parkinsonia microphyllum*	Foothills Palo Verde	7	12	12	NS	RIP	Exposed Roots / Leaning
556	*Parkinsonia microphyllum*	Foothills Palo Verde	7	12	12	NS	RIP	Cambium Damage / Leaning
557	*Parkinsonia microphyllum*	Foothills Palo Verde	10	15	16	NS	RIP	Cambium Damage
558	*Parkinsonia microphyllum*	Foothills Palo Verde	12	17	16	NS	RIP	Branch Dieback
559	*Ferocactus spp.*	Barrel			3	S	MO	
560	*Parkinsonia microphyllum*	Foothills Palo Verde	16	22	18	NS	RIP	Cambium Damage
	Not Surveyed						RIP	within 50' LS offset
	Not Surveyed						RIP	within 50' LS offset

Inventory/Salvage Summary

	Trees	Cacti	Total
Salvaged	0	0	**0**
Destroy	1	0	**1**
Remain In Place	9	0	**9**
Move Once	0	1	**1**
Total Plants	**10**	**1**	**11**

Legend

S = Salvageable / Salvage
NS = Non Salvageable
D = Destroy
RIP = Remain in Place
MO = Move Once

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1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
42745
JAY A. HORAK
Date Signed 09-30-20
ARIZONA, U.S.A.

REGISTERED LAND SURVEYOR
38561
RANDALL R. HAGER
DATE SIGNED 2-6-18
ARIZONA U.S.A.

AS BUILTS PREPARED BY:
RICK ENGINEERING
22425 N 16TH STREET, SUITE 1
PHOENIX, ARIZONA 85024

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REGISTERED LANDSCAPE ARCHITECT
21550
CARYN LOGAN HEAPS
CERTIFICATE NO.
03/16/2018
Date Signed
ARIZONA, U.S.A.
Expires 10/31/19

Del Sol Group
environments redefined

Stanley Consultants

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DWN SAS
CKD CLH

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WATER SERVICES DEPARTMENT

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REMOTE FACILITES

LS-76

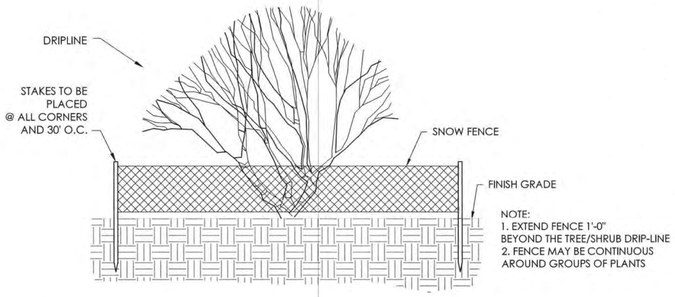
WEST ANTHEM LIFT STATION
NATIVE PLANT INVENTORY

CITY PROJECT NO. WS90400067

DATE 03/2018

N SHEET 2 (18 OF 44)

CAD FILE: LiftSta_NPI02-03



1 PROTECT-IN-PLACE FENCING

SCALE: N.T.S.

PLANT TABLET SCHEDULE

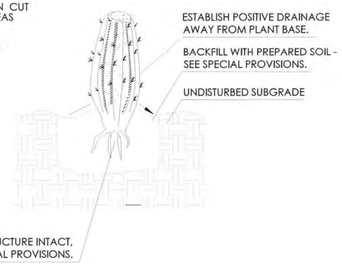
PLANT SIZE	NUMBER OF TABLETS
1 GALLON	1 TABLET
5 GALLON	2 TABLETS
15 GALLON	4 TABLETS
24" BOX, 1" CALIPER	6 TABLETS
36" BOX, 2" CALIPER	8 TABLETS
48" BOX, 2" CALIPER	8 TABLETS
54" BOX, 3" CALIPER	10 TABLETS
60" BOX, 3" CALIPER	10 TABLETS

3 PLANT TABLET SCHEDULE

SCALE: N.T.S.

NOTES:

1. ROOT PRUNE ALL SHREDDED OR DAMAGED ROOTS.
2. ENSURE ALL WOUNDS TO THE ROOT SYSTEM ARE CLEAN CUT BEFORE PLANTING, APPLY DUSTING SULFUR TO ALL AREAS BELOW GRADE.
3. BARE ROOTS SHALL NOT BE OUT OF THE GROUND FOR MORE THAN FIVE DAYS BEFORE PLANTING.
4. PLANTING DEPTH SHALL BE DEPTH AT WHICH PLANT WAS GROWN.
5. ORIENT CACTUS IN SAME NORTH ORIENTATION AS ORIGINALLY GROWN.



2 SMALL SAGUARO/BARREL PLANTING

SCALE: N.T.S.

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PHOENIX, AZ 85016
602-333-2200

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ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Professional Engineer
42745
JAY A. HORAK
ARIZONA, U.S.A.

REGISTERED LANDSCAPE ARCHITECT
36561
RANDALL R. HAGER
ARIZONA U.S.A.

AS BUILTS PREPARED BY:
RICK ENGINEERING
22425 N 16TH STREET, SUITE 1
PHOENIX, ARIZONA 85024

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS

REGISTERED LANDSCAPE ARCHITECT
21660
CARYN LOGAN
NEVADA
CERTIFICATE NO.
Expires 10/31/19

Del Sol Group
environment redefined

Stanley Consultants

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DWN SAS
CKD CLH

City of Phoenix

CITY OF PHOENIX
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REMOTE FACILITES

LS-76

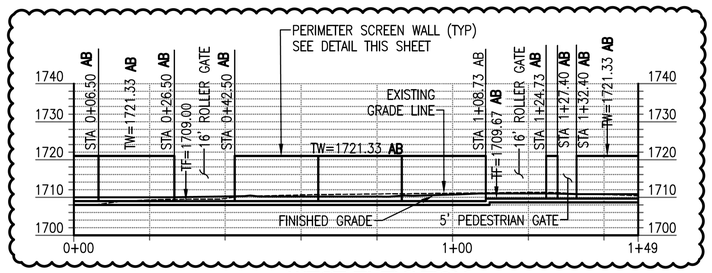
WEST ANTHEM LIFT STATION
NATIVE PLANT INVENTORY

CITY PROJECT NO. WS90400067

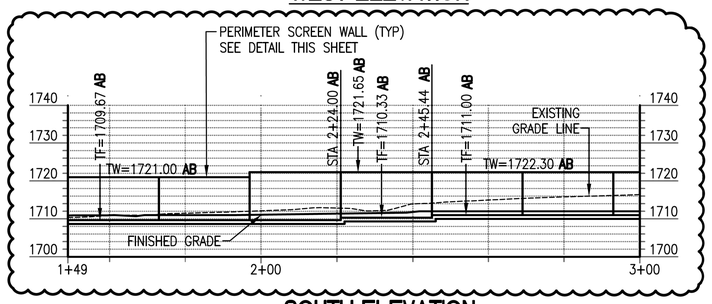
DATE 03/2018

N SHEET 3 (19 OF 44)

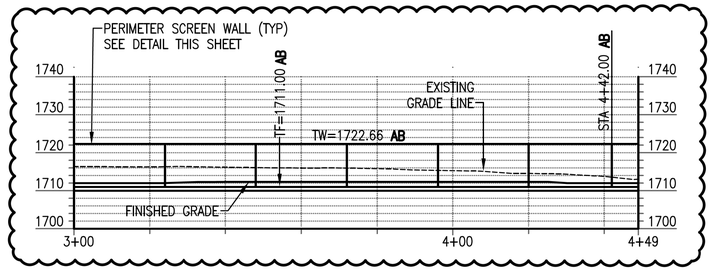
CAD FILE: LiftSta_NPI02-03



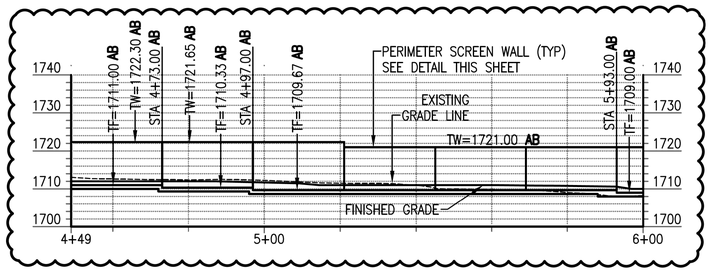
WEST ELEVATION



SOUTH ELEVATION

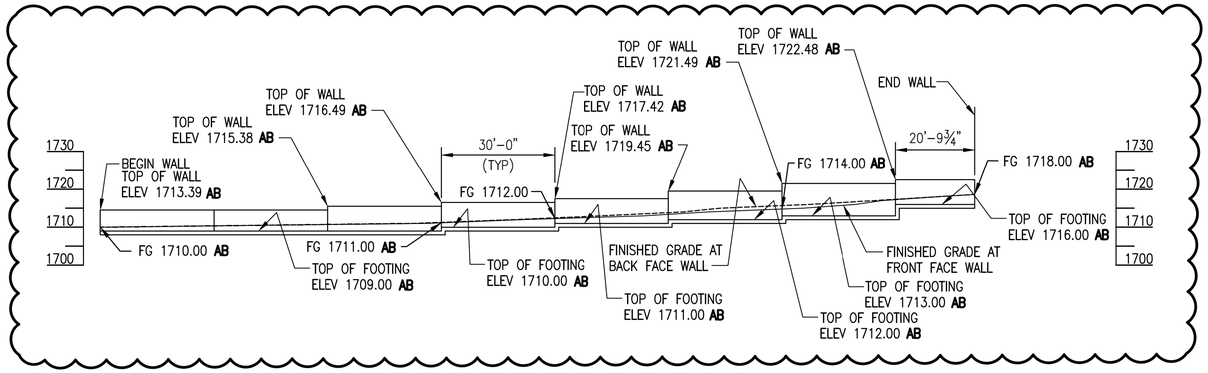


EAST ELEVATION



NORTH ELEVATION

PERIMETER WALL ELEVATIONS



BARRIER WALL ELEVATION

NOTES:

1. CONSTRUCTION – PROJECT SPECIFICATIONS
2. ACI 531, SPECIFICATIONS FOR CONCRETE MASONRY CONSTRUCTION.
3. DESIGN – AASHTO LRFD SPECIFICATIONS FOR HIGHWAY BRIDGES, 6TH EDITION, 2012.
4. SPECIAL INSPECTION IS REQUIRED FOR ALL MASONRY WALL CONSTRUCTION.
5. WIND VELOCITY 80 MPH, EXPOSURE C.
6. COMPACT BACKFILL FOR FOOTING AND WALL BASE MINIMUM 95 PERCENT OF ASTM D698 MAXIMUM DRY DENSITY.
7. MINIMUM REQUIRED ALLOWABLE SOIL BEARING CAPACITY = 1800 PSF.
8. ALL CORNERS OF WALL SHALL BE INTERLOCKED.
9. INTERFACE BETWEEN WALL AND PILASTERS SHALL BE INTERLOCKED.
10. ALL VERTICAL CELLS CONTAINING REINFORCEMENT SHALL BE GROUTED SOLID FULL HEIGHT.
11. BOND BEAMS WITH REINFORCEMENT SHALL BE GROUTED SOLID FULL LENGTH.
12. CONTROL JOINTS SHALL OCCUR AT INTERVALS NOT TO EXCEED 24'–0.
13. LOCATION OF CONSTRUCTION JOINT SHALL MATCH THE LOCATION OF A CONTROL JOINT.
14. CONTRACTOR SHALL LAYOUT WALL ALIGNMENT IN THE FIELD INCLUDING DEPTH TO TOP OF FOOTING FROM FINISHED GRADE. ANY DISCREPANCIES BETWEEN FIELD MEASUREMENTS AND THE PLANS SHALL BE IMMEDIATELY BROUGHT TO THE ATTENTION OF THE ENGINEER FOR RESOLUTION, PRIOR TO COMMENCING WALL CONSTRUCTION.
15. ELEVATION VIEWS ARE OF THE EXTERIOR FACES.
16. DO NOT SCALE DIMENSIONS FROM DRAWINGS.
17. PAY ITEM INCLUDES ALL LABOR AND MATERIALS REQUIRED FOR EXCAVATION, BACKFILL, CONCRETE FOOTING, MASONRY UNITS AND REINFORCING STEEL. PAY ITEM IS MEASURED AS WALL HEIGHT (H) TIMES LENGTH OF WALL.

MATERIAL NOTES:

1. CONCRETE: f'c = 3000 PSI
2. MASONRY: f'm = 1500 PSI, ASTM C90, MEDIUM OR NORMAL WEIGHT, RUNNING BOND, CMU BLOCK UNLESS NOTED OTHERWISE.
3. MORTAR: ASTM C270, TYPE S, CUBE STRENGTH 1800 PSI, ASTM C91.
4. GROUT: ASTM C476, TYPE: COARSE, CUBE STRENGTH 2000 PSI.
5. REINFORCING STEEL: ASTM 615, GRADE 60, fs = 24,000 PSI
6. JOINT REINFORCING: 9 GAUGE LADDER OR TRUSS TYPE, STANDARD WEIGHT, fy=33,000 PSI, WIRE: ASTM A82.

0 10' 20' 40'
SCALE: 1" = 20'

Contact Arizona 811 at least two full working days before you begin excavation
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Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

I HEREBY CERTIFY THAT THE "AS-BUILT" MEASUREMENTS AS SHOWN HEREON WERE MADE UNDER MY SUPERVISION OR AS NOTED AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer (Civil)
42745
JAY A.
HORAK
Date Signed 09-21-21
ARIZONA, U.S.A.

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS

Registered Professional Engineer (Civil)
40561
JAMES D.
JODER
Date Signed 03-28-18
ARIZONA, U.S.A.
EXPIRES 03/31/2019

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MTL
CKD LJL

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
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LS-76

WEST ANTHEM LIFT STATION
SITE WALL ELEVATIONS AND STRUCTURAL DETAIL

CITY PROJECT NO. WS90400067
DATE 03/2018
S SHEET 1 (20 OF 44)
CAD FILE: LS76-S001

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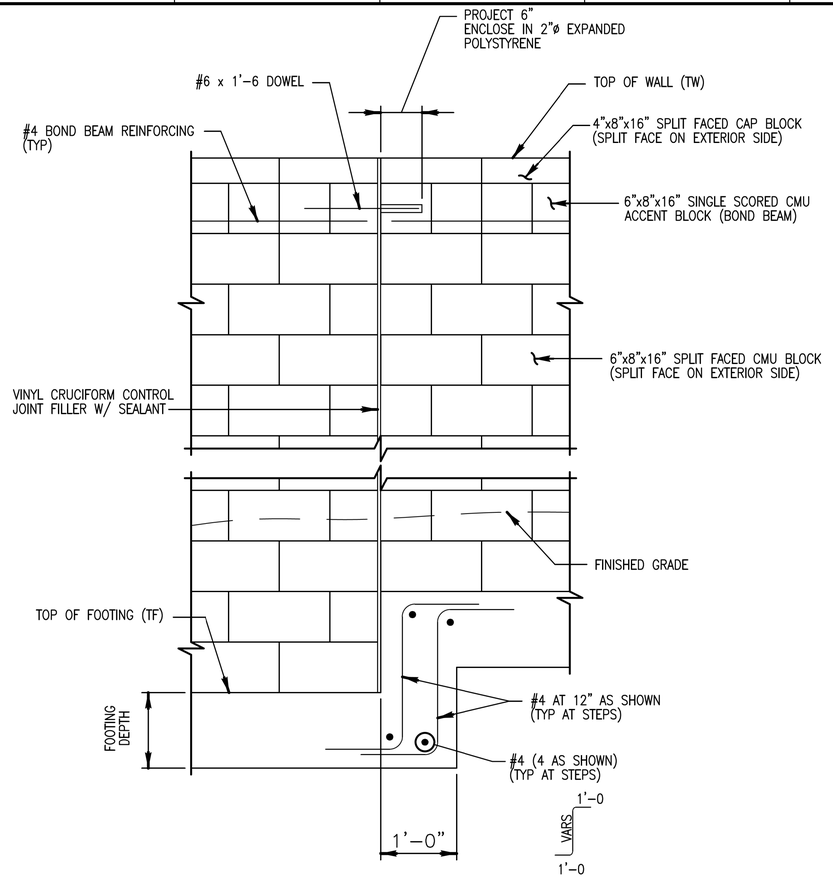
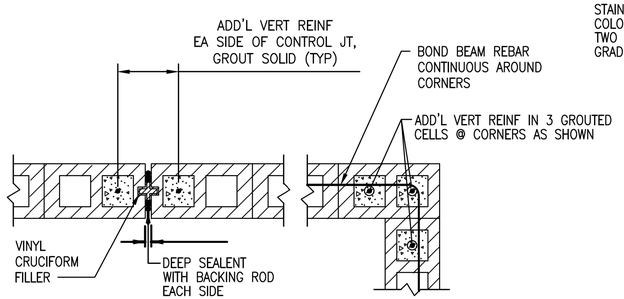


PERIMETER WALL ELEVATION DETAIL
NOT TO SCALE

NOTES:
PRIMARY FOOTING REINFORCING NOT SHOWN FOR CLARITY.

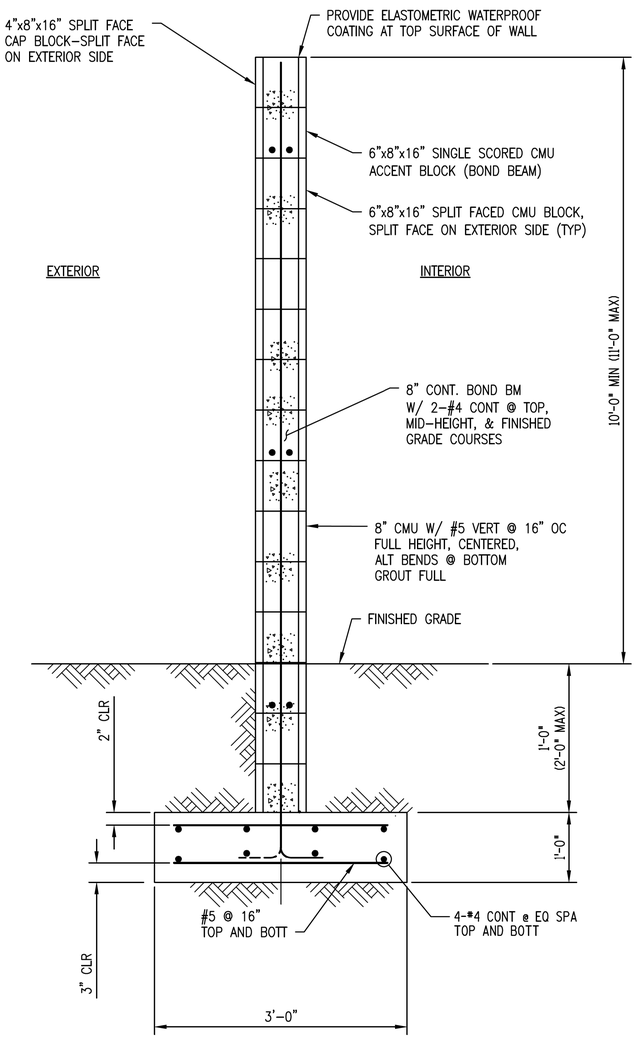
STAIN ALL EXPOSED WALL SURFACES DUNN EDWARDS COLOR TO MATCH ICI MOGAVE (30YY 31/205). MINIMUM TWO (2) COATS STAIN, MINIMUM 3" BELOW FINISHED GRADE.



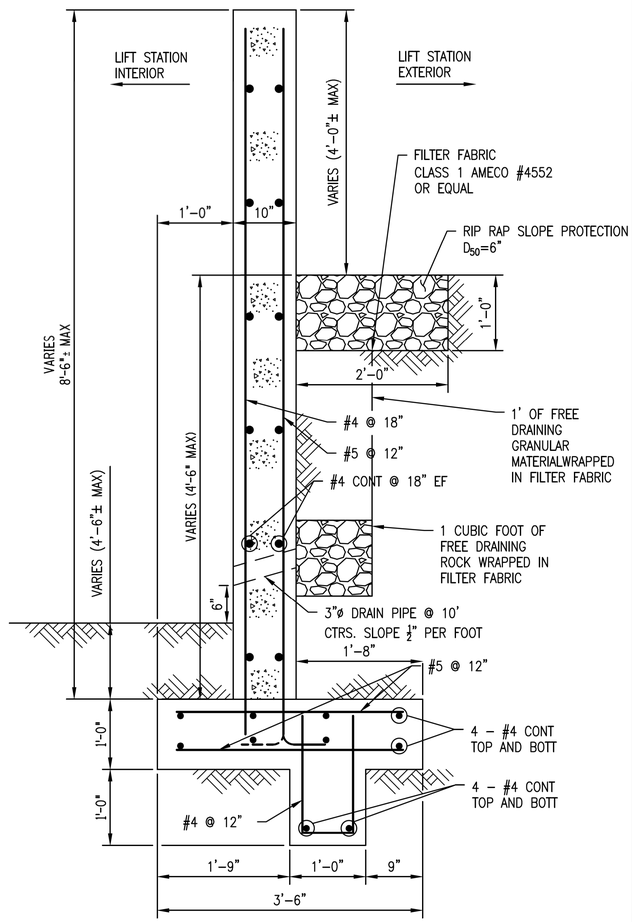
CONTROL JOINT
MAX SPACING=24'-0"

WALL 90° CORNER

PERIMETER WALL DETAILS AT JOINTS AND CORNERS
SCALE: NTS



PERIMETER WALL TYPICAL SECTION
SCALE: NTS
A C1 S2



BARRIER WALL TYPICAL SECTION
SCALE: NTS
B C2 S2

NOTE:
FOR STEP DETAILS IN BARRIER WALL FOOTING SEE PERIMETER WALL ELEVATION DETAIL.

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FOR CONSTRUCTION

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer 42745 JAY A. HORAK Date Signed 09-28-18 ARIZONA, U.S.A.

Contact Arizona 811 at least two full working days before you begin excavation
ARIZONA811 Call 811 or click Arizona811.com

FOR CITY OF PHOENIX USE ONLY - REFERENCE CID NUMBER: #

REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS

Registered Professional Engineer 40561 JAMES D. JODER Date Signed 09-28-18 ARIZONA, U.S.A. EXPIRES 03/31/2019

Stanley Consultants

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DWN MTL
CKD LJL

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
STRUCTURAL DETAILS 2

CITY PROJECT NO. WS90400067
DATE 03/2018
S SHEET 2 (21 OF 44)
CAD FILE: LS76-S003

USER: 9402 FILE: Z:\26866\11-CADD\Structural\LS76-S002.dwg DATE: 9/21/21 TIME: 10:38am

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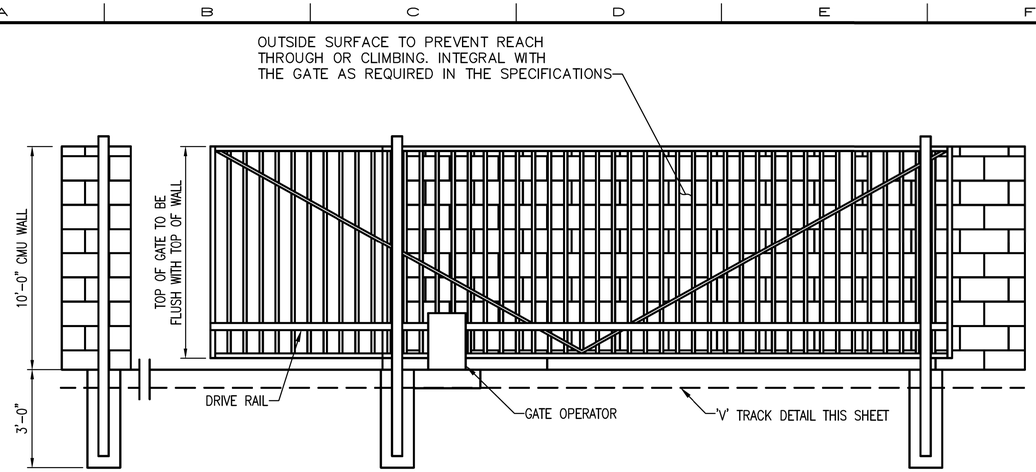
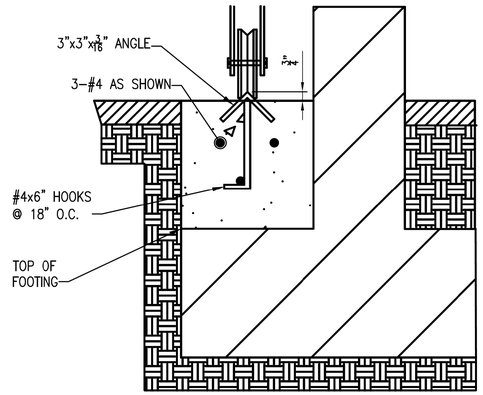


POST MOUNTED PINCH ROLLER SLIDE GATE

SCALE: NTS

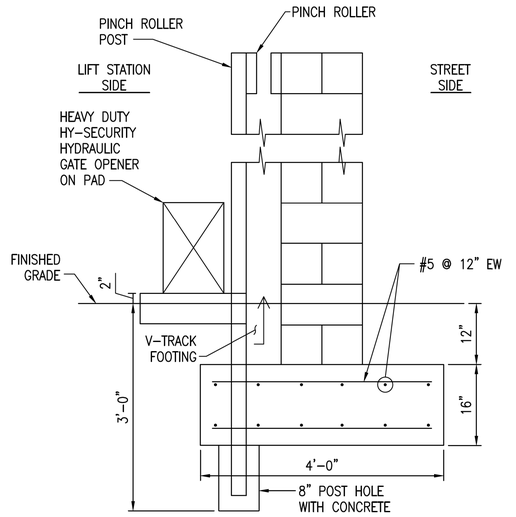


'V' TRACK DETAIL

SCALE: NTS

NOTE:

INSTALL V-TRACK AT ZERO OR UNIFORM SLOPE AS RECOMMENDED BY GATE OPENER MANUFACTURER. ADJUST GRADING SO V-TRACK AND FOOTING DO NOT INTERFERE WITH SURFACE DRAINAGE.

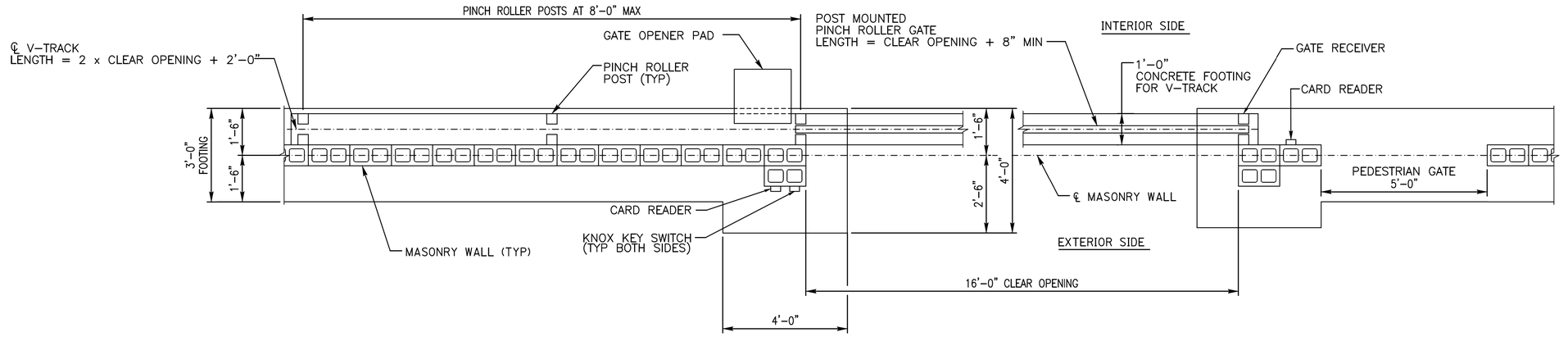


AUTOMATED PINCH ROLLER SLIDE GATE

SCALE: NTS

NOTE:

COORDINATE INSTALLATION OF PINCH ROLLER POSTS WITH CONSTRUCTION OF WALL FOOTING. CAST FOOTINGS AROUND POSTS AS SHOWN.



GATE PLAN

SCALE: NTS

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
42745
JAY A. HORAK
Date Signed 09-21-21
ARIZONA, U.S.A.

Registered Professional Engineer
40561
JAMES D. JODER
Date Signed 03-31-19
ARIZONA, U.S.A.
EXPIRES 03/31/2019

Contact Arizona 811 at least two full working days before you begin excavation
ARIZONA811
Call 811 or click Arizona811.com

Stanley Consultants

REVISIONS				
NO.	BY	DATE	CKD	REMARKS
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DES JDJ
DWN MTL
CKD LJL

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
STRUCTURAL DETAILS 3

CITY PROJECT NO. WS90400067
DATE 03/2018
S SHEET 3 (22 OF 44)
CAD FILE: LS76-S004

FOR CITY OF PHOENIX USE ONLY - REFERENCE CID NUMBER: #

REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS
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#	-	-	-	-	-	-	-
#	-	-	-	-	-	-	-

USER: 9402 FILE: Z:\26866\11-CADD\Structural\LS76-S003.dwg DATE: 9/21/21 TIME: 10:57am

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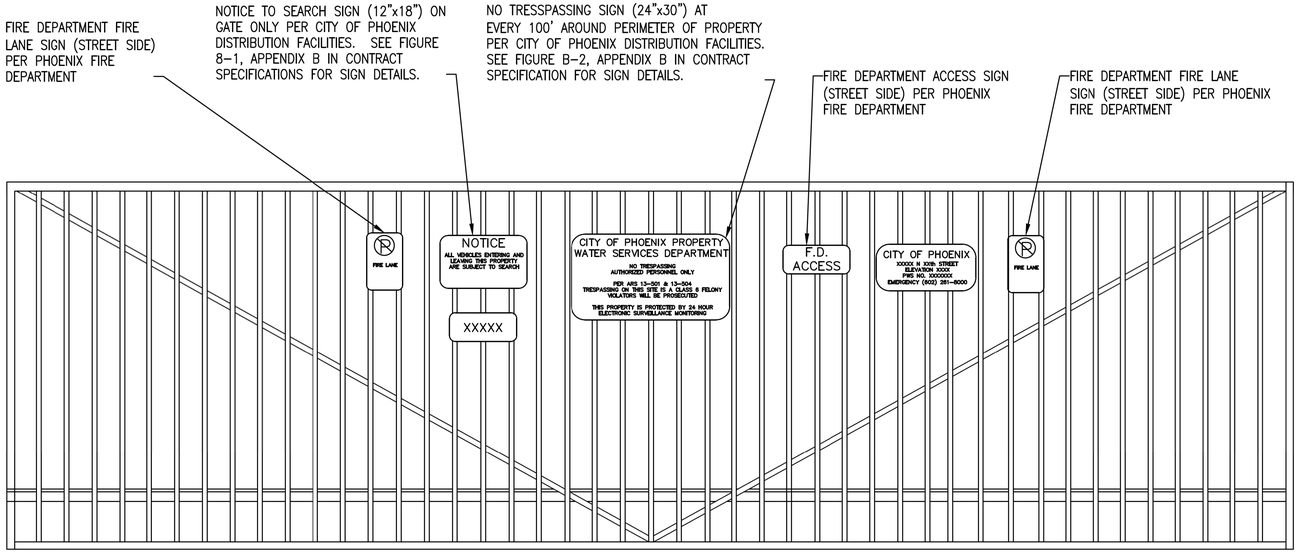


GATE SIGNS DETAIL
SCALE: NTS

NOTES:

1. CONTRACTOR TO SUBMIT GATE SHOP DRAWINGS TO ENGINEER FOR REVIEW. INCLUDE DIMENSIONS, MATERIALS, ELEVATIONS, DETAIL, AND PRODUCT INFORMATION.
2. ALL METAL TO BE PRIMED AND PAINTED PER SPECIFICATIONS
3. PROVIDE GATE LATCH AND LOCKING HARDWARE IN ACCORDANCE WITH SITE MANAGER. SUBMIT WITH SHOP DRAWINGS FOR ENGINEER TO REVIEW FOR COMPATIBILITY WITH FRAME.
4. ALL PAD LOCKS ARE TO BE SHROUDED.

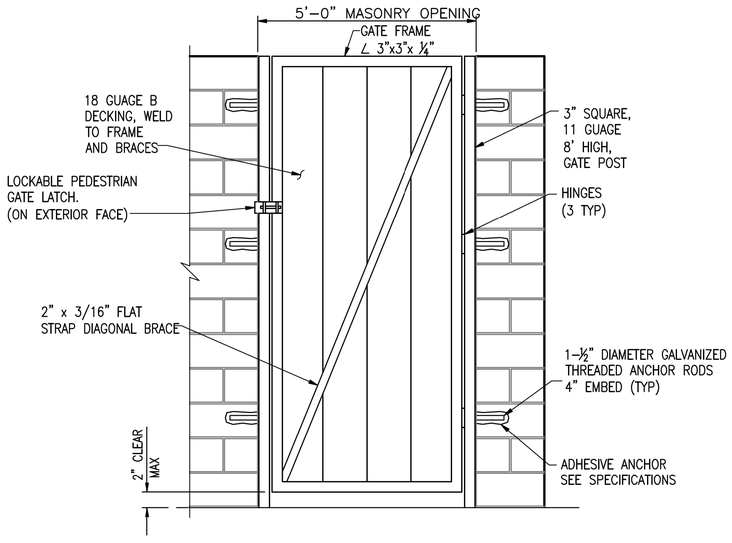
Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Professional Engineer
42745
JAY A. HORAK
Date Signed 09-28-21
ARIZONA, U.S.A.

WET WELL AND DISCHARGE PIPING CONC PAD DETAIL
SCALE: NTS



PEDESTRIAN GATE DETAIL
SCALE: NTS

NOTE:

1. AT EXIT THE KNOX BOX AND CARD READERS ARE LOCATED ON NORTH SIDE.

ENTRANCE STRIPING PLAN
SCALE: NTS

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS

Registered Professional Engineer (Civil)
40561
JAMES D. JODER
Date Signed 03-28-19
ARIZONA, U.S.A.
EXPIRES 03/31/2019

Stanley Consultants

REVISIONS				
NO.	BY	DATE	CKD	REMARKS
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DES JDJ
DWN MTL
CKD LJL

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
STRUCTURAL DETAILS 1

CITY PROJECT NO. WS90400067
DATE 03/2018
S SHEET 4 (23 OF 44)
CAD FILE: LS76-S002

USER: 9402 FILE: Z:\26866\11-CADD\Structural\LS76-S004.dwg DATE: 9/21/21 TIME: 11:11am

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AREA CLASSIFICATIONS

	DESCRIPTION
DAMP	INDICATES THAT ALL ELECTRICAL EQUIPMENT AND MATERIALS INSTALLED WITHIN THE ROOM OR AREA IN WHICH THIS NOTATION APPEARS SHALL BE OF NEMA 12 CONSTRUCTION (OR GASKETED AND SUITABLE FOR USE IS A WET LOCATION WHERE NEMA STANDARDS DO NOT APPLY) UNLESS OTHER-WISE NOTED.
WET	INDICATES THAT ALL ELECTRICAL EQUIPMENT AND MATERIALS INSTALLED WITHIN THE ROOM OR AREA IN WHICH THIS NOTATION APPEARS SHALL BE OF NEMA 4X CONSTRUCTION (OR GASKETED AND SUITABLE FOR USE IN A WET LOCATION WHERE NEMA STANDARDS DO NOT APPLY) UNLESS OTHER-WISE NOTED.
CORROSIVE	INDICATES THAT ALL ELECTRICAL EQUIPMENT AND MATERIALS INSTALLED WITHIN THE ROOM OR AREA IN WHICH THIS NOTATION APPEARS SHALL BE OF NEMA 4X NON-METALLIC CONSTRUCTION (OR CORROSION RESISTANT CONSTRUCTION SUITABLE FOR USE IN A WET LOCATION WHERE NEMA STANDARDS DO NOT APPLY) UNLESS OTHERWISE NOTED.
CLASS 1, DIV. 1 GROUP D	INDICATES THAT ALL ELECTRICAL EQUIPMENT AND MATERIALS INSTALLED WITHIN THE ROOM OR AREA IN WHICH THIS NOTATION APPEARS SHALL CONFORM TO N.E.C. REQUIREMENTS FOR THE HAZARDOUS AREA CLAS- SIFICATION SHOWN.

BREAKERS

SINGLE LINE	PLAN	
52 XXXX/XXXX	——	DRAWOUT MEDIUM VOLTAGE POWER BREAKER UPPER NUMBER INDICATES LONG TIME TRIP SETTING LOWER NUMBER INDICATES BREAKER CONTINUOUS CURRENT RATING
XP XAT/XAF	CB	THERMAL-MAGNETIC CIRCUIT BREAKER TRIP RATING ABOVE; FRAME RATING BELOW. TYPICAL FOR OTHER TYPES OF BREAKERS. BREAKER TO BE 3 POLE UNLESS NOTED OTHERWISE AS 1P OR 2P
CB-# ##A/ # PH (XXX)		COMBINATION MOTOR STARTER WITH MOTOR CIRCUIT PROTECTOR, MAGNETIC CONTACTOR AND OVERLOAD PROTECTION X= AMPERE SIZE, Y= FVNR-FULL VOLTAGE, NON-REVERSING FVR- FULL VOLTAGE REVERSING RVNR-REDUCED VOLTAGE NON-REVERSING 2S1W-TWO SPEED, ONE WINDING 2S2W-TWO SPEED, TWO WINDING Z= NEMA SIZE
Y Z	Y Z	MOTOR STARTER WITH MAGNETIC CONTACTOR AND OVERLOAD PROTECTION Y= FVNR-FULL VOLTAGE, NON-REVERSING FVR- FULL VOLTAGE REVERSING RVNR-REDUCED VOLTAGE NON-REVERSING 2S1W-TWO SPEED, ONE WINDING 2S2W-TWO SPEED, TWO WINDING Z= NEMA SIZE

COMMUNICATION SYSTEMS

TTB	TELEPHONE TERMINAL BOARD 4FT X 8FT X 3/4 INCH UNLESS NOTED OTHERWISE
▼	TELEPHONE OUTLET, WALL TYPE (MOUNT 1'-6" AFF UNO)
▼	TELEPHONE OUTLET AND FLOOR BOX
▼	TELEPHONE/DATA OUTLET, WALL TYPE (MOUNT 1'-6" AFF UNO)
▼	TELEPHONE/DATA OUTLET AND FLOOR BOX
(S) C1	PAGING SPEAKER, WALL MOUNTED "H1" AND "C1" DENOTES TYPE. H=HORN, C=CONE
(S) H1	PAGING SPEAKER, WALL MOUNTED, BI-DIRECTIONAL NOTATIONS SAME AS ABOVE
(S) H3	
(S) C2	PAGING SPEAKER, FLUSH MOUNTED CEILING TYPE
S	PAGING STATION, SURFACE MOUNTED
VC	REMOTE WALL MOUNTED VOLUME CONTROL. FOR CEILING SPEAKER (MOUNT UP 5'-0" AFF UNO)
A	PAGING SPEAKER AMPLIFIER ASSEMBLY

CONDUIT

———	EXPOSED CONDUIT
- - - - -	UNDERGROUND DUCT BANK OR CONCEALED CONDUIT IN CONCRETE FLOOR, CEILING OR WALL UNLESS OTHERWISE INDICATED OR NOTED.
———)))———	INDICATES CONDUIT TURNING UP OR TOWARD THE VIEWER.
———)))———	INDICATES CONDUIT TURNING DOWN OR AWAY FROM THE VIEWER.
1000	CONDUITS IDENTIFIED BY A NUMBER SHALL BE LISTED IN THE CONDUIT SCHEDULES
AA	CONDUITS IDENTIFIED BY LETTERS SHALL CONFORM TO THE TABLES IN THE LEGEND
———3	CONDUIT STUBBED OUT AND CAPPED
~~	FLEXIBLE CONDUIT OR MANUFACTURER'S CABLE(S)
——+——+——	TEE FITTING IN CONDUIT
◉	ES STYLE SEALING HUB

CONDUIT CONTINUED

	DESCRIPTION
► XXXX	CONDUIT HOMERUN, XXX DENOTES DESTINATION CONTRACTOR SHALL FIELD ROUTE FROM EQUIPMENT TO DESIGNATED LOCATION
(2)-3"C, 3-#3/0, 1-#2G	DENOTES A QUANTITY OF TWO (2) 3-INCH CONDUITS EACH CONTAINING THREE NO. 3/0 AWG CONDUCTORS AND 1 NO. 2 AWG GROUND CONDUCTOR
2 PR #16 TWSH	DENOTES A QUANTITY OF TWO INSTRUMENT CABLES. EACH CABLE TO CONSIST OF TWO NO. 16 AWG CONDUCTORS TWISTED TOGETHER AND COVERED WITH A METALLIC SHIELD AND AN OVERALL PROTECTIVE JACKET. REFER TO THE SPECIFICATIONS FOR THE EXACT CABLE TO BE PROVIDED.
2 TR #16 TWSH	SAME AS ABOVE EXCEPT CABLE TO CONSIST OF THREE NO. 16 AWG CONDUCTORS TWISTED, SHIELDED AND COVERED WITH AN OVERALL PROTECTIVE JACKET. REFER TO THE SPECIFICATIONS FOR THE EXACT CABLE TO BE PROVIDED.
2 PR #16 TW	DENOTES A QUANTITY OF TWO INSTRUMENT CABLES. EACH CABLE TO CONSIST OF TWO NO. 16 AWG CONDUCTORS TWISTED TOGETHER AND AN OVERALL PROTECTIVE JACKET. REFER TO THE SPECIFICATIONS FOR THE EXACT CABLE TO BE PROVIDED.
(3)-4"C	THREE 4-INCH CONDUITS
——G——	BARE COPPER GROUNDING CONDUCTOR AWG #4/0 UNLESS NOTED OTHERWISE OR SPECIFIED

CONTROL DIAGRAM CONDUCTORS

	CONDUCTORS NOT CONNECTED
	CONDUCTORS CONNECTED
	CONDUCTOR SHIELD
	CONDUCTOR SHIELD TWISTED PAIR
	FIELD CONDUCTOR SHIELD
	FIELD CONDUCTOR SHIELD TWISTED PAIR
	EARTH GROUND
	CHASSIS GROUND
	NEUTRAL
	SEPARABLE CONNECTOR SIGNIFICATION SHOWN.

CONTROL DIAGRAM COMPUTER CONTROL SYSTEM INPUT\OUTPUT

DI #	DISCRETE INPUT
DO #	DISCRETE OUTPUT
AI #	ANALOG INPUT
AO #	ANALOG OUTPUT

ELEMENTS

	RESISTOR OR RESISTIVE ELEMENT
	OVERLOAD RELAY THERMAL ELEMENT (HEATER)
	STRIP HEATER OR HEATING ELEMENT
*	HIGH VOLTAGE, GROUP OPERATED, AIR-BREAK SWITCH * CONTINUOUS AMPERE RATING

EQUIPMENT

SINGLE LINE	PLAN	
UH-_KW	UH-	UNIT HEATER NO. 1
WH-_KW	WH-	WATER HEATER NO. 1
	DM	DAMPER MOTOR
DAMPER MOV	MOV	MOTOR OPERATED VALVE "XXXX" DENOTES LOOP NUMBER TO BE OBTAINED FROM INSTRUMENTATION DRAWINGS
	RCS	REMOTE CONTROL STATION
ITP	ITP	XXX

FIRE ALARM SYSTEMS

	DESCRIPTION
TYPE R	FIRE ALARM HEAT DETECTOR 135Y FIXED TEMPERATURE UNLESS OTHER- WISE NOTED. "200" DENOTES 200YF TYPE, "R" DENOTES FIXED TEMPERATURE RATE-OF-RISE TYPE.
(2) I	FIRE ALARM DUCT SMOKE DETECTOR PHOTOCELL TYPE UNLESS OTHERWISE NOTED: "I" DENOTES IONIZATION TYPE.
(2)	FIRE ALARM DUCT SMOKE DETECTOR
FACP-	FIRE ALARM CONTROL PANEL NO. 1
FAVP-	FIRE ALARM VENTILATION PANEL NO. 1 (WITH GRAPHIC PANEL)
FARAP-	FIRE ALARM REMOTE ANNUNCIATOR NO. 1
M WP	FIRE ALARM MANUAL PULL STATION, MOUNT UP 4'-0" WP DENOTES WEATHERPROOF COVER
F	OUTDOOR WEATHERPROOF FIRE ALARM MASTER BOX
F	WP FIRE ALARM SPEAKER, MOUNT UP 7'-8"
(S)	FIRE ALARM STROBE, WALL MOUNT UP 6'-8" OR AT CEILING
F	FIRE ALARM HORN AND STROBE LIGHT COMBINATION, MOUNT UP 6'-8"
F	FIRE ALARM HORN AND STROBE LIGHT COMBINATION, CEILING MOUNT
	SPRINKLER VALVE SUPERVISORY SWITCH
F	FIRE ALARM BELL
FB	WEATHERPROOF HI-DENSITY FIRE ALARM STROBE LIGHT
	SPRINKLER FLOW ALARM SWITCH
CM	ADDRESSABLE CONTROL MODULE
MM	ADDRESSABLE MONITOR MODULE
SD	SMOKE DETECTOR

GROUNDING

SINGLE LINE	PLAN	
		GROUND ROD
		GROUND ROD IN GROUNDING WELL
		GROUND ROD IN TEST WELL
		GROUND GRID CABLE CONNECTION, WELDED

LIGHTING

$a	SINGLE POLE SWITCH "a" INDICATES SWITCHLEG SHALL CONTROL LUMINAIRES WITH "a" DESIGNATION
$A b	DOUBLE POLE SWITCH "b" INDICATES SWITCHLEG SHALL CONTROL LUMINAIRES WITH "b" DESIGNATION
$3 c	THREE WAY SWITCH "c" INDICATES SWITCHLEG SHALL CONTROL LUMINAIRES WITH "c" DESIGNATION
$4 d	FOUR WAY SWITCH "d" INDICATES SWITCHLEG SHALL CONTROL LUMINAIRES "d" DESIGNATION
$M	SINGLE POLE, DOUBLE THROW MOMENTARY CONTACT SWITCH, CENTER OFF
$P	SINGLE POLE SWITCH AND PILOT LIGHT
PB	PULL BOX
(PB)	
Ca	LIGHTING CONTACTOR WITH NUMBER OF POLES AS INDICATED a-CONTACTOR NUMBER (C1, C2, ETC.)
ALCP-X OR ALP-X	AREA LIGHTING CONTACTOR PANEL X= PANEL NAME
TM	TIME SWITCH
LP-X OR LP-X	LIGHTING PANELBOARD NO. X (240/120V OR 208/120V) X= PANELBOARD NAME
PP-X OR PP-X	POWER DISTRIBUTION PANELBOARD NO. X (480V OR 480/277V) X= PANELBOARD NAME
XX X Y b NL	TYPICAL LUMINAIRES SEE SCHEDULE FOR SPECIFICS "XX"-FIXTURE TYPE X= PANELBOARD NAME "b"-CONTROLLED BY SWITCH "b" Y= CIRCUIT NUMBER NL= NIGHT LIGHT (UNSWITCHED)
XX NL X Y b	FLUORESCENT OR LED TYPE LUMINAIRES. SEE SCHEDULE FOR SPECIFICS. NOTATIONS SAME AS ABOVE.

LIGHTING CONTINUED

XX NL X Y a	FLUORESCENT TYPE LUMINAIRES. SEE SCHEDULE FOR SPECIFICS. NOTATIONS SAME AS ABOVE.
	INDICATES ALL LUMINAIRES WITHIN THE ROOM OR AREA IN WHICH THIS NOTATION APPEARS SHALL BE TYPE "A" UNLESS OTHERWISE NOTED. SEE LIGHTING FIXTURE SCHEDULE FOR TYPES
TYPE	
(R)	ALARM BEACON. COLOR AS NOTED. SEE SPECIFICATIONS FOR REQUIREMENTS.
E1 LP-X Y	EMERGENCY LUMINAIRES WITH BATTERY PACK "E1" FIXTURE TYPE. SEE SCHEDULE FOR SPECIFICS. X= PANELBOARD NAME Y= CIRCUIT NUMBER
REM	REMOTE EMERGENCY LUMINAIRES "E2"-FIXTURE TYPE. SEE SCHEDULE FOR SPECIFICS
X1 LP-3 Y *	CEILING MOUNTED EXIT SIGN "X1" LUMINAIRE TYPE. SEE SCHEDULE FOR SPECIFICS X= PANELBOARD NAME Y= CIRCUIT NUMBER * SP= SELF POWERED
X2 LP-X Y *	WALL OUTLET EXIT SIGN. ARROW INDICATES DIRECTION OF EXCESS "X2" LUMINAIRE TYPE. SEE SCHEDULE FOR SPECIFICS. X= PANELBOARD NAME Y= CIRCUIT NUMBER * SP= SELF POWERED

MISCELLANEOUS

SINGLE LINE	PLAN	
	——	CONDUCTORS OR CONDUITS CROSSING PATHS BUT NOT CONNECTED
	——	CONDUCTORS ELECTRICALLY CONNECTED
	——	INDICATES LIMITS OF EQUIPMENT OR WIRING ENCLOSURE
FU# AMPS	——	FUSE, AMPERE RATING AS NOTED
FU# AMPS	——	FUSE DISCONNECT
	——	INDUCTOR
K	——	KEY INTERLOCK
E K	——	ELECTRONIC KEY INTERLOCK
	——	CORD AND PLUG CONNECTION.
	—— (T)	THERMOSTAT
	—— (OS)	OCCUPANCY SENSOR
	—— (PC)	PHOTOCELL
	—— ESA	EMERGENCY SHOWER ALARM STATION
	——	SINGLE FACE CLOCK AND CLOCK HANGER OUTLET
		JUMPER (OPTION 1)
		JUMPER (OPTION 2)
XXX		MOTOR SWITCH
		DEMOLITION

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer (Civil) 42745 JAY A. HORAK Date Signed 09/21/21 ARIZONA, U.S.A.

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PROJECT NAME
DATE
CAD FILE NAME
DWG NUMBER
PROJECT NO.
ENGINEERING COMPANY
REMARKS

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DES TSL
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CKD LEI

63292 LANE E. INGRAM 11/15/2018 REGISTERED PROFESSIONAL ENGINEER ARIZONA, U.S.A. EXPIRES 03/31/2020

Stanley Consultants

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
SYMBOLS AND LEGEND 1

CITY PROJECT NO. WS90400067
DATE 03/2018
E SHEET 1 (24 OF 44)
CAD FILE: LS76-E001

USER: 9402 FILE: Z:\26866\11-CADD\Electrical\LS76-E001.dwg DATE: 9/21/21 TIME: 11:19am

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POWER SWITCHES

SINGLE LINE	PLAN	DESCRIPTION
		NON-FUSIBLE DISCONNECT SWITCH, 600 VOLT, 3 POLE, * AMPERE RATING
	F	FUSIBLE DISCONNECT SWITCH, 600 VOLT, 3 POLE, AMPERE RATING AND FUSE SIZE AS NOTED *AMPERE RATING *FUSE RATING
	P 2	MANUAL MOTOR STARTER WITH THERMAL OVERLOAD PROTECTION "P" INDICATES WITH PILOT LIGHT "2" INDICATES NUMBER OF POLES
		DRAWOUT TYPE EQUIPMENT OR DEVICE
		MEDIUM VOLTAGE CABLE TERMINATION
		MEDIUM VOLTAGE AIR INTERRUPTER SWITCH
		MEDIUM VOLTAGE FUSED AIR INTERRUPTER SWITCH
		MEDIUM VOLTAGE FUSED MOTOR CONTROLLER *AT=AUTOTRANSFORMER TYPE
KVA # VOLTS	T	TRANSFORMER, RATINGS AND CONNECTIONS AS NOTED. UNLESS OTHERWISE NOTED ON THE ONE LINE DIAGRAMS ALL DRY TYPE TRANSFORMERS SERVICING ADMINISTRATIVE AND LABORATORY SPACES SHALL HAVE A K FACTOR OF 13. ALL OTHER DRY TYPE TRANSFORMERS SHALL HAVE A K-4 RATING. ISOLATION TRANSFORMERS SHALL HAVE A K-20 RATING
KVA#		METER * WM-WATTMETER WHM-WATTHOUR METER WHDM-WATTHOUR DEMAND METER WHDR-WATTHOUR DEMAND RECORDER PF-POWER FACTOR METER TRANSDUCER * AX-CURRENT TRANSDUCER WX-WATT TRANSDUCER
XX/XX (*) CT		CURRENT TRANSFORMER *QUANTITY XXXX = PRIMARY AMPERE RATING
XX/XX (*) **		POTENTIAL TRANSFORMER (PT) OR CONTROL POWER TRANSFORMER (CPT) *QUANTITY XXXX = PRIMARY VOLTAGE RATING
G#		GENERATOR WITH GENERATION NUMBER, RATINGS AND CONNECTIONS AS NOTED IN CALL-OUT ON DRAWING
RATE ATS-#	ATS-#	AUTOMATIC TRANSFER SWITCH (ATS) "N" INDICATES NORMAL SOURCE "S" INDICATES STANDBY SOURCE "RATE" INDICATES CONTINUOUS CURRENT RATING "#" INDICATES ATS NAME
VFD	VFD	AC MOTOR SPEED CONTROLLER (VARIABLE FREQUENCY DRIVE)
SCR	SCR	DC MOTOR SPEED CONTROLLER (SILICON CONTROLLED RECTIFIER)
#	MTR	MOTOR, NUMERAL INDICATES HORSEPOWER
VS VM *		VOLTMETER WITH SWITCH, 3 PHASE * = SCALE
VS AM *		AMMETER WITH SWITCH, 3 PHASE * = SCALE
LA		LIGHTNING ARRESTOR
		SURGE SUPPRESSER
TVSS	TVSS	TRANSIENT VOLTAGE SURGE SUPPRESSOR (POWER DISTRIBUTION TYPE)
TAGNUMBER		PILOT LIGHT, COLOR AS NOTED A-AMBER, B-BLUE, C-CLEAR G-GREEN, R-RED, W-WHITE
*		SPECIAL CAPACITOR *SC-SURGE CAPACITOR PR-POWER FACTOR CORRECTION CAPACITOR
		CONTROL STATION (STANDMOUNT OR WALLMOUNT) SEE SCHEMATIC DIAGRAMS AND/OR INSTRUMENTATION DIAGRAMS FOR TYPE AND QUANTITY OF OPERATORS.
TAGNUMBER	TAGNUMBER OR SV	SOLENOID OPERATED VALVE
ETM		ELAPSED TIME METER

PUSH BUTTONS

SINGLE LINE	DESCRIPTION
	EMERGENCY STOP PUSHBUTTON WITH RED MUSHROOM HEAD OPERATOR (MAINTAINED CONTACT)
	PUSHBUTTON, MOMENTARY CONTACT, SPRING RETURN, NORMALLY CLOSED
	PUSHBUTTON, MOMENTARY CONTACT, SPRING RETURN, NORMALLY OPEN
	START-STOP PUSHBUTTON CONTROL STATION, MAINTAINED CONTACT WITH LOCKOUT DEVICE ON STOP
	2 POSITION SELECTOR SWITCH, NORMALLY CLOSED
	2 POSITION SELECTOR SWITCH, NORMALLY OPEN
	2 POSITION 2 POLE SELECTOR SWITCH
LOCAL COMPUTER	2 POSITION 3 POLE SELECTOR SWITCH
	3 POSITION SELECTOR SWITCH, NORMALLY CLOSED
	3 POSITION SELECTOR SWITCH, NORMALLY OPEN
	3 POSITION 3 POLE SELECTOR SWITCH
	4 POSITION SELECTOR SWITCH, NORMALLY OPEN

PUSH BUTTONS CONT.

SINGLE LINE	DESCRIPTION
	4 POSITION SELECTOR SWITCH, NORMALLY CLOSED
	4 POSITION 4 POLE SELECTOR SWITCH

RELAY CONTACTS

SINGLE LINE	DESCRIPTION
M	MOTOR STARTER COIL, NUMBER AS INDICATED
TR	TIMING RELAY RANGE AS NOTED STEPPING AS NOTED
CR	CONTROL RELAY COIL, NUMBER AS INDICATED
IM	NORMALLY CLOSED MOTOR STARTER CONTACT
IM	NORMALLY OPEN MOTOR STARTER CONTACT
R	NORMALLY OPEN RELAY CONTACT
R	NORMALLY CLOSED RELAY CONTACT
	NOTC-NORMALLY OPEN TIMED CLOSING, WHEN ENERGIZED
	NCTO-NORMALLY CLOSED TIMED OPENING, WHEN ENERGIZED
	NOTO-NORMALLY OPEN, TIMED OPENING WHEN DE-ENERGIZED
	NCTC-NORMALLY CLOSED, TIMED CLOSING WHEN DE-ENERGIZED

SWITCH CONTACTS

SINGLE LINE	PLAN	DESCRIPTION
	TAGNUMBER OR X 0000	FIELD MOUNTED INSTRUMENT X= DESIGNATION TO BE OBTAINED FROM INSTRUMENTATION DRAWINGS 0000= LOOP NUMBER TO BE OBTAINED FROM INSTRUMENTATION DRAWINGS
XO		AUXILLARY SWITCH CONTACT NORMALLY CLOSED
XO		AUXILLARY SWITCH CONTACT NORMALLY OPEN
		NORMALLY OPEN SWITCH
		NORMALLY CLOSED SWITCH
		LIQUID LEVEL (FLOAT) SWITCH NORMALLY OPEN, CLOSES ON RISING LEVEL
		LIQUID LEVEL (FLOAT) NORMALLY CLOSED, OPENS ON RISING LEVEL
		PRESSURE SWITCH NORMALLY OPEN, CLOSES ON RISING PRESSURE
		PRESSURE SWITCH NORMALLY CLOSED, OPENS ON DROPPING PRESSURE
		VACUUM SWITCH NORMALLY OPEN, CLOSES ON RISING PRESSURE
		VACUUM SWITCH NORMALLY CLOSED, OPENS ON DROPPING PRESSURE
		DIFFERENTIAL PRESSURE SWITCH NORMALLY OPEN, CLOSES ON RISING DIFFERENTIAL PRESSURE
		DIFFERENTIAL PRESSURE SWITCH NORMALLY CLOSED, OPENS ON RISING DIFFERENTIAL PRESSURE
		TEMPERATURE SWITCH NORMALLY OPEN, CLOSES ON RISING TEMPERATURE
		TEMPERATURE SWITCH NORMALLY CLOSED, OPENS ON RISING TEMPERATURE
		FLOW SWITCH (AIR, WATER, ETC.,) NORMALLY OPEN, CLOSES ON INCREASED FLOW
		FLOW SWITCH (AIR, WATER, ETC.,) NORMALLY CLOSED, OPENS ON INCREASED FLOW
		POSITION (LIMIT) SWITCH NORMALLY OPEN

SWITCH CONTACTS CONT.

SINGLE LINE	DESCRIPTION
	POSITION (LIMIT) SWITCH NORMALLY OPEN-HELD CLOSED
	NORMALLY CLOSED
	NORMALLY CLOSED-HELD OPEN
	TORQUE SWITCH NORMALLY OPEN, CLOSES ON HIGH TORQUE
	TORQUE SWITCH NORMALLY CLOSED, OPENS ON HIGH TORQUE
	PUSH-TEST, 110V S6 LAMP UNLESS NOTED, LETTER IS LENS COLOR * R-RED G-GREEN B-BLUE

RECEPTACLES

LP-X Y	208V, 3P, 4W, RECEPTACLE *AMPERE RATING AS NOTED X= PANELBOARD NUMBER Y= CIRCUIT NUMBER
LP-X Y	COMBINATION 20A, 120V, 2P, 3W DUPLEX AND 20A, 240V, 2P,3W SINGLE RECEPTACLES UNDER COMMON PLATE X= PANELBOARD NUMBER Y= CIRCUIT NUMBER
LP-X Y	DOUBLE RECEPTACLE (QUAD), 20A, 120V, 2P, 3W MOUNTED IN 2 GANG BOX. X= PANELBOARD NUMBER Y= CIRCUIT NUMBER
	240V, 20, 3W, RECEPTACLE *AMPERE RATING AS NOTED
	MULTI-OUTLET ASSEMBLY
TYPE	FLOOR OUTLET BOX WITH TYPE OUTLET INDICATED
LP-X Y	480V, 3P, 4W RECEPTACLE AND DISCONNECT SWITCH *AMPERE RATING AS NOTED X= PANELBOARD NUMBER Y= CIRCUIT NUMBER
LP-X Y	DUPLEX RECEPTACLE, 20A, 120V, 2P, 3W UNLESS OTHERWISE NOTED * C-MOUNTED ABOVE COUNTER-TOP GF- GROUND FAULT INTERRUPTER TYPE WP-WEATHERPROOF T-TRANSIENT VOLTAGE SURGE SUPPRESSER X= PANELBOARD NUMBER Y= CIRCUIT NUMBER
LP-X Y	240V, 3P, 4W, RECEPTACLE **AMPERE RATING AS NOTED *WP= WEATHER PROOF XP= EXPLOSION PROOF X= PANELBOARD NUMBER Y= CIRCUIT NUMBER

SECURITY SYSTEMS

DS	SECURITY SYSTEM DOOR OR SWITCH
WS	SECURITY SYSTEM WINDOW SWITCH
KP	SECURITY SYSTEM KEY PAD
CR	SECURITY SYSTEM CARD ACCESS READER
KB	KNOX BOX
GL	ELECTRIC GATE LOCK

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
42745
JAY A. HORAK
Date Signed 09-21-21
ARIZONA, U.S.A.

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS

Registered Professional Engineer
63292
LANE E. INGRAM
11/13/2018
ARIZONA, U.S.A.
EXPIRES: 03/31/2020

Stanley Consultants

REVISIONS					DES
NO.	BY	DATE	CKD	REMARKS	TSL
					DWN
					TSL
					CKD
					LRJ

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
SYMBOLS AND LEGEND 2

CITY PROJECT NO. WS90400067
DATE 03/2018
E SHEET 2 (25 OF 44)
CAD FILE: LS76-E002

USER: 9402 FILE: Z:\26866\11-CADD\Electrical\LS76-E002.dwg DATE: 9/21/21 TIME: 12:26pm

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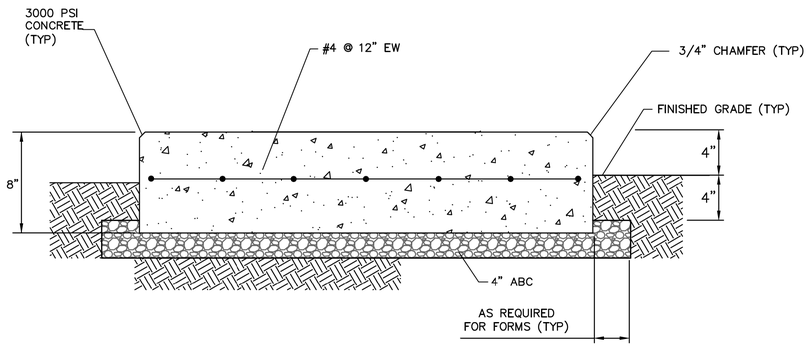
NOTES:

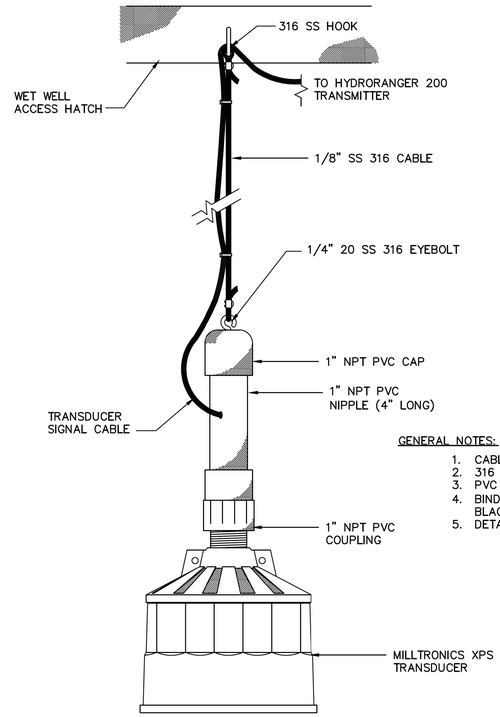
1. CONCRETE EQUIPMENT PAD SIZED TO FIT EQUIPMENT FURNISHED.



CONCRETE EQUIPMENT PAD

DETAIL A (TYP | E3)

SCALE = NTS



GENERAL NOTES:

1. CABLE AND MOUNTING HARDWARE TO BE 316 SS.
2. 316 SS HOOK MOUNTED AT WET WELL ACCESS HATCH.
3. PVC NIPPLE DRILLED TO ALLOW TRANSDUCER SIGNAL CABLE TO PASS THROUGH.
4. BIND TRANSDUCER SIGNAL CABLE TO LENGTH OF 1/8" 316 SS CABLE USING BLACK, UV RESISTANT CABLE TIES.
5. DETAIL TYPICAL FOR TWO LEVEL TRANSDUCERS.

LEVEL ELEMENT INSTALLATION

DETAIL B (E5 | E3)

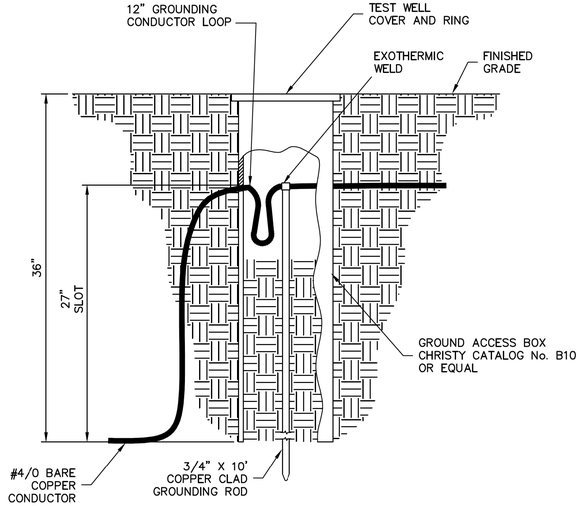
SCALE = NTS

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

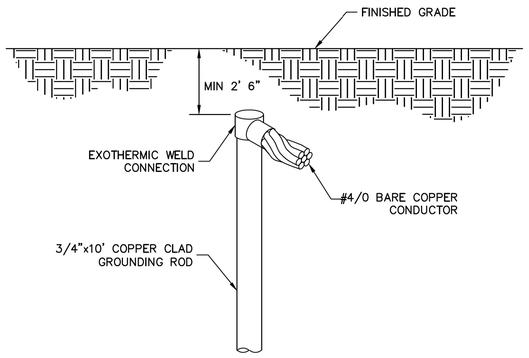
Registered Professional Engineer Certificate
42745
JAY A. HORAK
Date Signed 09-30-21
ARIZONA, U.S.A.



GROUND ROD WITH TEST ACCESS WELL

DETAIL C (E6 | E3)

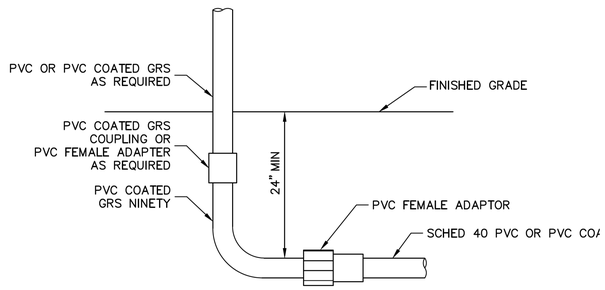
SCALE = NTS



EXOTHERMIC GROUND ROD CONNECTION

DETAIL D (E6 | E3)

SCALE = NTS



PVC COATED GRS 90 DEGREE ELBOWS BELOW GRADE DIRECT BURIED OR CONCRETE ENCASED

DETAIL E (TYP | E3)

SCALE = NTS

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63292
LANE E. INGRAM
11/15/2018
ARIZONA, U.S.A.
EXPIRES 03/31/2020

Stanley Consultants

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NO.	BY	DATE	CKD	REMARKS

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DWN TSL
CKD LEI

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
ELECTRICAL DETAILS 1

CITY PROJECT NO. WS90400067
DATE 03/2018
E SHEET 3 (26 OF 44)
CAD FILE: LS76-E003

USER: 9402 FILE: Z:\26866\11-CADD\Electrical\LS76-E003.dwg DATE: 9/21/21 TIME: 12:37pm

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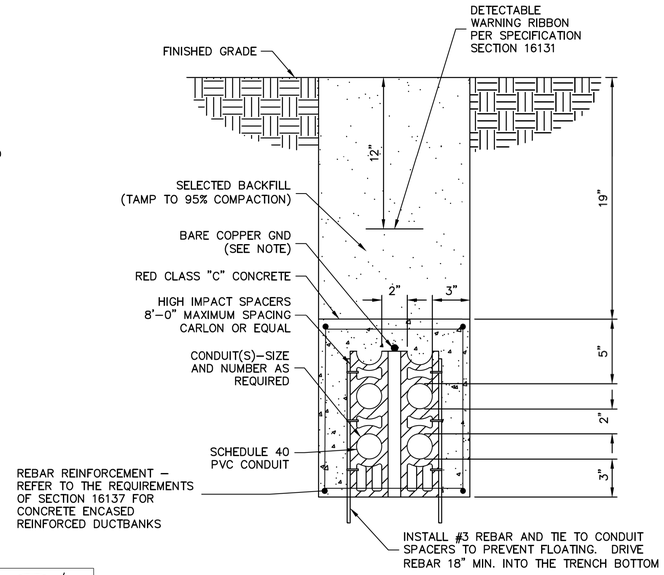
NOTES:

1. GROUND CONDUCTOR SHALL RUN CONTINUOUSLY THROUGH MANHOLES AND SHALL CONTINUE FROM DUCTBANK INTO SWITCHGEAR OR BUILDING GROUNDING SYSTEM AND SHALL BE BONDED TO EACH PVC COATED RIGID STEEL CONDUIT. SIZE TO BE #4/0 UNLESS OTHERWISE INDICATED ON PLANS.
2. ALL DIMENSIONS ARE MINIMUM.
3. MAINTAIN MINIMUM 6" SEPARATION BETWEEN 480 VAC CONDUIT AND 24 VAC/24 VDC CONDUIT.
4. MAINTAIN MINIMUM 3" SEPARATION BETWEEN 480 VAC CONDUITS AND 120 VAC CONDUITS; AND 120 VAC CONDUITS AND 24 VAC/24 VDC CONDUITS.
5. REPLACE SURFACE MATERIAL IN KIND.



DUCTBANK - CONCRETE ENCASED

DETAIL F (TYP | E4)

SCALE = NTS

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

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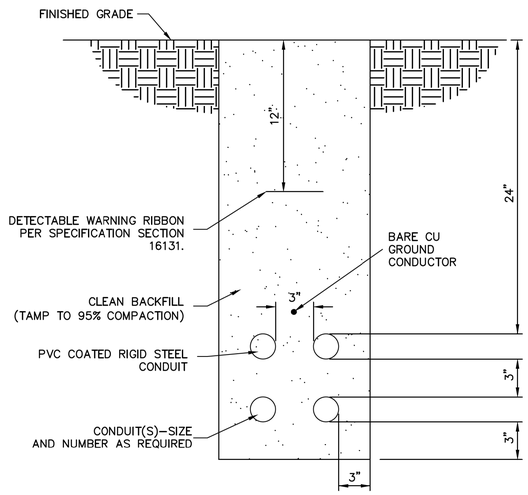
REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
42745
JAY A.
HORAK
ARIZONA, U.S.A.
Date Signed 09-21-21

DUCTBANK NOTES:

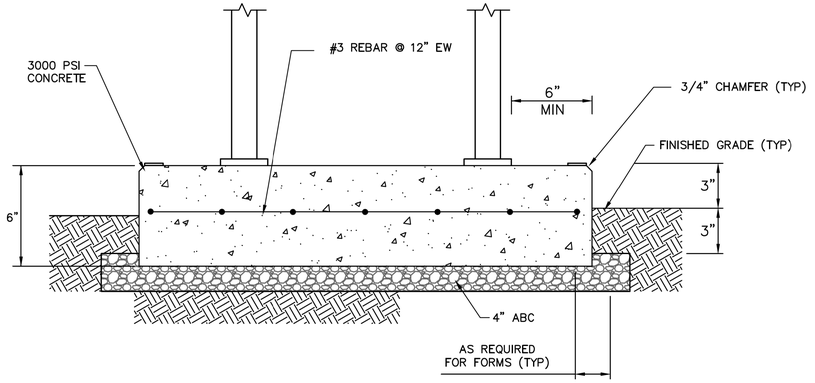
1. GROUND CONDUCTOR SHALL RUN CONTINUOUSLY THROUGH MANHOLES AND SHALL CONTINUE FROM DUCTBANK INTO SWITCHGEAR OR BUILDING GROUNDING SYSTEM AND SHALL BE BONDED TO EACH PVC COATED RIGID STEEL CONDUIT. SIZE TO BE #4/0 UNLESS OTHERWISE INDICATED ON PLANS.
2. ALL DIMENSIONS ARE MINIMUM.
3. MAINTAIN MINIMUM 6" SEPARATION BETWEEN 480 VAC CONDUIT AND 24 VAC/24 VDC CONDUIT.
4. MAINTAIN MINIMUM 3" SEPARATION BETWEEN 480 VAC CONDUITS AND 120 VAC CONDUITS; AND 120 VAC CONDUITS AND 24 VAC/24 VDC CONDUITS.
5. REPLACE SURFACE MATERIAL IN KIND.
6. DUCTBANKS CROSSING ROADWAYS/DRIVEWAYS SHALL BE REBAR REINFORCED IN ACCORDANCE WITH SPECIFICATION 16137.



DUCTBANK - DIRECT BURIED

DETAIL G (TYP | E4)

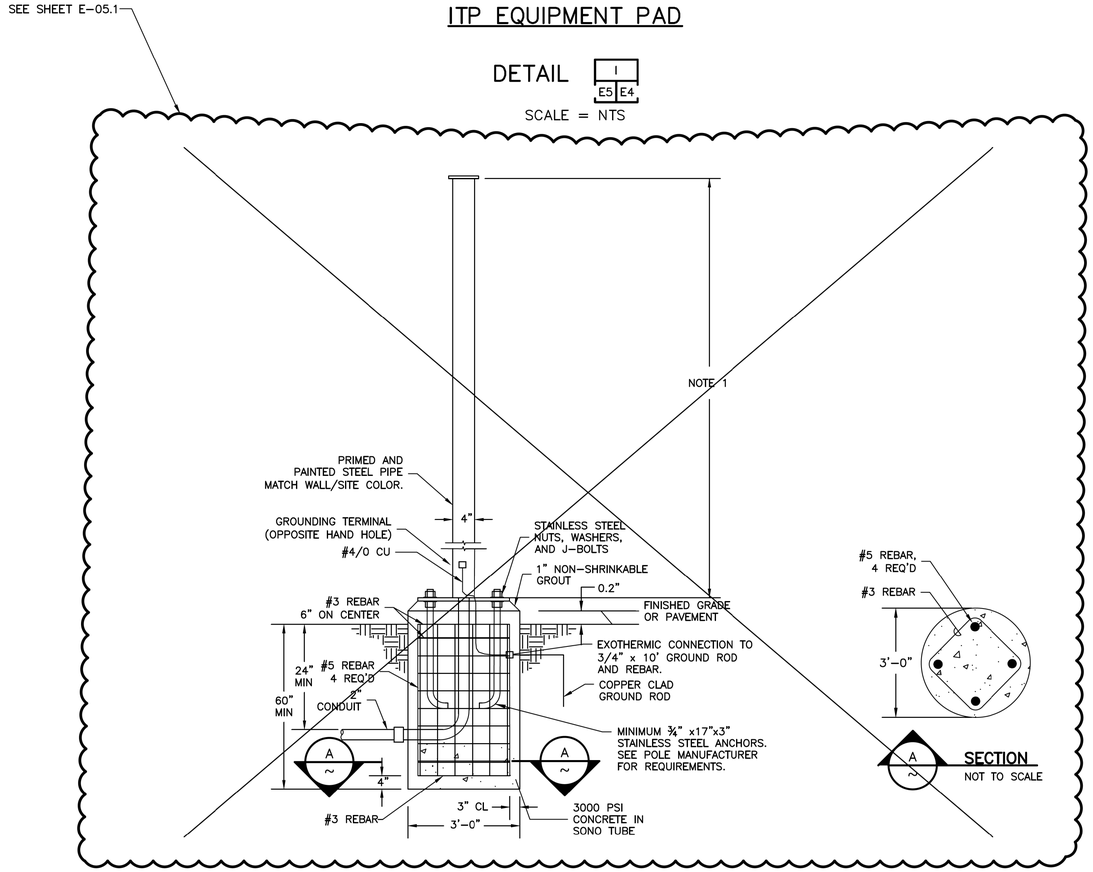
SCALE = NTS



ITP EQUIPMENT PAD

DETAIL I (E5 | E4)

SCALE = NTS



ANTENNA POLE MOUNTING BASE

DETAIL H (TYP | E4)

SCALE = NTS

NOTES:

1. CONTRACTOR SHALL SUBMIT FINAL CONCRETE BASE DRAWINGS SEALED BY STRUCTURAL ENGINEER LICENSED IN THE STATE OF ARIZONA.

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS
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Registered Professional Engineer
63292
LANE E.
INGRAM
11/13/2018
ARIZONA, U.S.A.
EXPIRES: 03/31/2020

Stanley Consultants

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NO.	BY	DATE	CKD	REMARKS	TSL
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*					TSL
*					CKD
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City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
ELECTRICAL DETAILS 2

CITY PROJECT NO. WS90400067

DATE 03/2018

E SHEET 4 (27 OF 44)

CAD FILE: LS76-E004

USER: 9402 FILE: Z:\26866\11-CADD\Electrical\LS76-E004.dwg DATE: 9/30/21 TIME: 10:07am

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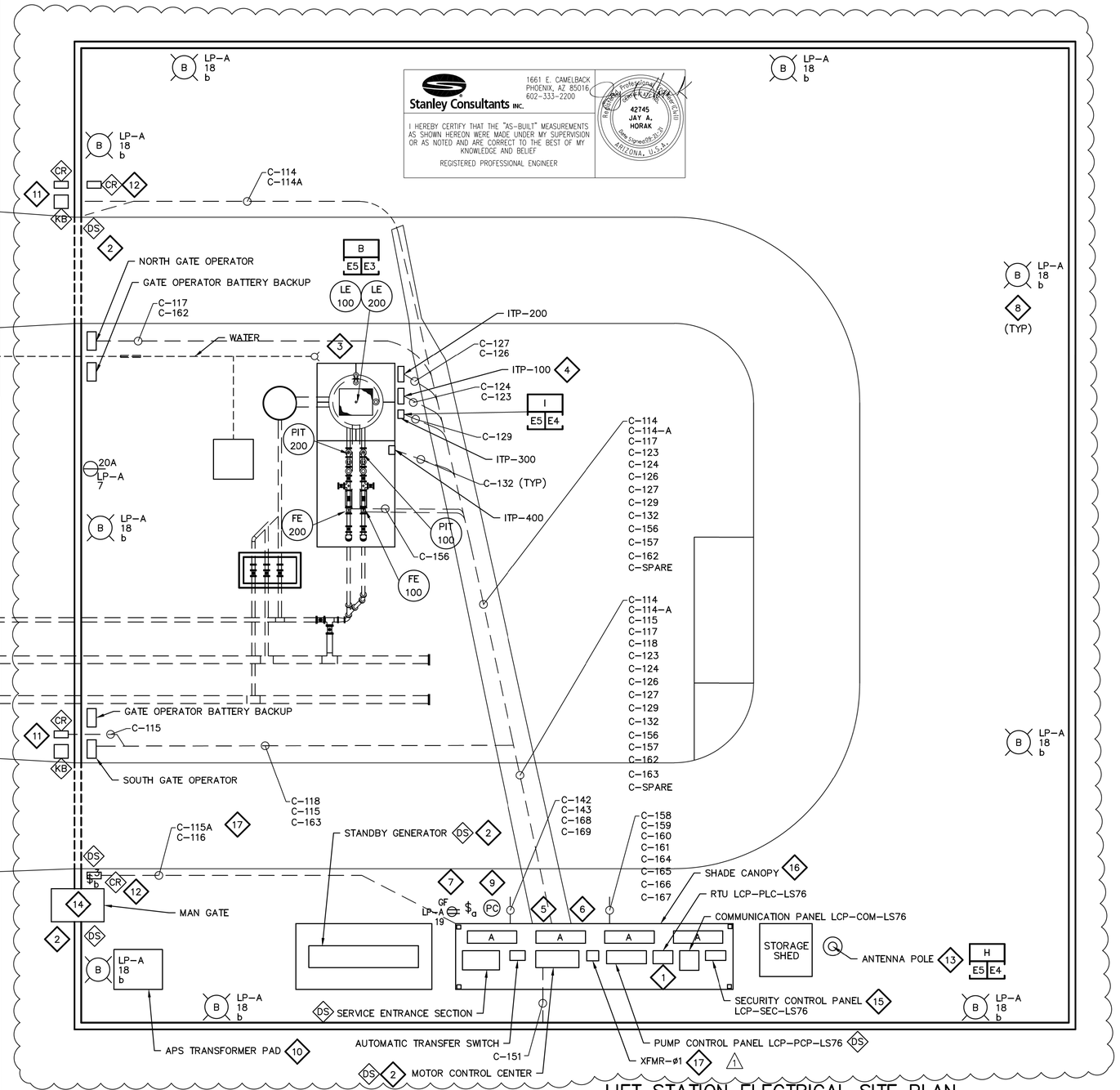

LIFT STATION ELECTRICAL SITE PLAN

5 2.5 0 5

SCALE: 1" = 5'

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

I HEREBY CERTIFY THAT THE "AS-BUILT" MEASUREMENTS AS SHOWN HEREON WERE MADE UNDER MY SUPERVISION OR AS NOTED AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
42745
JAY A. HORAK
ARIZONA, U.S.A.

N

CONSTRUCTION NOTES:

KEYED NOTES

1. LIGHTING CONTROL PANEL ALCP-100 TO BE LOCATED INSIDE LCP-PCP-LS76.
2. PROVIDE ONE INTRUSION SWITCH FOR EACH ENTRANCE GATE (AUTOMATIC AND MAN-DOOR) EACH DOOR OF THE STANDBY GENERATOR, SES, ATS, MCC, AND ALL CONTROL PANELS.
3. THE ENCLOSED SPACE WITHIN THE INTERIOR OF THE WET WELL IS CLASSIFIED AS A CLASS 1, GROUP D, DIVISION 1 AREA. ABOVE GRADE AT THE WET WELL, THE SPACE ENCLOSED WITHIN 3 FEET OF THE TOP OF THE WET WELL IS CLASSIFIED AS A CLASS 1, GROUP D, DIVISION 2 AREA. AREA BEYOND ENVELOPE IS UNCLASSIFIED, BUT REGARDED AS WET AND CORROSIVE.
4. OBSERVE CLASSIFIED AREA LIMITS WHEN MOUNTING TERMINATION PANELS. ALL SEAL-OFFS SHALL BE CROUSE-HINDS ES STYLE SEALING HUBS.
5. FASTEN EQUIPMENT TO CONCRETE PAD UTILIZING 316SS CONCRETE ANCHORS PER MANUFACTURERS REQUIREMENTS.
6. ELECTRICAL EQUIPMENT SHADE CANOPY TO BE PROVIDED VIA DEFERRED SUBMITTAL.
7. INSTALL 120V, 20A GFCI DUPLEX RECEPTACLE AND 120V, 20A, SPST LIGHT SWITCH IN SURFACE MOUNTED BOXES (AT 36" & 42" AFG, RESPECTIVELY) WITH WP WIU COVER ON SHADE STRUCTURE SUPPORT POST.
8. SURFACE MOUNTED WALL-PACK LUMINAIRE. STUBUP CONDUIT AND EXTEND TO A FLUSH MOUNTED JUNCTION BOX LOCATED NEAR TOP OF WALL.
9. INSTALL PHOTOCELL ON SHADE CANOPY FACING NORTH.
10. INSTALL TRANSFORMER PAD PER APS REQUIREMENTS. MAINTAIN MIN 2' OFF THE WALL.
11. INSTALL KNOX BOX AND CARD READER IN FLUSH MOUNTED JUNCTION BOXES AT 42" AFG.
12. INSTALL CARD READER IN FLUSH MOUNTED JUNCTION BOXES AT 42" AFG.
13. CONTRACTOR TO PROVIDE RADIO PATH SURVEY.
14. CONTRACTOR TO INSTALL 3-WAY HAND-OFF-AUTOMATIC SWITCH FOR CONTROL OF SITE LIGHTING. SWITCH WILL BE INTEGRATED INTO THE CONTROL CIRCUIT IN ALCP-100.
15. SECURITY CONTROL PANEL LCP-SEC-LS76 TO BE SUBMITTED ON AND BUILT TO THE REQUIREMENTS OF THE DIVISION 18000 SPECIFICATIONS. CABINET TO BE PROVIDED WITH SOLAR SHIELDS AND AN AIR CONDITIONER PER THE REQUIREMENTS OF SPECIFICATION 17260
16. THE STRUCTURAL DESIGN AND CALCULATIONS FOR THE SHADE CANOPY AND ELECTRICAL EQUIPMENT PAD SHALL BE PROVIDED BY THE CONTRACTOR AS A DEFERRED SUBMITTAL.
17. (1) FURNISH AND INSTALL 2-#1, #BG, 1 1/2" C-C200. FURNISH AND INSTALL 3-2/0, #6G, 2"C-C201.

DUCT BANK SURVEY

NORTHING	EASTING	ELEVATION
1029706.3810	630626.2180	1707.8510
1029706.2280	630618.6440	1707.0650
1029740.4370	630613.4690	1707.0230
1029739.5390	630607.5620	1707.1450
1029768.3280	630612.3230	1707.3920
1029790.3200	630607.4910	1707.3460
1029796.6310	630603.8550	1707.8770
1029810.6330	630601.0790	1708.2010
1029809.9690	630599.3620	1708.1920
1029796.1760	630601.9730	1707.8870
1029791.7330	630602.4200	1707.6840

LIGHTING FIXTURE SCHEDULE

TYPE	LAMP	VOLTAGE	MOUNTING	DESCRIPTION
A	LED	120 VAC	OVERHEAD	LITHONIA DMW2 L24 4000LM ACL MD 120V GZ1 4000K 80CRI, OR EQUAL
B	60W LED 5000K	120 VAC	WALL	LITHONIA TWR2 LED P1 50K MVOLT DDBTXD, OR EQUAL

REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	REMARKS
1	STANLEY CONSULTANTS	WS90400067	LIFT STATION 76	7-1-2020	LS76-E005	RFI 11

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DWG NUMBER 28 OF 44

EXPIRES 03/31/2020

Stanley Consultants

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1	MW	7/1/2020		RFI 11
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DWN TSL
CKD LEI

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
ELECTRICAL SITE PLAN

CITY PROJECT NO. WS90400067
DATE 03/2018
E SHEET 5 (28 OF44)
CAD FILE: LS76-E005

USER: 9402 FILE: C:\Users\9402\Desktop\PDF\Max\MAX CADD\LS76-E005.DWG DATE: 10/11/21 TIME: 02:41pm

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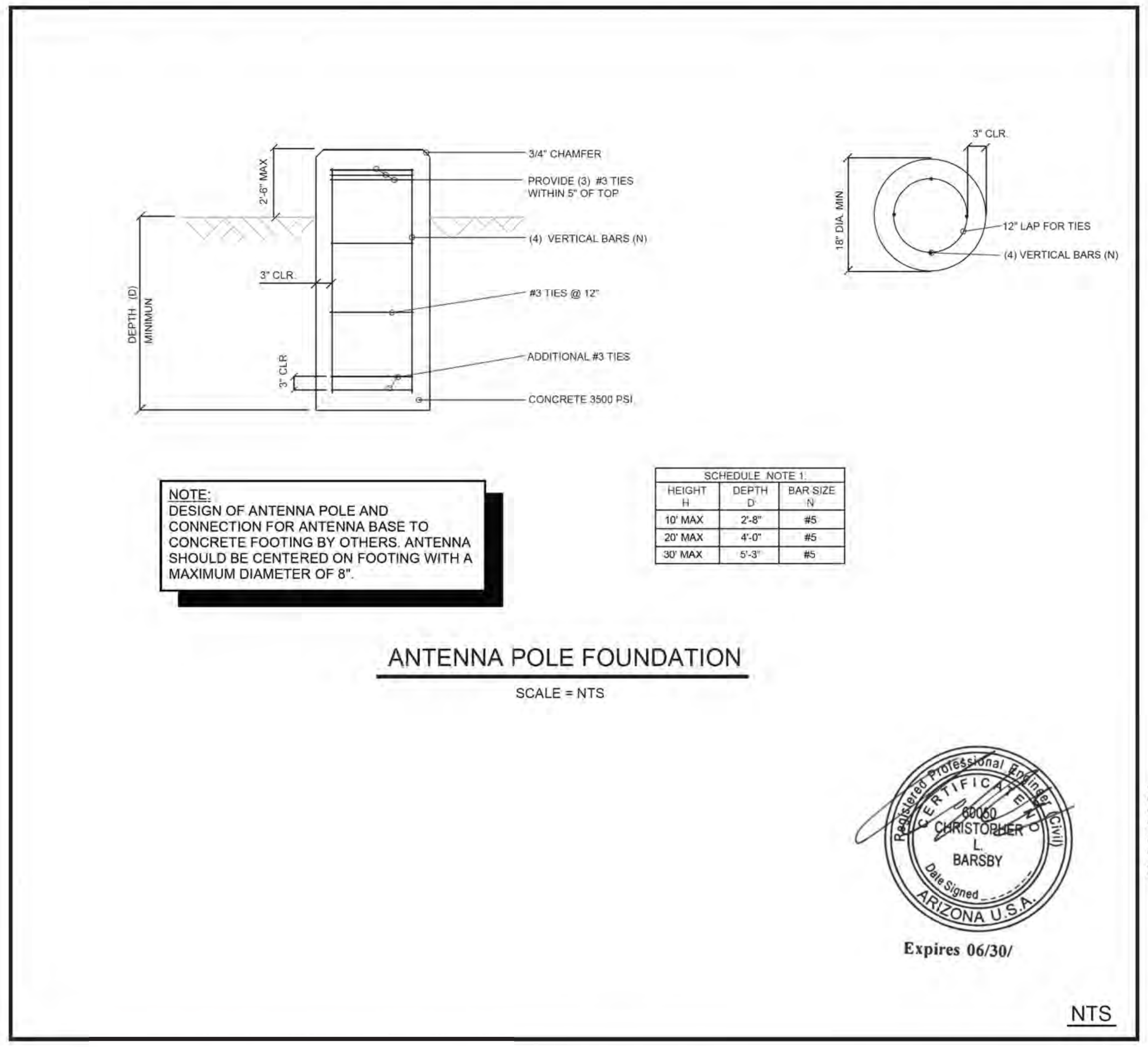
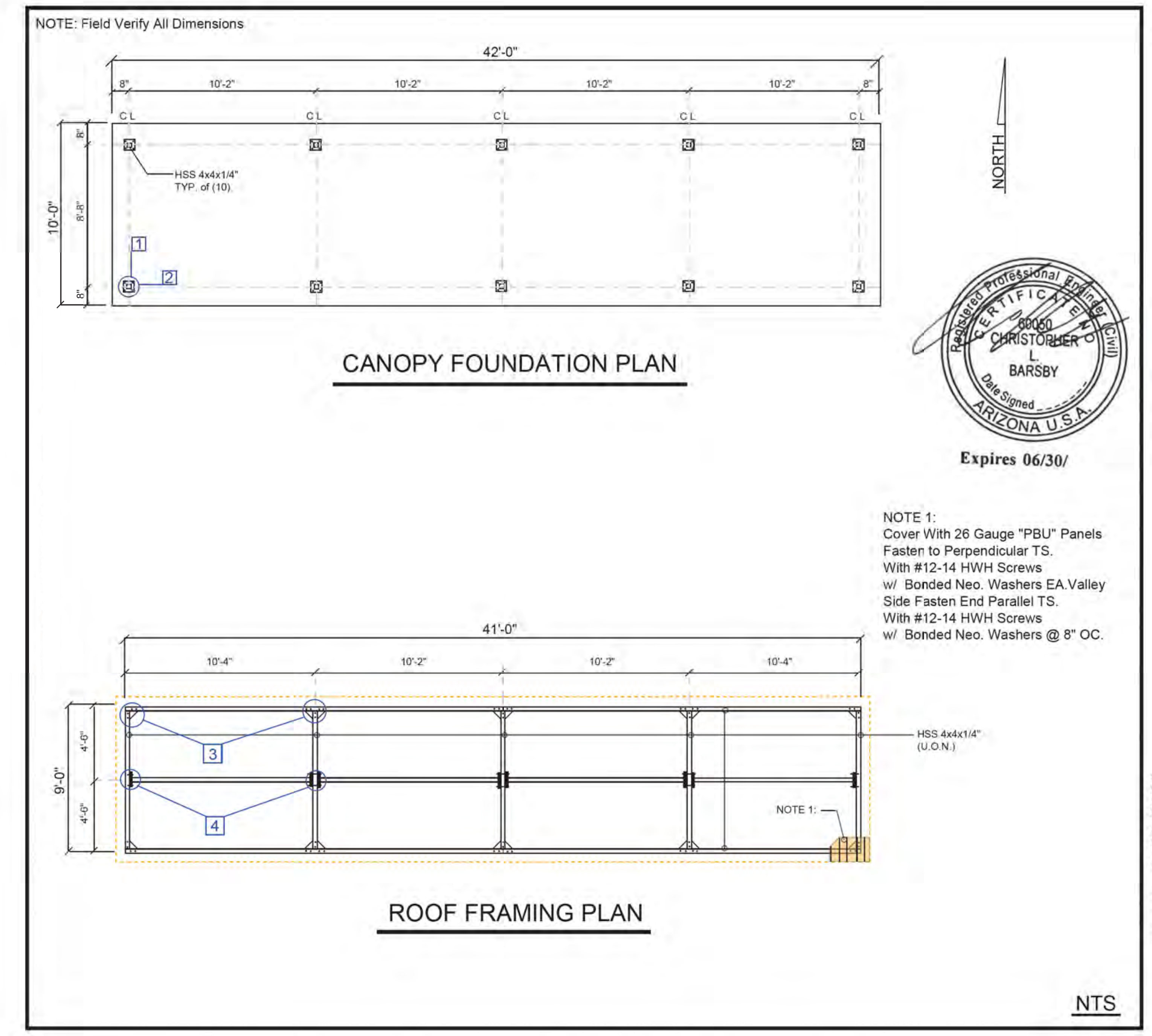


3/4" CHAMFER
PROVIDE (3) #3 TIES WITHIN 5" OF TOP
(4) VERTICAL BARS (N)
#3 TIES @ 12"
ADDITIONAL #3 TIES
CONCRETE 3500 PSI
3" CLR.
12" LAP FOR TIES
18" DIA. MIN
NOTE:
DESIGN OF ANTENNA POLE AND CONNECTION FOR ANTENNA BASE TO CONCRETE FOOTING BY OTHERS. ANTENNA SHOULD BE CENTERED ON FOOTING WITH A MAXIMUM DIAMETER OF 8".
SCHEDULE NOTE 1
HEIGHT H | DEPTH D | BAR SIZE N
10' MAX | 2'-8" | #5
20' MAX | 4'-0" | #5
30' MAX | 5'-3" | #5
ANTENNA POLE FOUNDATION
SCALE = NTS
Expires 06/30/
NTS
City of Phoenix
West Anthem Lift Station No. 76
ALUMA-LINE INC
Sheet No. 3 of 8
7-23-2020



NOTE: Field Verify All Dimensions
42'-0"
NORTH
CANOPY FOUNDATION PLAN
Expires 06/30/
NOTE 1:
Cover With 26 Gauge "PBU" Panels
Fasten to Perpendicular TS.
With #12-14 HWH Screws
w/ Bonded Neo. Washers EA.Valley
Side Fasten End Parallel TS.
With #12-14 HWH Screws
w/ Bonded Neo. Washers @ 8" OC.
41'-0"
ROOF FRAMING PLAN
NTS
City of Phoenix
West Anthem Lift Station No. 76
ALUMA-LINE INC
Sheet No. 4 of 8
7-23-2020

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

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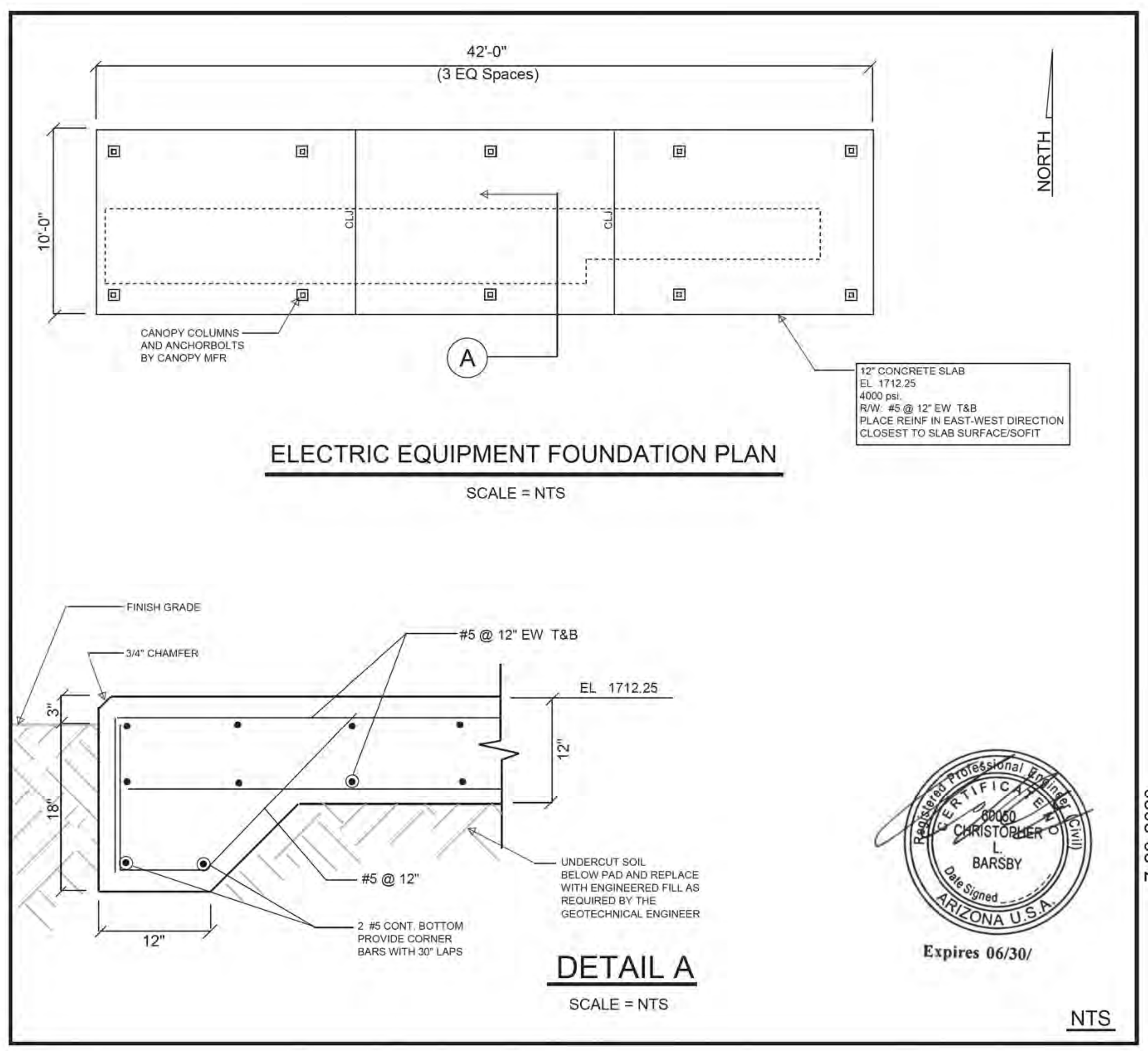
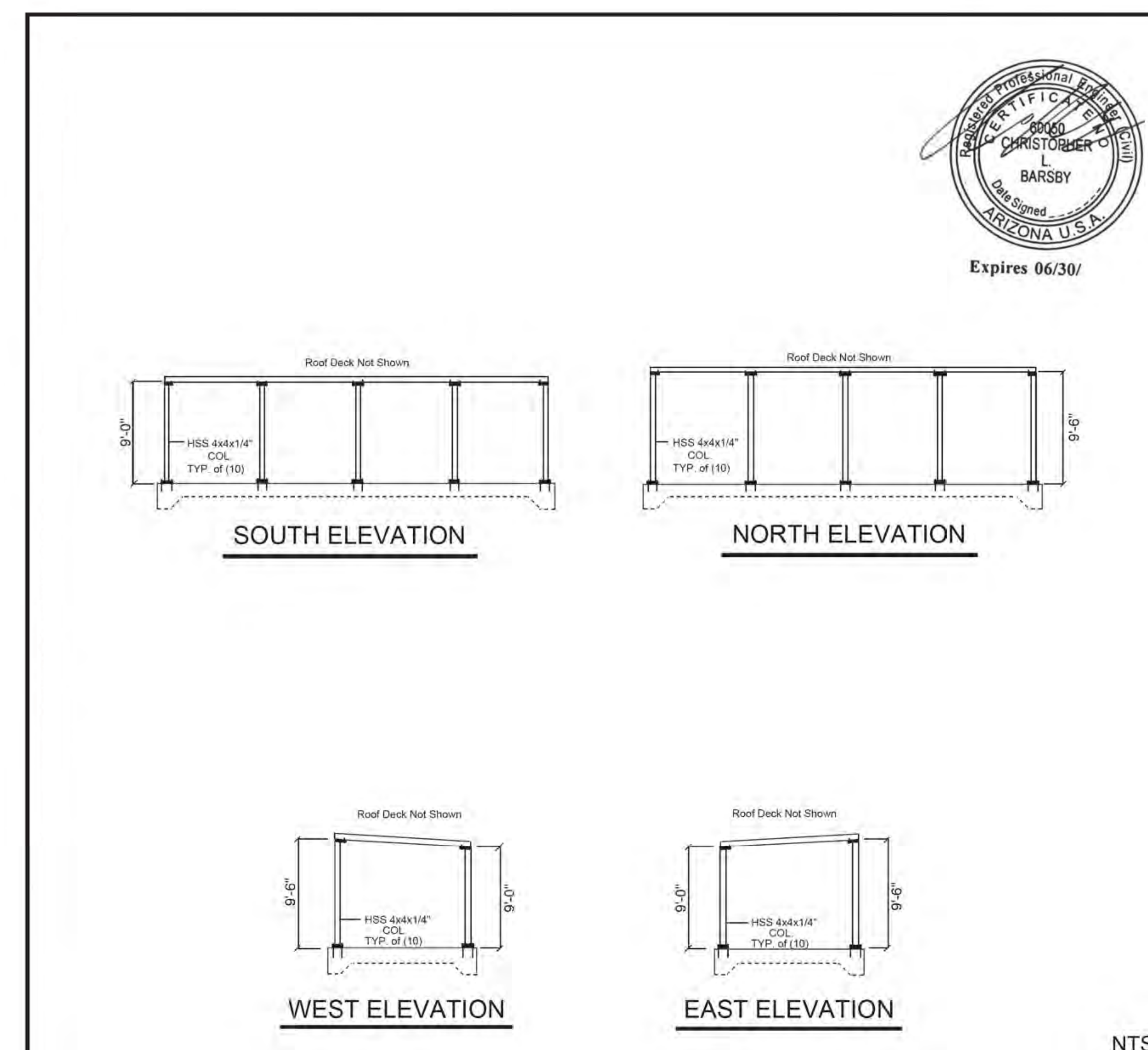
REGISTERED PROFESSIONAL ENGINEER

42745 JAY A. HORAK ARIZONA, U.S.A.



42'-0"
(3 EQ Spaces)
10'-0"
NORTH
CANOPY COLUMNS AND ANCHORBOLTS BY CANOPY MFR.
12" CONCRETE SLAB
EL. 1712.25
4000 psi.
R/W. #5 @ 12" EW T&B
PLACE REINF IN EAST-WEST DIRECTION CLOSEST TO SLAB SURFACE/SOFIT
A
ELECTRIC EQUIPMENT FOUNDATION PLAN
SCALE = NTS
FINISH GRADE
3/4" CHAMFER
#5 @ 12" EW T&B
EL 1712.25
12"
18"
#5 @ 12"
2 #5 CONT. BOTTOM PROVIDE CORNER BARS WITH 30" LAPS
UNDERCUT SOIL BELOW PAD AND REPLACE WITH ENGINEERED FILL AS REQUIRED BY THE GEOTECHNICAL ENGINEER
DETAIL A
SCALE = NTS
Expires 06/30/
NTS
City of Phoenix
West Anthem Lift Station No. 76
ALUMA-LINE INC
Sheet No. 2 of 8
7-23-2020



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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS
1	STANLEY CONSULTANTS	WS90400067	LIFT STATION 76	7-1-2020	LS76-E005	28 OF 44	RFI 11

08/6/2020

21

NO.	BY	DATE	CKD	REMARKS
1				

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DWN TSL
CKD LEI

Stanley Consultants

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT
COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76
WEST ANTHEM LIFT STATION
ELECTRICAL SITE PLAN

CITY PROJECT NO. WS90400067
DATE 03/2018
E SHEET 5A (28 OF44)
CAD FILE: LS76-E005A

USER: 9402 FILE: Z:\26866\11-CADD\Electrical\LS76-E005.DWG DATE: 9/30/21 TIME: 10:16am

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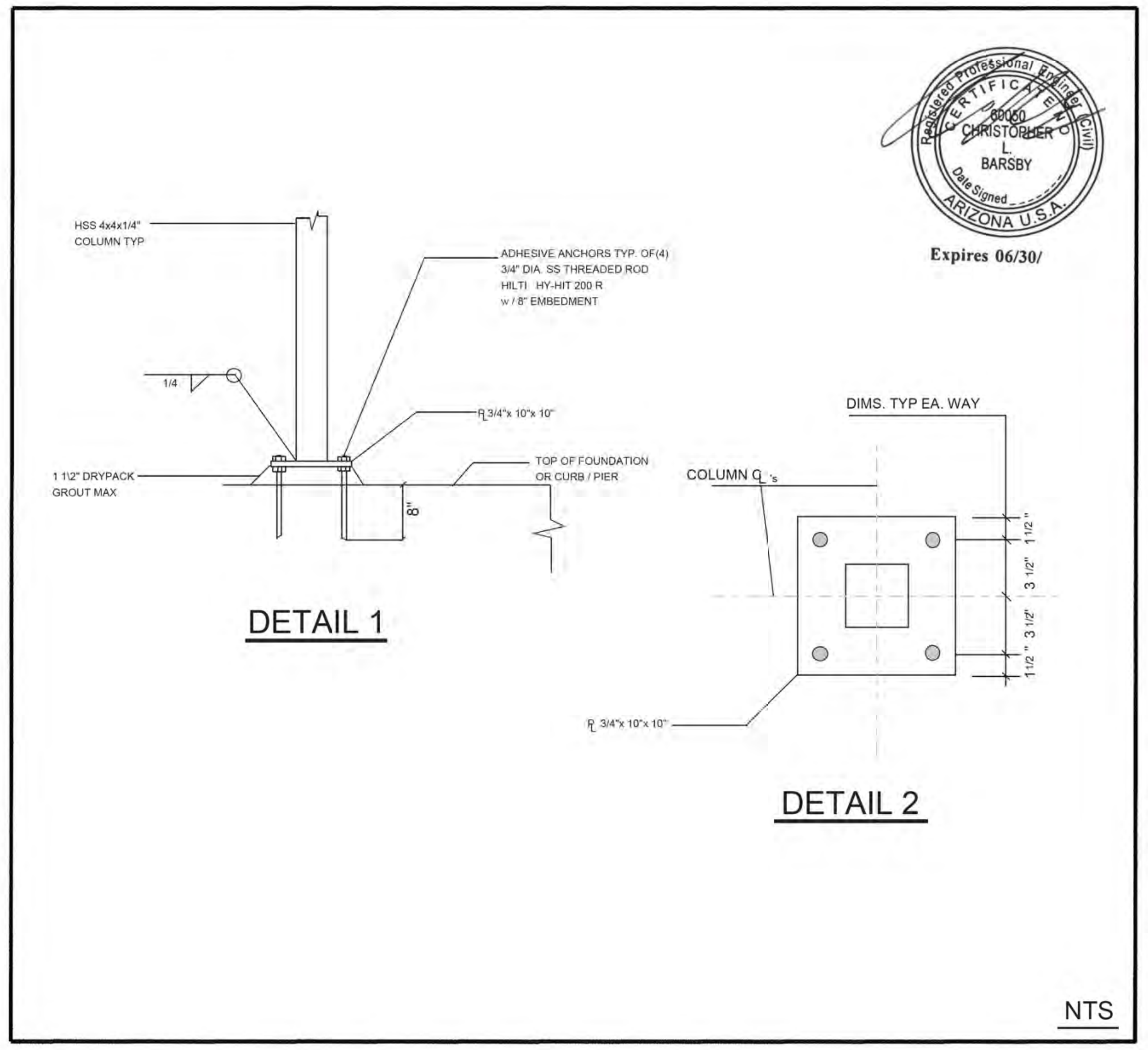
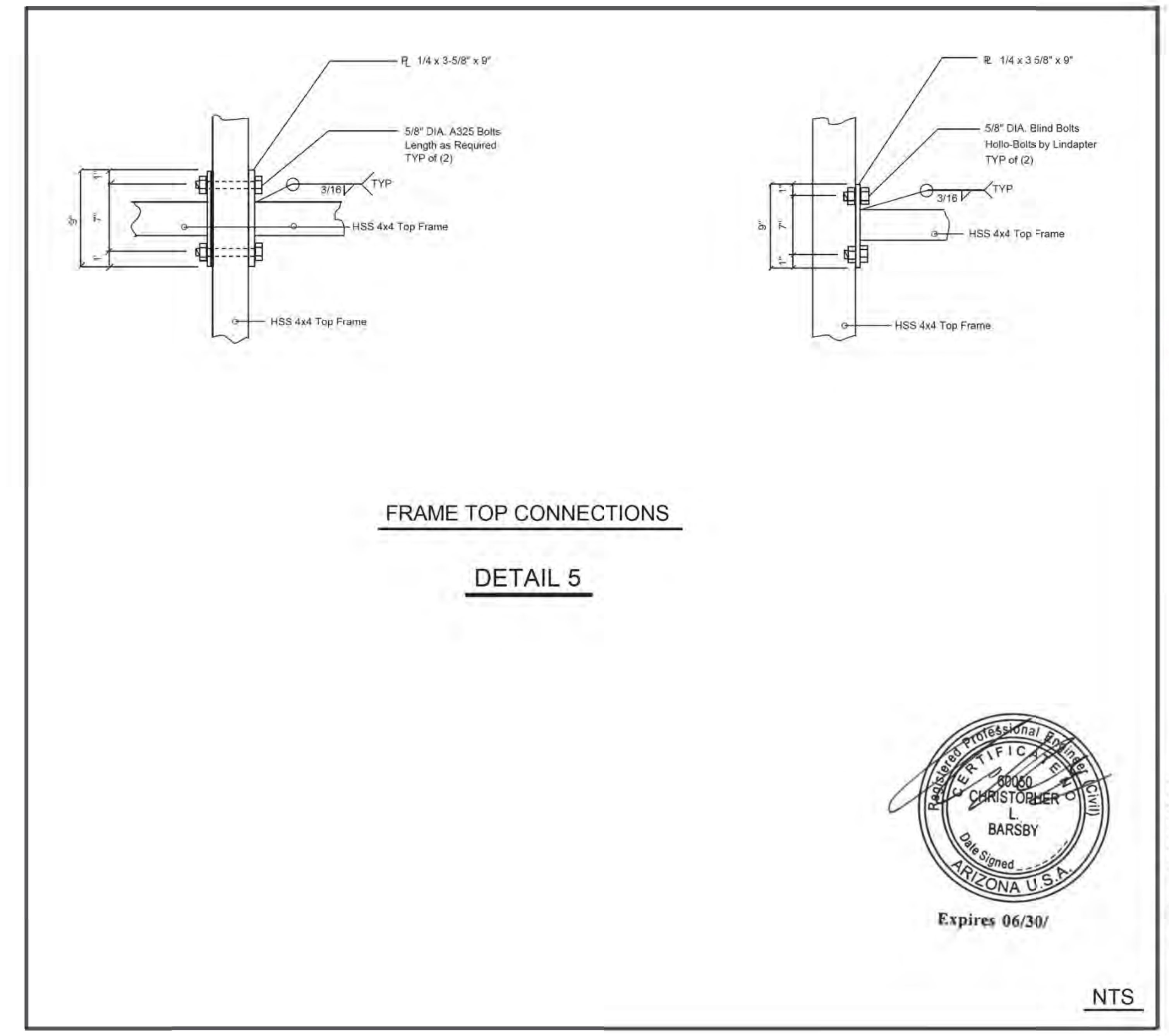


City of Phoenix
West Anthem Lift Station No. 76
ALUMA-LINE INC
Sheet No. 6 of 8
7-23-2020



City of Phoenix
West Anthem Lift Station No. 76
ALUMA-LINE INC
Sheet No. 8 of 8
7-23-2020

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

I HEREBY CERTIFY THAT THE "AS-BUILT" MEASUREMENTS AS SHOWN HEREON WERE MADE UNDER MY SUPERVISION OR AS NOTED AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF

REGISTERED PROFESSIONAL ENGINEER

42745
JAY A.
HORAK
ARIZONA, U.S.A.

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS

REVISIONS

NO.	BY	DATE	CKD	REMARKS
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City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
ELECTRICAL SITE PLAN

CITY PROJECT NO. WS90400067
DATE 03/2018
E SHEET 5B (28 OF44)
CAD FILE: LS76-E005B

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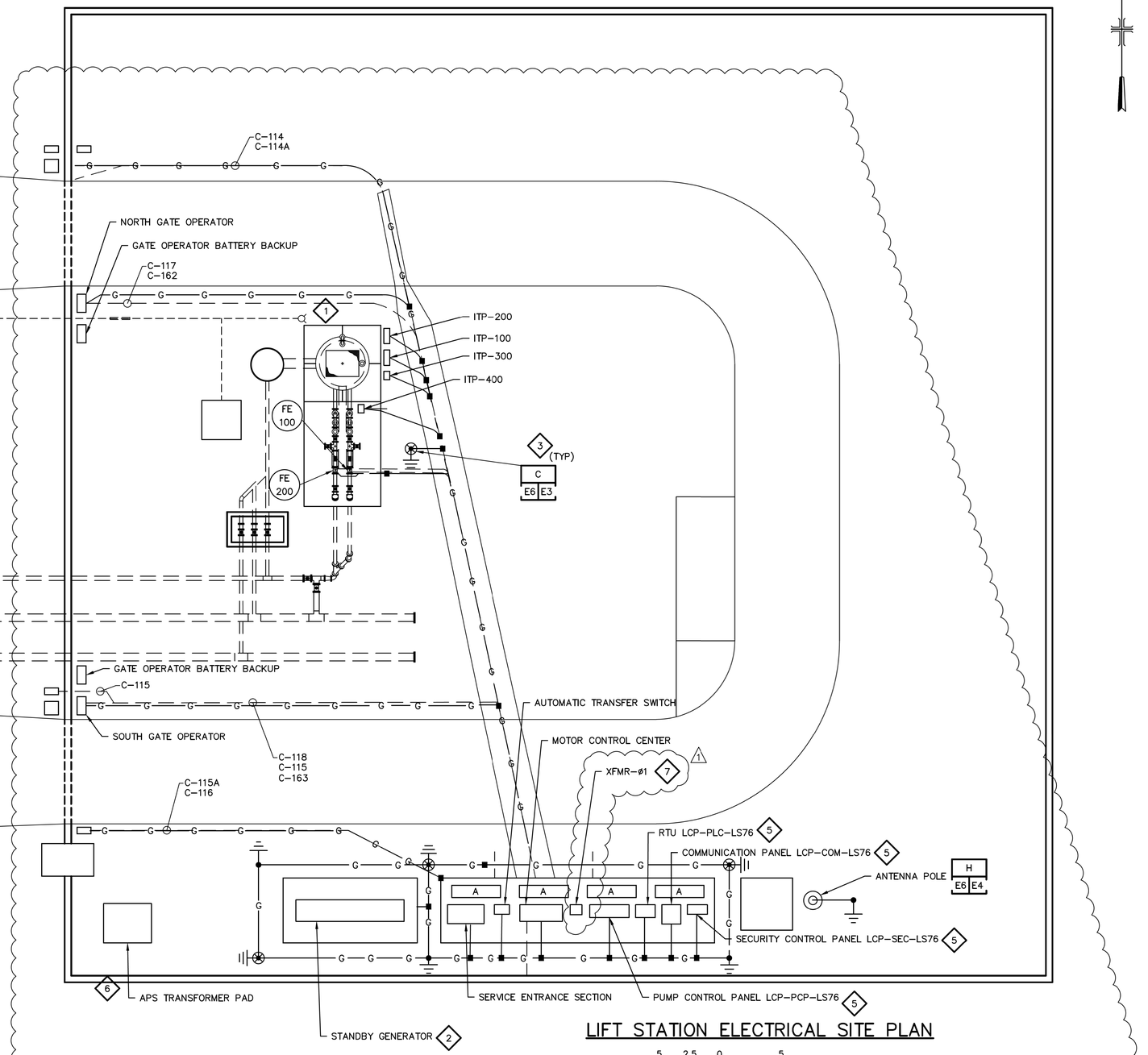

LIFT STATION ELECTRICAL SITE PLAN

5 2.5 0 5

SCALE: 1" = 5'

N

KEYED NOTES

1. THE ENCLOSED SPACE WITHIN THE INTERIOR OF THE WETWELL IS CLASSIFIED AS A CLASS 1, GROUP D, DIVISION 1 AREA. ABOVE GRADE AT THE WETWELL, THE SPACE ENCLOSED WITHIN 3 FEET OF THE TOP OF THE WETWELL IS CLASSIFIED AS A CLASS 1, GROUP D, DIVISION 2 AREA. AREA BEYOND THE ENVELOPE IS UNCLASSIFIED BUT REGARDED AS WET AND CORROSIVE.
2. BOND #4/0 BARE COPPER BONDING JUMPER TO SHADE STRUCTURE METAL POST WITH APPROVED UL LISTED LUG.
3. INSTALL GROUND TEST WELL WITH 12" LOOP OF THE GROUNDING CONDUCTOR TO ALLOW FOR GROUND GRID TESTING. INSTALL GROUNDING TEST TAG.
4. PROVIDE A 12" LOOP OF GROUNDING CONDUCTOR BELOW PANEL LP-A TRANSFORMER FOR GROUND GRID TESTING PURPOSES. INSTALL GROUNDING TEST TAG.
5. ALL CONTROL PANELS TO BE GROUNDED PER THE REQUIREMENTS OF SPECIFICATIONS 16061 AND 17260.
6. CONTRACTOR TO COORDINATE TRANSFORMER PAD GROUNDING REQUIREMENTS WITH APS
7. BOND THE GROUNDING ELECTRODE CONDUCTOR TO THE SECONDARY SIDE OF THE TRANSFORMER

1

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

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REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
42745
JAY A. HORAK
Date Signed 09-21-21
ARIZONA, U.S.A.

REMARKS
RFI 11

DWG NUMBER
29 OF 44

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME
1	STANLEY CONSULTANTS	WS90400067	LIFT STATION 76	7-1-2020	LS76-E006

Registered Professional Engineer
63292
LANE E. INGRAM
11/13/2018
ARIZONA, U.S.A.
EXPIRES 03/31/2020

Stanley Consultants

REVISIONS				
NO.	BY	DATE	CKD	REMARKS
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CKD LEI

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION GROUNDING PLAN

CITY PROJECT NO. WS90400067
DATE 03/2018
E SHEET 6 (29 OF 44)
CAD FILE: LS76-E006

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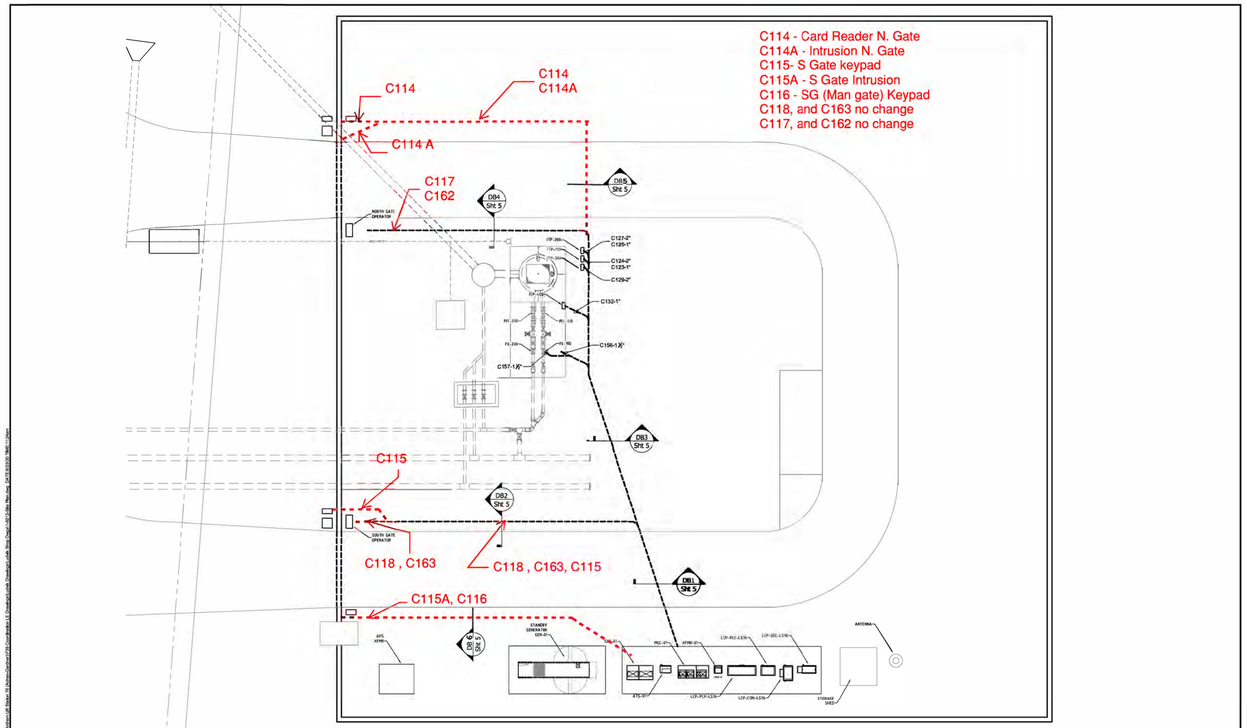

REVISIONS			
NO.	BY	DATE	REMARKS
1	EA	06.23.20	Revised per review Comments
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-	-	-	-
-	-	-	-
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-	-	-	-
-	-	-	-

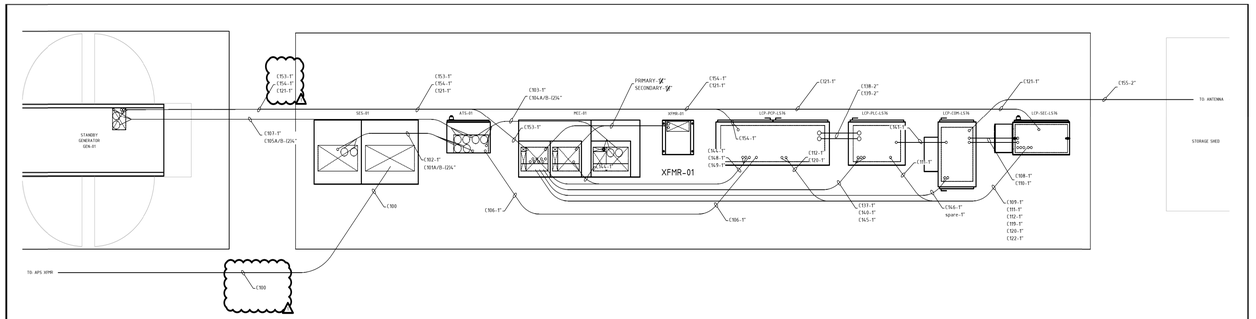
DES DR
CAD EA
CKD DR

LUDVIK ELECTRIC
PROJECT #9212
1020 E. UNIVERSITY DR.
PHOENIX, ARIZONA 85034

CITY OF PHOENIX
WATER SERVICES DEPARTMENT
COLLECTION SYSTEMS
REMOTE FACILITIES

ELECTRICAL
SITE PLAN &
DUCTBANK ROUTING

DATE 6/23/20
SHEET 1 OF 5
SCALE 1 1/2" = 1'-0"
CAD FILE 9212 - SITE PLAN



REVISIONS			
NO.	BY	DATE	REMARKS
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DES DR
CAD EA
CKD DR

LUDVIK ELECTRIC
PROJECT #9212
1020 E. UNIVERSITY DR.
PHOENIX, ARIZONA 85034

CITY OF PHOENIX
WATER SERVICES DEPARTMENT
COLLECTION SYSTEMS
REMOTE FACILITIES

ELECTRICAL
EQUIPMENT LAYOUT

DATE 6/23/20
SHEET 3 OF 5
SCALE 1 1/2" = 1'-0"
CAD FILE 9212 - SITE PLAN

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

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REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
42745
JAY A. HORAK
Date Signed 06-23-20
ARIZONA, U.S.A.

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME

REMARKS

DWG NUMBER

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DWN TSL
CKD LEI

Stanley Consultants

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS–76

WEST ANTHEM LIFT STATION
GROUNDING PLAN

CITY PROJECT NO. WS90400067
DATE 03/2018
E SHEET 6A (29 OF 44)
CAD FILE: LS76–E006A

USER: 9402 FILE: Z:\26866\11–CADD\Electrical\LS76–E006.DWG DATE: 9/30/21 TIME: 03:15pm

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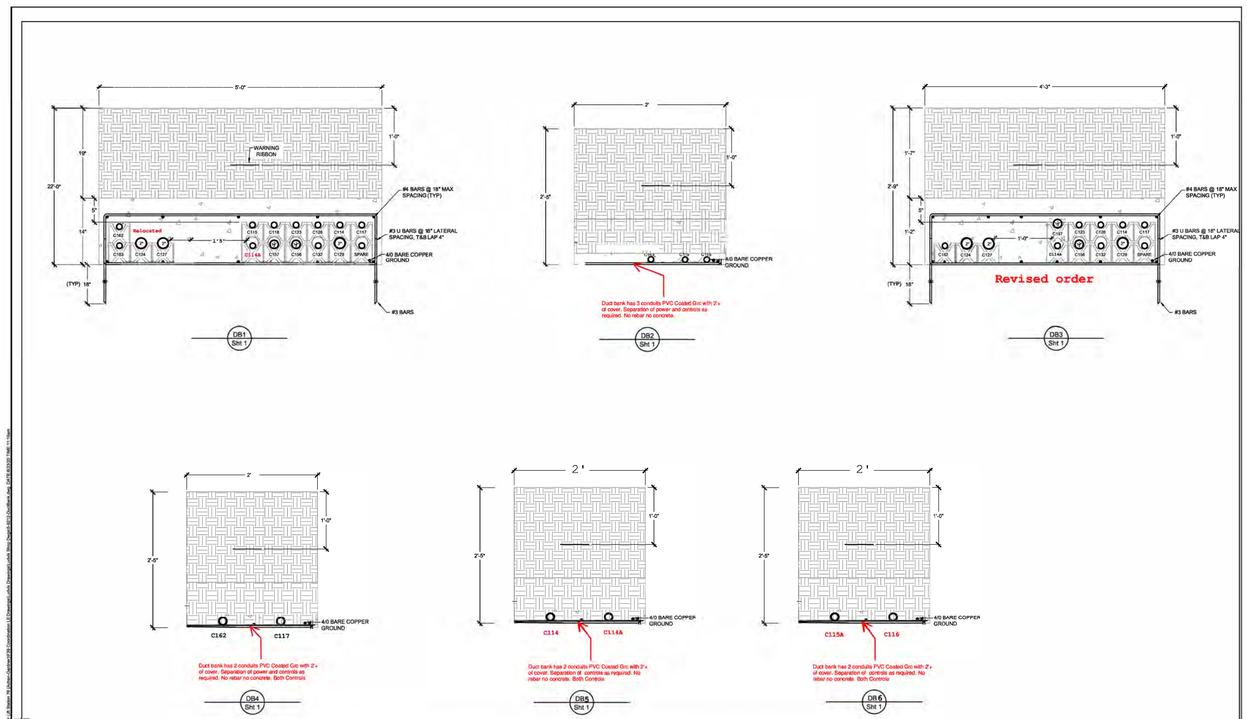

NOTE:
• ALL CONDUIT 1" UNLESS NOTED OTHERWISE

REVISIONS			
NO.	BY	DATE	REMARKS
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*	-	-	-

DES DR
CAD EA
CKD DR

LUDVIK ELECTRIC
PROJECT #9212
1020 E. UNIVERSITY DR.
PHOENIX, ARIZONA 85034

CITY OF PHOENIX
WATER SERVICES DEPARTMENT
COLLECTION SYSTEMS
REMOTE FACILITIES

DUCTBANK
SECTION CUTS

DATE 5/27/20
SHEET 5 OF 5
SCALE 1 1/2" = 1'-0"
CAD FILE 9212 - DUCTBANK

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

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REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
42745
JAY A. HORAK
Date Signed 09-22-20
ARIZONA, U.S.A.

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Stanley Consultants

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CKD LEI

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

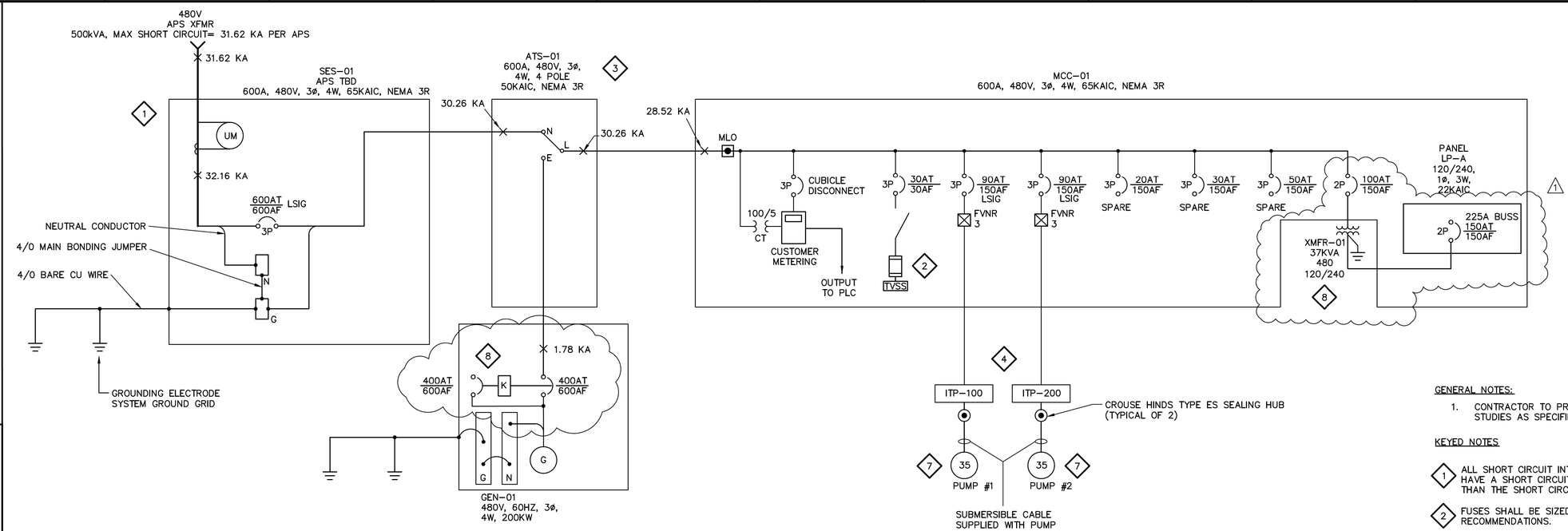
COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
GROUNDING PLAN

CITY PROJECT NO. WS90400067
DATE 03/2018
E SHEET 6B (29 OF 44)
CAD FILE: LS76-E006B

USER: 9402 FILE: Z:\26866\11-CADD\Electrical\LS76-E006.DWG DATE: 9/30/21 TIME: 03:31pm



ELECTRICAL SINGLE LINE DIAGRAM

GENERAL NOTES:

1. CONTRACTOR TO PROVIDE PRELIMINARY AND FINAL POWER SYSTEM STUDIES AS SPECIFIED IN SPECIFICATION SECTION 16215.

KEYED NOTES

1. ALL SHORT CIRCUIT INTERRUPTING AND PROTECTING DEVICES SHALL HAVE A SHORT CIRCUIT INTERRUPTING RATING EQUAL TO OR GREATER THAN THE SHORT CIRCUIT CURRENT AVAILABLE AT THE DEVICE.
2. FUSES SHALL BE SIZED PER EQUIPMENT MANUFACTURER'S RECOMMENDATIONS.
3. AUTOMATIC TRANSFER SWITCH SHALL BE PROVIDED WITH A NEMA 3R HINGED, GASKETED, AND LOCKABLE SECURE DOUBLE-DOOR OPTION TO PROTECT THE CONTROL KEYPAD, SELECTOR SWITCHES, AND INDICATING LAMPS FROM WEATHER AND UN-AUTHORIZED ACCESS.
4. PUMP MOTOR LEAD ITP'S ARE TO REMAIN SEPARATE TO ALLOW FOR MAINTENANCE ON ONE MOTOR WHILE THE OTHER IS IN OPERATION.
5. SERVICE ENTRANCE SECTION TO BE LABELED PER THE REQUIREMENTS OF THE NEC. 110.24(A) – AVAILABLE FAULT CURRENT; 702.7(A) – EMERGENCY GENERATOR LOCATION; 702.7(A).
6. SECURITY CONTROL PANEL LCP-SEC-LS76 TO BE SUBMITTED ON AND BUILT TO THE REQUIREMENTS OF THE DIVISION 18000 SPECIFICATIONS.
7. SUBMERSIBLE PUMPS TO BE LISTED AS CLASS 1 DIVISION 1, GROUP D
8. FOLLOW NEC 10' TAP RULE.

1

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1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

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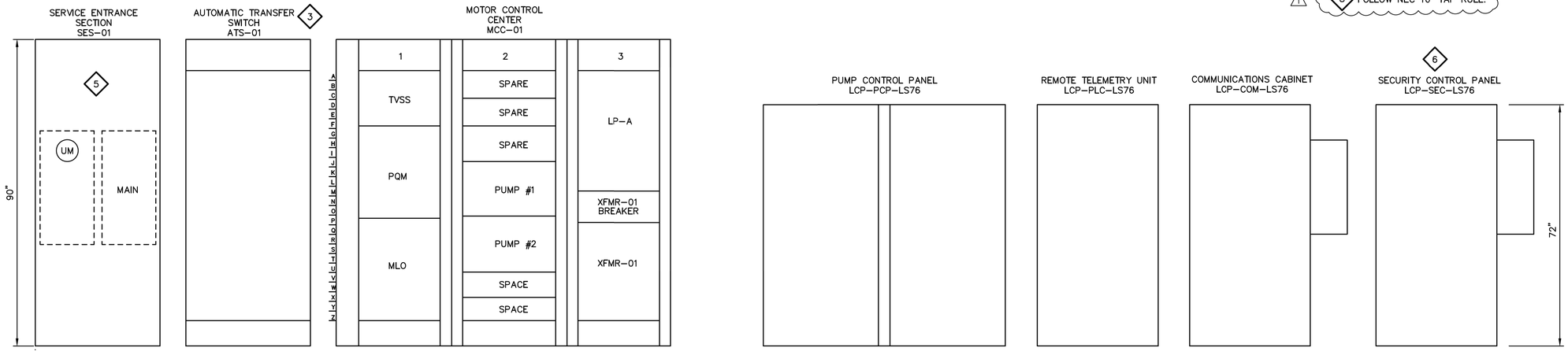
REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
42745
JAY A. HORAK
Date Signed 09-21-21
ARIZONA, U.S.A.



EQUIPMENT ELEVATION

REVISIONS				
NO.	BY	DATE	CKD	REMARKS
1	MW	7/1/2020		RFI 11
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DES TSL
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63292
LANE E.
INGRAM
JL/15/2018
ARIZONA, U.S.A.
EXPIRES 03/31/2020

Stanley Consultants

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
ELECTRICAL SINGLE LINE/EQUIPMENT ELEVATION

CITY PROJECT NO. WS90400067
DATE 03/2018
E SHEET 7 (30 OF 44)
CAD FILE: LS76-E007

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME
1	STANLEY CONSULTANTS	WS90400067	LIFT STATION 76	7-1-2020	LS76-E007
#	#	#	#	#	#

REMARKS	DWG NUMBER
RFI 11	30 OF 44

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KEYED NOTES

1. PHASE 2 AND PHASE 3 LOAD SUMMARIES DEPICT ANTICIPATED LOADS FOR FUTURE SITE CAPACITY UPGRADES PROJECTS.

RFI 11

PANEL: LP-A — **MANUFACTURER: TBD**

VOLTAGE, PHASE & WIRE: 120/240 VAC 1Ø, 3W — **LOCATION:** LS-76 Inside MCC

BUS SIZE: 1 225 ~~100~~ AMPS — **ENCLOSURE:** Nema 3R

MAIN SIZE: 150 ~~100~~ AMPS — **MOUNTING:** MCC Section

MAIN TYPE: ~~MCB~~ — **BUS BRACING:** 22kAIC

MAIN TYPE: Bolt-On — **FED FROM:** XFMR-01 45KVA

CKT NO.	LOAD DESCRIPTION	CKT. BKR. AMP	AMPS A	AMPS B	AMPS A	AMPS B	CKT. BKR. AMP	LOAD DESCRIPTION	CKT NO.
1	EXTERIOR 120VAC OUTLETS	20	6.0		6.0		20	ALCP-100	2
3	GENERATOR BATTERY CHARGER	20		4.5		0.0	20	SPARE	4
5	GENERATOR BLOCK HEATER	20	12.5		5.0		20	LCP-PCP-LS76 UPS	6
7	EXTERIOR 240VAC OUTLET	20		3.0		1.0	20	LCP-SEC-LS76	8
9			3.0		5.0		20	LCP-PLC-LS76 UPS POWER	10
11	LCP-PLC-LS76 LIGHT & RCPT	20		2.0		14.0	20	LCP-SEC-LS76 AIR CONDITIONER	12
13	LCP-PCP-LS76 LIGHT & RCPT	20	2.0		10.0		20	LCP-COM-LS76	14
15	LCP-PCP-LS76 - PUMP #1 CONTROL PWR	20		2.0		5.0	20	LCP-COM-LS76 AIR CONDITIONER	16
17	LCP-PCP-LS76 - PUMP #2 CONTROL PWR	20	2.0		6.0		20	SITE LIGHTING	18
19	SHADE CANOPY LIGHTING & RECEPT	20		3.0		13.0	20	NORTH GATE CONTROLLER	20
21	SOUTH GATE CONTROLLER	20	13.0		13.0		20		22
23		20		13.0		0.0	20	SPARE	24
25	SPACE							SPACE	26
27	MAIN	100						SPACE	28
29								SPACE	30

NOTES:

KVA A PHASE= 12.5 **AMPS A PHASE=** 104.4

KVA B PHASE= 9.1 **AMPS B PHASE=** 75.6

TOTAL KVA = 21.6 (Load totals are calculated as continuous duty at 125%)

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

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REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer — 42745 JAY A. HORAK — Date Signed 09-7-20 — ARIZONA, U.S.A.

PHASE 1 LOAD SUMMARY

FAC/AREA (ZONE/SITE): LIFT STATION 76
EQUIPMENT LOCATION:
TAG NAME: MCC-01
FED FROM: SES-01

MANUFACTURER: TBD
VOLTS/PHASE/WIRE: 480VAC / 3 PHASE / 4 WIRE
MAIN BUS RATING: 600
MAIN BREAKER (AMPS): 600
AIC RATING (AMPS): 65 KAIC
MAIN LUG ONLY: YES

SECTION NO.	TAG/CMMS NUMBER	BREAKER SIZE	STARTER SIZE	FEEDER CABLE SIZE	EQUIPMENT NAME	KVA	HP	FLA	BREAKER TRIP RATING
J2		MCP	3		PUMP #1		35	46.0	60A
P2		MCP	3		PUMP #2		35	46.0	60A
N3		125A	N/A		XFMR-01	45	N/A	93.8	125A
A1		15A	N/A		TVSS		N/A	2.0	15A
G1		N/A	N/A		PQM		N/A	2.0	15A
SUBTOTAL OF FLA FOR NON-MOTOR LOADS (KVA):						45.0		54.2	
SUBTOTAL OF FLA FOR MOTOR LOADS:								189.8	
PLUS 25% OF LARGEST MOTOR:								23.44	
TOTAL AMPS								267.3	
% LOADED (NO LARGER THAN 80% OF SELECTED LOAD SERVICE SIZE):								44.6%	

PHASE 2 LOAD SUMMARY

FAC/AREA (ZONE/SITE): LIFT STATION 76
EQUIPMENT LOCATION:
TAG NAME: MCC-01
FED FROM: SES-01

MANUFACTURER: TBD
VOLTS/PHASE/WIRE: 480VAC / 3 PHASE / 4 WIRE
MAIN BUS RATING: 600
MAIN BREAKER (AMPS): 600
AIC RATING (AMPS): 65 KAIC
MAIN LUG ONLY: YES

1

SECTION NO.	TAG/CMMS NUMBER	BREAKER SIZE	STARTER SIZE	FEEDER CABLE SIZE	EQUIPMENT NAME	KVA	HP	FLA	BREAKER TRIP RATING
J2		MCP	4		PUMP #1		54	61.0	110A
P2		MCP	4		PUMP #2		54	61.0	110A
N3		125A	N/A		XFMR-01	45	N/A	93.8	125A
A1		30A	N/A		TVSS		N/A	2.0	30A
G1		N/A	N/A		PQM		N/A	2.0	N/A
		MCP	1		BIOFILTER BLOWER		0.75	1.6	
SUBTOTAL OF FLA FOR NON-MOTOR LOADS (KVA):						45.0		54.2	
SUBTOTAL OF FLA FOR MOTOR LOADS:								221.4	
PLUS 25% OF LARGEST MOTOR:								23.44	
TOTAL AMPS								298.9	
% LOADED (NO LARGER THAN 80% OF SELECTED LOAD SERVICE SIZE):								49.8%	

PHASE 3 LOAD SUMMARY

FAC/AREA (ZONE/SITE): LIFT STATION 76
EQUIPMENT LOCATION:
TAG NAME: MCC-01
FED FROM: SES-01

MANUFACTURER: TBD
VOLTS/PHASE/WIRE: 480VAC / 3 PHASE / 4 WIRE
MAIN BUS RATING: 800
MAIN BREAKER (AMPS): 800
AIC RATING (AMPS): 65 KAIC
MAIN LUG ONLY: YES

1

SECTION NO.	TAG/CMMS NUMBER	BREAKER SIZE	STARTER SIZE	FEEDER CABLE SIZE	EQUIPMENT NAME	KVA	HP	FLA	BREAKER TRIP RATING
J2		225A	RVSS	TBD	PUMP #1		150	188.0	225A
P2		225A	RVSS	TBD	PUMP #2		150	188.0	225A
N3		125A	N/A	TBD	XFMR-01	45	N/A	93.8	125A
A1		30A	N/A	TBD	TVSS		N/A	2.0	30A
G1		N/A	N/A	TBD	PQM		N/A	2.0	N/A
		MCP	1	TBD	BIOFILTER BLOWER		0.75	1.6	
SUBTOTAL OF FLA FOR NON-MOTOR LOADS (KVA):						45.0		54.2	
SUBTOTAL OF FLA FOR MOTOR LOADS:								475.4	
PLUS 25% OF LARGEST MOTOR:								47.00	
TOTAL AMPS								576.5	
% LOADED (NO LARGER THAN 80% OF SELECTED LOAD SERVICE SIZE):								72.1%	

FOR CITY OF PHOENIX USE ONLY – REFERENCE CID NUMBER: #

REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	REMARKS
1	STANLEY CONSULTANTS	WS90400067	LIFT STATION 76	7-1-2020	LS76-E008	RFI 11

DWG NUMBER 31 OF 44

Registered Professional Engineer — 53292 LANE E. INGRAM — 11/13/2018 — ARIZONA, U.S.A. — EXPIRES 03/31/2020

Stanley Consultants

REVISIONS				
NO.	BY	DATE	CKD	REMARKS
1	MW	7/1/2020		RFI 11
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DWN TSL
CKD LEI

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
PANEL AND LOAD SCHEDULES

CITY PROJECT NO. WS90400067
DATE 03/2018
E SHEET 8 (31 OF 44)
CAD FILE: LS76-E008

USER: 9402 FILE: Z:\26866\11-CADD\Electrical\LS76-E008.dwg DATE: 9/30/21 TIME: 01:05pm

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FOR CONSTRUCTION

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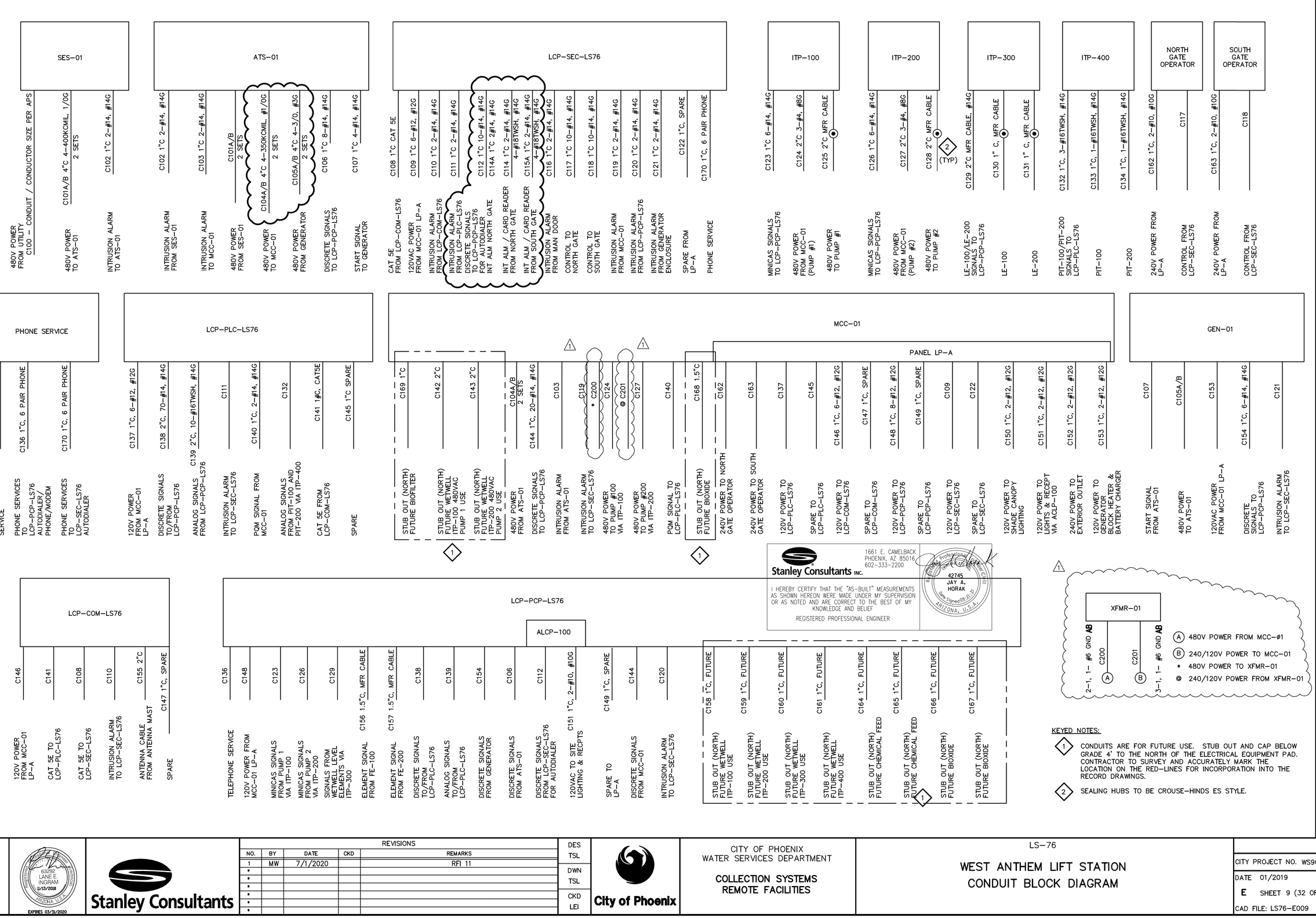

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

I HEREBY CERTIFY THAT THE "AS-BUILT" MEASUREMENTS AS SHOWN HEREON WERE MADE UNDER MY SUPERVISION OR AS NOTED AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF

REGISTERED PROFESSIONAL ENGINEER

42745
JAY A. HORAK
Date Signed 09-01-20
ARIZONA, U.S.A.

KEYED NOTES:

1. CONDUITS ARE FOR FUTURE USE. STUB OUT AND CAP BELOW GRADE 4' TO THE NORTH OF THE ELECTRICAL EQUIPMENT PAD. CONTRACTOR TO SURVEY AND ACCURATELY MARK THE LOCATION ON THE RED–LINES FOR INCORPORATION INTO THE RECORD DRAWINGS.
2. SEALING HUBS TO BE CROUSE–HINDS ES STYLE.

FOR CITY OF PHOENIX USE ONLY – REFERENCE CID NUMBER: #

REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER
1	STANLEY CONSULTANTS	WS90400067	LIFT STATION 76	7-1-2020	LS76-E009	32 OF 44

REMARKS: RFI 11

EXPIRES 03/31/2020

Stanley Consultants

REVISIONS					DES
NO.	BY	DATE	CKD	REMARKS	TSL
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City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS–76

WEST ANTHEM LIFT STATION
CONDUIT BLOCK DIAGRAM

CITY PROJECT NO. WS90400067
DATE 01/2019
E SHEET 9 (32 OF 44)
CAD FILE: LS76–E009

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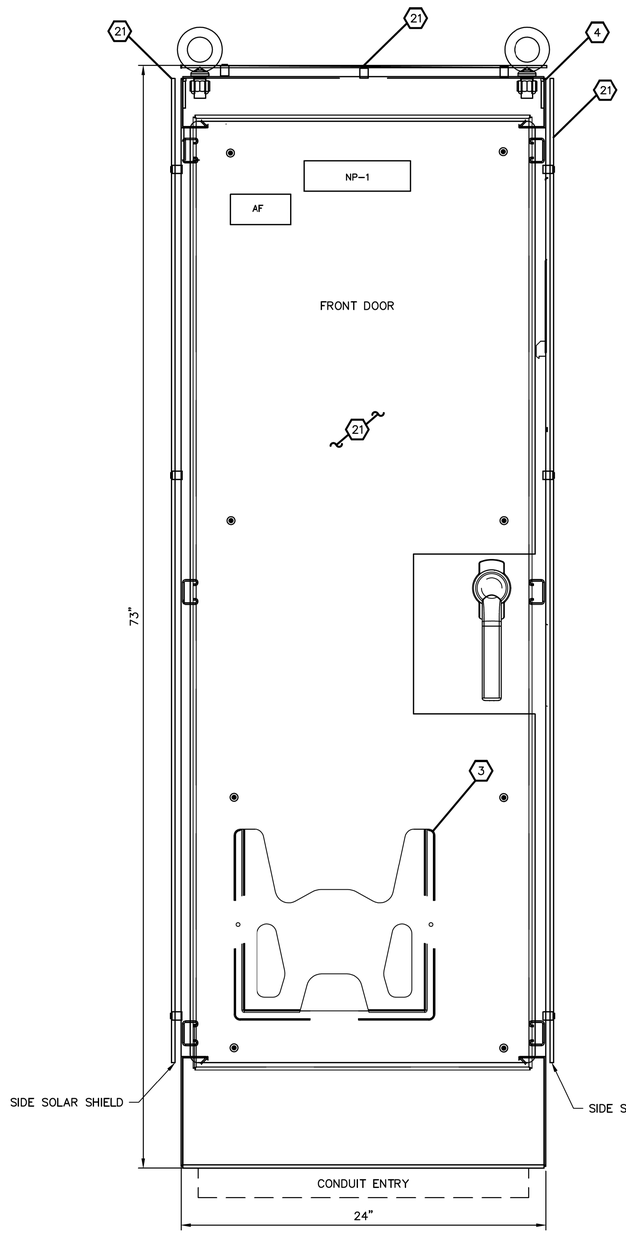
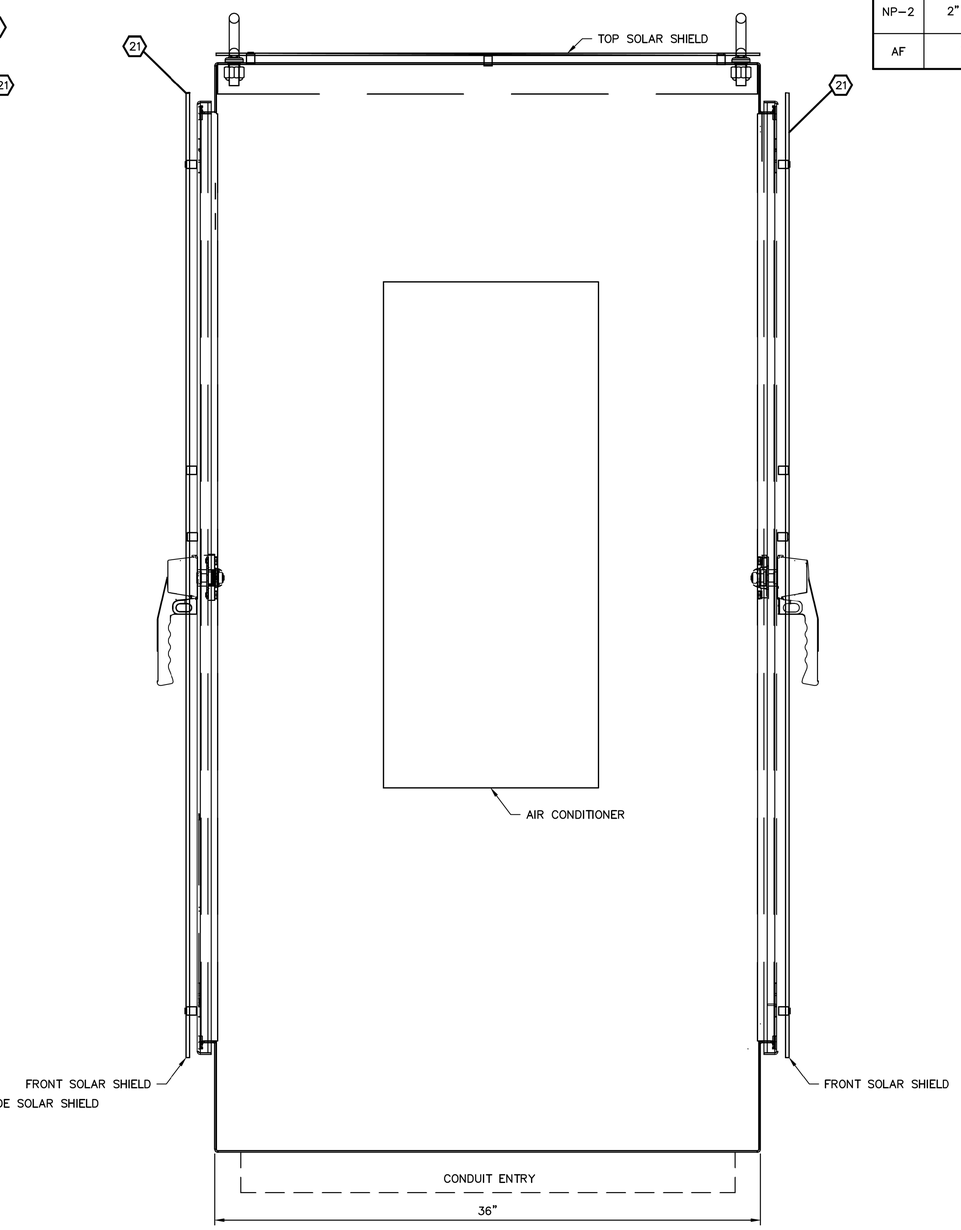


FRONT ELEVATION



SIDE ELEVATION

NAMEPLATE SCHEDULE

No.	SIZE AND TEXT	FIRST LINE	SECOND LINE	THIRD LINE
NP-1	1-1/2" x 6", 1/8" LETTERS	MAN. DATA PER 17260	CIRCUIT DATA PER 17260	CIRCUIT DATA PER 17260
NP-2	2" x 7", 1/2" LETTERS	RADIO PANEL	LCP-COM-LS76	
AF	ARC FLASH LABEL <GENERIC LABEL>			

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
42745
JAY A.
HORAK
Date Signed 09-21-21
ARIZONA, U.S.A.

GENERAL NOTES:

1. ALL NAMEPLATES SHALL BE BLACK LETTERING ON WHITE BACKGROUND.
2. CONTROL PANELS SHALL BE FURNISHED IN ACCORDANCE WITH THE REQUIREMENTS AS SHOWN ON THE DRAWINGS, AND AS SPECIFIED IN DIVISION 17000, SECTIONS 17051, 17052, 17053, 17226 AND 17260.
3. CONTRACTOR TO PROVIDE CONTROL PANEL SCHEMATICS AS PART OF PANEL SUBMITTAL.
4. NEMA 4X, 316 SS, 14 GAUGE PANEL.
5. SOLAR SHIELDS AND AIR CONDITIONER TO BE INSTALLED PER THE REQUIREMENTS OF SPECIFICATION 17260.
6. CONTROL PANEL TO BE CONSTRUCTED AND LABELED TO THE REQUIREMENTS OF NEC 409.3, 4.9.110, AND 409.110.3(B).
7. NAMEPLATE SCHEDULE TO BE COMPLETED PER TEH REQUIREMENTS OF 17260.

FOR CITY OF PHOENIX USE ONLY - REFERENCE CID NUMBER: #

REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	REMARKS

62292
LANE E.
INGRAM
11/13/2018
REGISTERED PROFESSIONAL ENGINEER
ARIZONA, U.S.A.
EXPIRES 03/31/2020

Stanley Consultants

REVISIONS				
NO.	BY	DATE	CKD	REMARKS

DES TSL
DWN TSL
CKD LEI

City of Phoenix

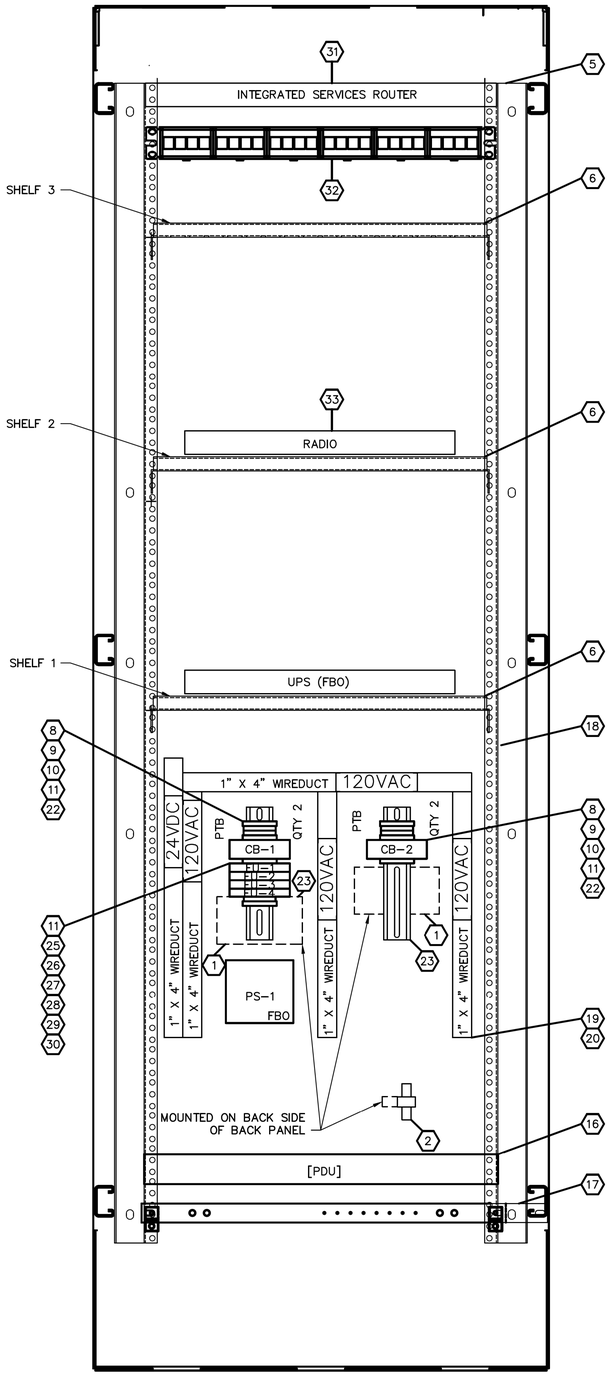
CITY OF PHOENIX
WATER SERVICES DEPARTMENT

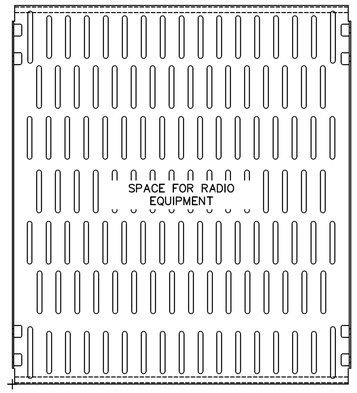
COLLECTION SYSTEMS
REMOTE FACILITIES

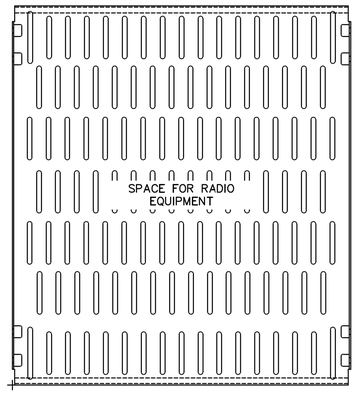
LS-76

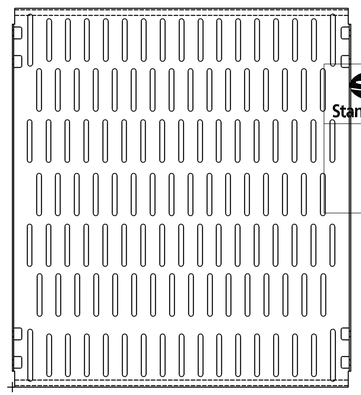
WEST ANTHEM LIFT STATION
COMMUNICATIONS CABINET - LCP-COM-LS76
EXTERIOR ELEVATION

CITY PROJECT NO. WS90400067
DATE 03/2018
E SHEET 10 (33 OF 44)
CAD FILE: LS76-E010









Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
42745
JAY A.
HORAK
Date Signed 09-21-21
ARIZONA, U.S.A.

BILL OF MATERIALS

ITEM	QTY	MANUFACTURER	PART NUMBER	UL/UR NUMBER	DESCRIPTION
1	2	POLYPHASER	IX-2H1DC56-IG	QVGQ2.E229916	SUPPRESSOR, LIGHTNING, CAT5, ISOLATED GROUND
2	1	POLYPHASER	IS-50NX-C2	N/A	SUPPRESSOR, LIGHTNING, 125-1000MHZ
3	1	HOFFMAN	ADP3	E61997	ENCLOSURE, ACCESSORY, DATA POCKET, METAL 12" X 12" X 3.5"
4	1	HOFFMAN	A722436SSFSDAN4-MOD	E61997	ENCLOSURE, 72"H X 24"W X 36"D, NEMA 4X, 316SS, FRONT AND REAR DOORS
5	2	HOFFMAN	A72RA19TH	N/A	ENCLOSURE, ACCESSORY, 19" RACK ANGLES, 14 GAUGE STEEL, 7MM DIA HOLES, 61.25"L (SET OF 2)
6	3	HOFFMAN	A19SH6	N/A	ENCLOSURE ACCESSORY, SHELF, FIXED, 14 GAUGE STEEL, LARGE VENTILATION SLOTS
7	1	HOFFMAN	CR290216G036	ACVS2.SA6453	AIR CONDITIONING, SIDE MOUNT, NEMA 4X, SS, 2200BTU/HR, 115V, 50/60HZ
8	2	EATON	FAZ-C20/1-NA-SP	E235139	BREAKER, UL 489, THERMAL-MAGNETIC, 10KA RATING, 20A, 1-POLE, C CURVE, (TMC 1 M1 100 20A)
9	4	PHOENIX CONTACT	3004362	XCFR.E60425	TERMINAL BLOCK SIGNAL TIER, FEED THROUGH, 600V, 30A, #10-30 AWG, GRAY (UK5N)
10	2	PHOENIX CONTACT	3003020	XCFR.E60425	TERMINAL BLOCK, END COVER, GRAY (UK5N)
11	7	PHOENIX CONTACT	0800886	XCFR.E60425	TERMINAL BLOCK, END BARRIER (E/NS 35 N)
12	A/R	CAROL/GENERAL CABLE	76822.01	ZKHZ.E90495	WIRE 600V, MTW, STRANDED, #12 AWG. BLACK
13	A/R	CAROL/GENERAL CABLE	76822.02	ZKHZ.E90495	WIRE 600V, MTW, STRANDED, #12 AWG. WHITE
14	A/R	CAROL/GENERAL CABLE	76822.03	ZKHZ.E90495	WIRE 600V, MTW, STRANDED, #12 AWG. GREEN
15	A/R	GENERAL CABLE	496517-GREEN	E90494	WIRE, 600V, UL TYPE XHHW-2, #6 AWG, GREEN XLPE INSULATION, GROUND
16	1	HOFFMAN	DP1N191020ST	E303970	NETWORKING MANAGEMENT, CABLE/POWER, POWER DISTRIBUTION UNIT, SURGE PROTECTION, 120VAC, 20A, RECEPTS: 2 FRONT/8 BACK NEMA 5-20R, 1RU
17	1	HOFFMAN	DG19	E319377	ENCLOSURE ACCESSORY, KIT, BAR, GROUND, RACK MOUNTED, HORIZONTALLY, COPPER ALLOY
18	1	HOFFMAN	P19RP10UP	N/A	ENCLOSURE, ACCESSORY, PANEL, 19-INCH, OPEN FRAME RACK MOUNTED
19	A/R	PANDUIT	F1X2LG6	RJTY.E95425	WIRE DUCT, NARROW SLOT, LT GRAY 1"W X 2"H
20	A/R	PANDUIT	C1LG6	RJTY.E95425	WIRE DUCT, COVER, LT GRAY, FOR 1" WIRE DUCT
21	5	HOFFMAN	CUSTOM BY HOFFMAN	N/A	SOLAR SHIELD, 10 GAUGE ALUMINUM, PAINTED WHITE
22	2	EATON	Z-IHK-NA	E177451	BREAKER, ACCESSORY, AUXILIARY CONTACT, 1 CONTACT
23	A/R	PHOENIX CONTACT	0801733	XCFR2.E60425	DINRAIL
24					
25	3	PHOENIX CONTACT	3046090	XCFR.E60425	DC FUSED TERMINAL BLOCK UT 4-HESILA 24 (5X20), 6KV SURGE
26	1	PHOENIX CONTACT	3046100	XCFR.E60425	AC FUSED TERMINAL BLOCK UT 4-HESILA 250 (5X20), 4KV SURGE
27	1	BUSSMAN	GMC-4A	JDYX.E19180	FUSE, 5X20MM, GLASS TYPE, TIME DELAY, 4A
28	3	BUSSMAN	GMC-2A	JDYX.E19180	FUSE, 5X20MM, GLASS TYPE, TIME DELAY, 2A
29	1	PHOENIX CONTACT	2775375	XCFR.E60425	TERMINAL BLOCK, SINGLE TIER, FEED-THROUGH, DOUBLE CONNECTION, 500V, 24A, #10-#30 AWG, GRAY (UDK 3)
30	1	PHOENIX CONTACT	2775113	XCFR.E60425	TERMINAL BLOCK, END COVER, GRAY (FOR 2775375)
31	1	CISCO	C819H-K9	UL 60950-1	ROUTER W/ THE FOLLOWING FEATURES / OPTIONS: CON-SNTC819HK9, SL-810-AIS, FL-C810-WAASX, ISR-CCP-EXP, SL-810-ADVSEC, S81HUK9-15602T, ACS-810-DM
32	1	PANDUIT	NKFP24Y		24 PORT MODULAR PATCH PANEL
33	1	RADWIN	RW-55A0-0150		RADIO

GENERAL NOTES:

1. ALL NAMEPLATES SHALL BE BLACK LETTERING ON WHITE BACKGROUND.
2. CONTROL PANEL TO BE CONSTRUCTED AND LABELED TO THE REQUIREMENTS OF NEC 409.3, 4.9.110, AND 409.110.3(B).
3. LCP-COM-LS76 TO BE PROVIDED WITH AN AIR CONDITIONER AND SOLAR SHIELDS PER THE REQUIREMENTS OF SPECIFICATION 17260.

CIRCUIT BREAKER SCHEDULE

CB NO.	NO. OF POLES	RATING	PURPOSE	RUNG NO.
1	1	20A	UPS / 24 VDC	10
2	1	20A	AIR CONDITIONING UNIT	3

FUSE SCHEDULE

FUSE NO.	MANUFACTURER	RATING	PURPOSE	RUNG NO.
FU-1	BUSSMAN	1A (TD)	POWER SUPPLY	19
FU-2	BUSSMAN	2A (TD)	RADIO	22
FU-3	BUSSMAN	2A (TD)	SPARE	24
FU-4	BUSSMAN	2A (TD)	SPARE	26

FOR CITY OF PHOENIX USE ONLY - REFERENCE CID NUMBER: #

REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	CAD FILE NAME	DATE	DWG NUMBER
#						

REMARKS

Registered Professional Engineer
63292
LANE E. INGRAM
11/13/2018
ARIZONA, U.S.A.

Stanley Consultants

REVISIONS				
NO.	BY	DATE	CKD	REMARKS
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DWN TSL
CKD

City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
COMMUNICATIONS CABINET - LCP-COM-LS76
INTERIOR ELEVATION / BOM

CITY PROJECT NO. WS90400067

DATE 03/2018

E SHEET 11 (34 OF 44)

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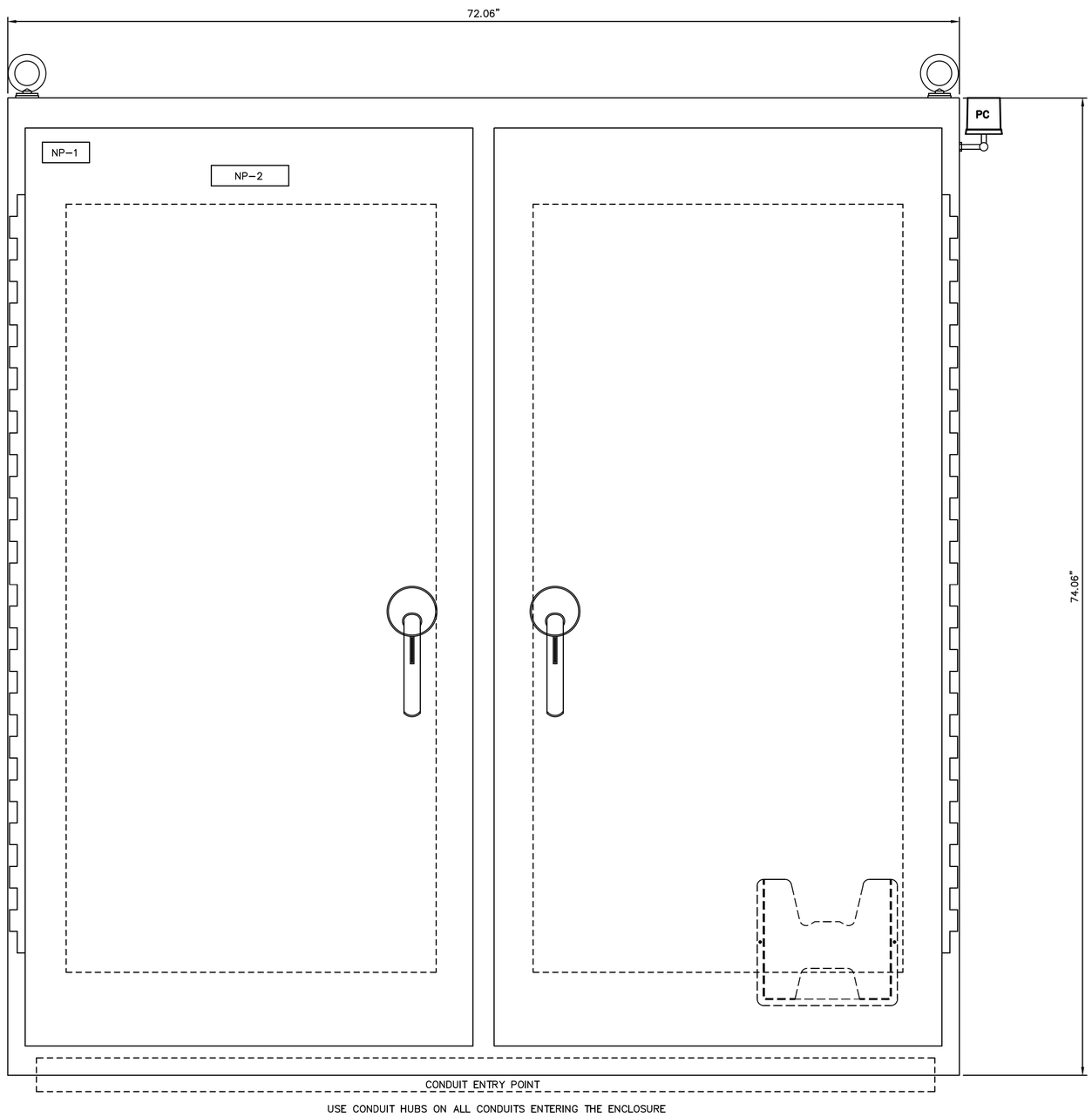

USE CONDUIT HUBS ON ALL CONDUITS ENTERING THE ENCLOSURE

NAMEPLATE SCHEDULE					
NO.	SIZE AND TEXT	FIRST LINE	SECOND LINE	THIRD LINE	FOURTH LINE
NP-1	1-1/2"X3" 3/16" LETTERS	PANEL MFR	20A, 120VAC, 60HZ	1 PHASE	
NP-2	2"X7" 1/2" LETTERS	LCP-PCP-LS76	LIFT STATION 76	PUMP CONTROL PANEL	

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
42745
JAY A. HORAK
Date Signed 09-01-21
ARIZONA, U.S.A.

GENERAL NOTES:

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FOR CITY OF PHOENIX USE ONLY - REFERENCE CID NUMBER: #

REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	REMARKS	DWG NUMBER
#							

Registered Professional Engineer
63292
LANE E. INGRAM
11/13/2018
ARIZONA, U.S.A.
EXPIRES 03/31/2020

Stanley Consultants

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NO.	BY	DATE	CKD	REMARKS
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City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
PUMP CONTROL PANEL - LCP-PCP-LS76
FRONT ELEVATION/EXTERIOR LAYOUT

CITY PROJECT NO. WS90400067
DATE 03/2018
E SHEET 12 (35 OF 44)
CAD FILE: LS76-E012

USER: 9402 FILE: Z:\26866\11-CADD\Electrical\LS76-E012.DWG DATE: 9/21/21 TIME: 02:47pm

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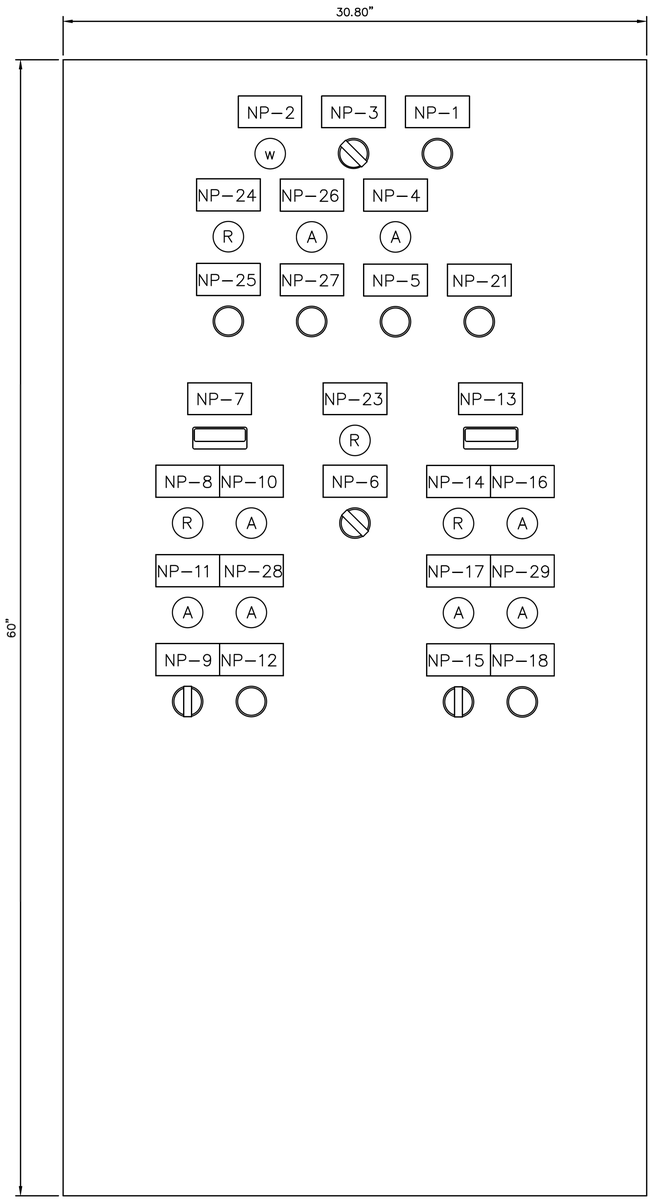
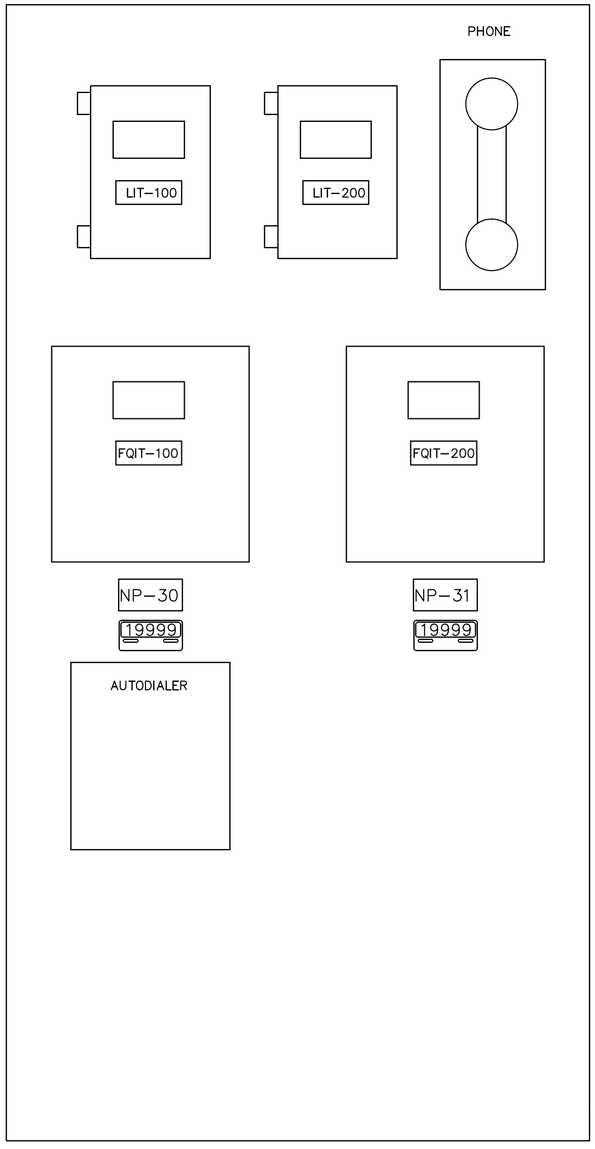


LEFT SWING PANEL



RIGHT SWING PANEL

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
42745
JAY A.
HORAK
Date Signed 09-21-21
ARIZONA, U.S.A.

GENERAL NOTES:

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3. CONTROL PANEL TO BE CONSTRUCTED AND LABELED TO THE REQUIREMENTS OF NEC 409.3, 4.9.110, AND 409.110.3(B).

FOR CITY OF PHOENIX USE ONLY - REFERENCE CID NUMBER: #

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Registered Professional Engineer
63292
LANE E.
INGRAM
11/13/2018
ARIZONA, U.S.A.
EXPIRES 03/31/2020

Stanley Consultants

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City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
PUMP CONTROL PANEL - LCP-PCP-LS76
SWING-PANEL INTERIOR LAYOUT

CITY PROJECT NO. WS90400067
DATE 03/2018
E SHEET 13 (36 OF 44)
CAD FILE: LS76-E013

USER: 9402 FILE: Z:\26866\11-CADD\Electrical\LS76-E013.DWG DATE: 9/21/21 TIME: 03:03pm

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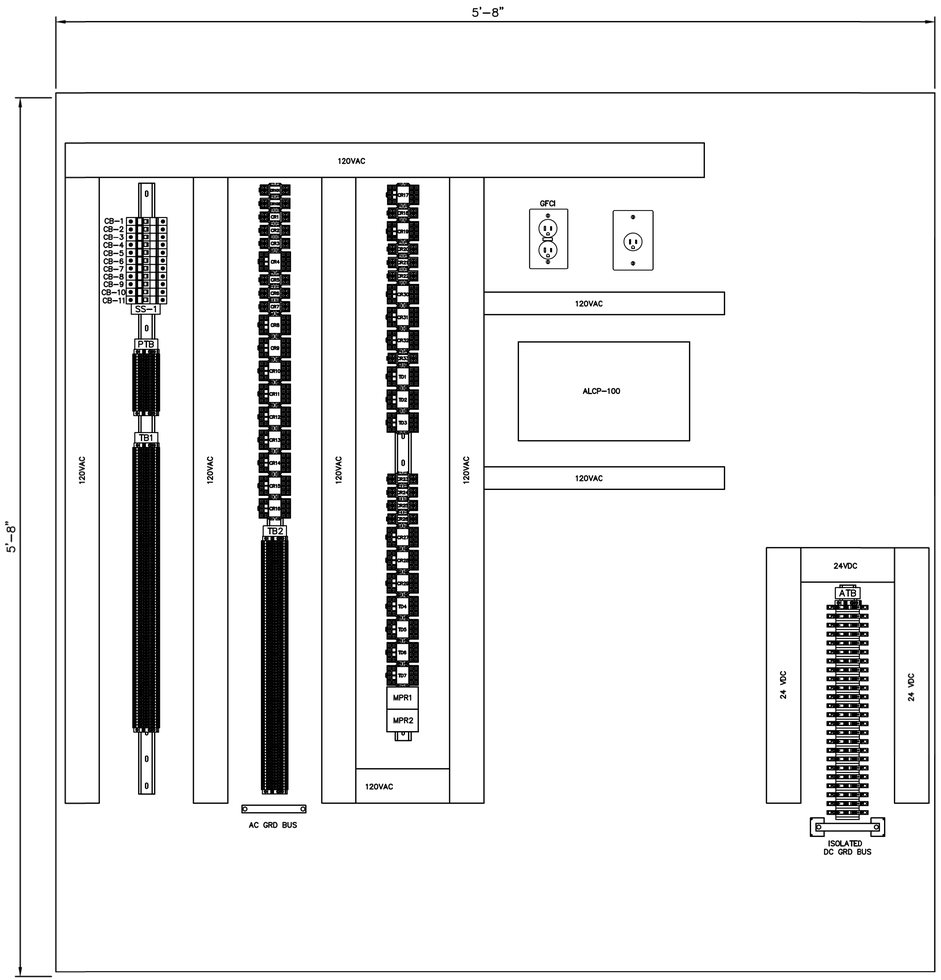
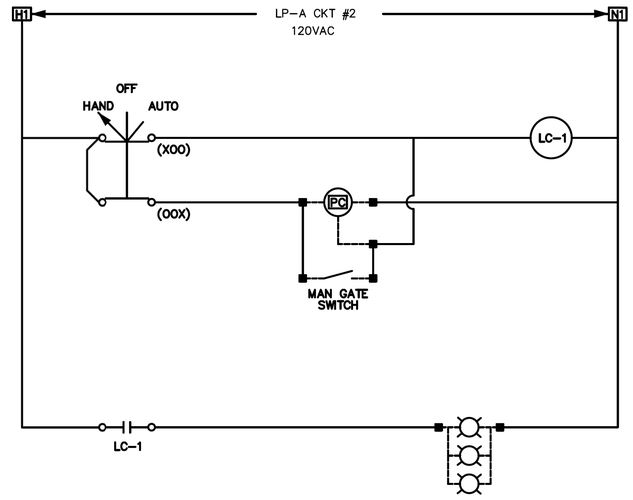


AREA LIGHTING

ALCP-100



Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
42745
JAY A. HORAK
Date Signed 09-21-21
ARIZONA, U.S.A.

GENERAL NOTES:

1. CONTROL PANEL LAYOUT SHOWN IS APPROXIMATE AND FOR ILLUSTRATION PURPOSES ONLY. NOT ALL NECESSARY COMPONENTS HAVE BEEN DEPICTED. CONTRACTOR AND PANEL VENDOR TO DETERMINE SPECIFIC CONFIGURATION BASED ON CONTRACT P & ID'S SPECIFICATION 17051 PROCESS CONTROL DESCRIPTIONS AND SPECIFICATIONS 17260, CONTROL PANELS.
2. CONTROL PANEL TO BE CONSTRUCTED AND LABELED TO THE REQUIREMENTS OF NEC 409.3, 4.9.110, AND 409.110.3(B).

FOR CITY OF PHOENIX USE ONLY - REFERENCE CID NUMBER: #

REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS
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63292
LANE E. INGRAM
11/13/2018
REGISTERED PROFESSIONAL ENGINEER
ARIZONA, U.S.A.
EXPIRES 03/31/2020

Stanley Consultants

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City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
PUMP CONTROL PANEL - LCP-PCP-LS76
INTERIOR ELEVATION

CITY PROJECT NO. WS90400067
DATE 03/2018
E SHEET 14 (37 OF 44)
CAD FILE: LS76-E014

USER: 9402 FILE: Z:\26866\11-CADD\Electrical\LS76-E014.DWG DATE: 9/21/21 TIME: 03:12pm

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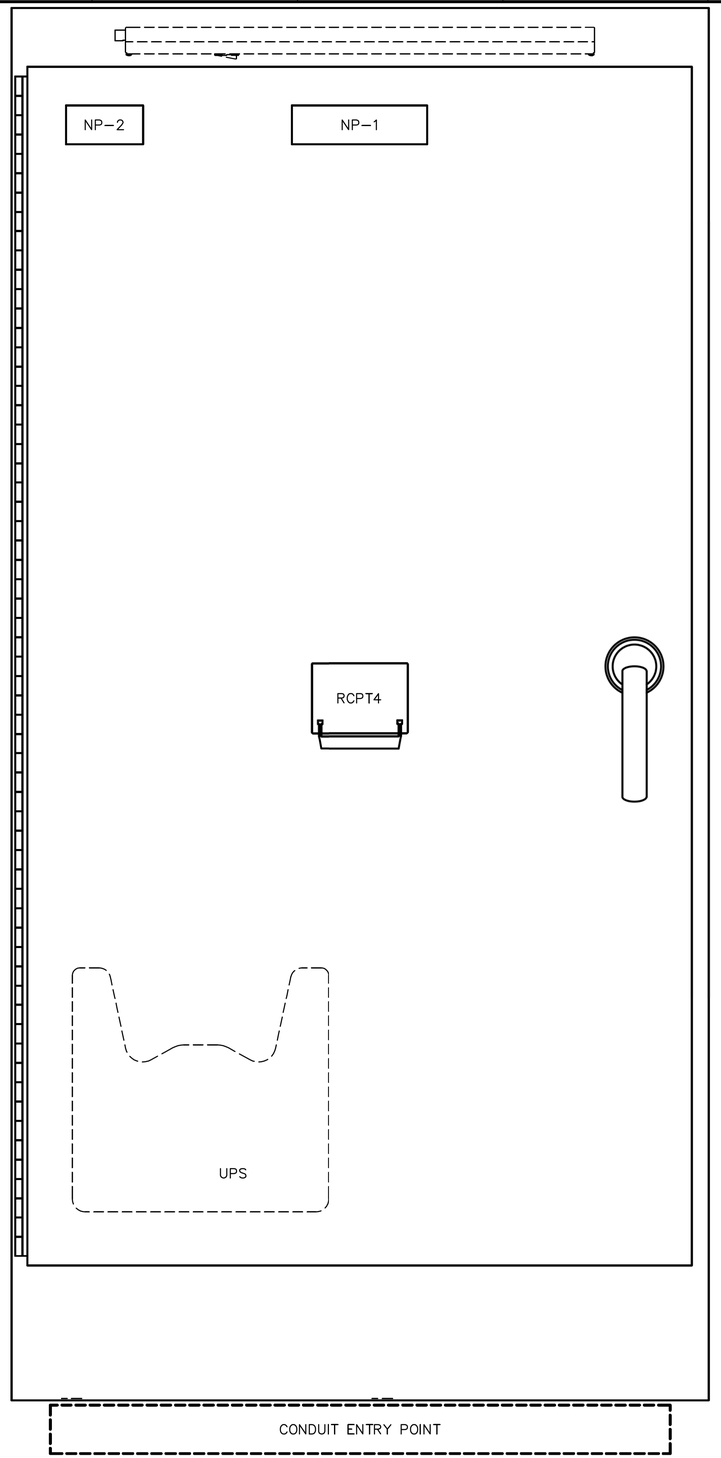

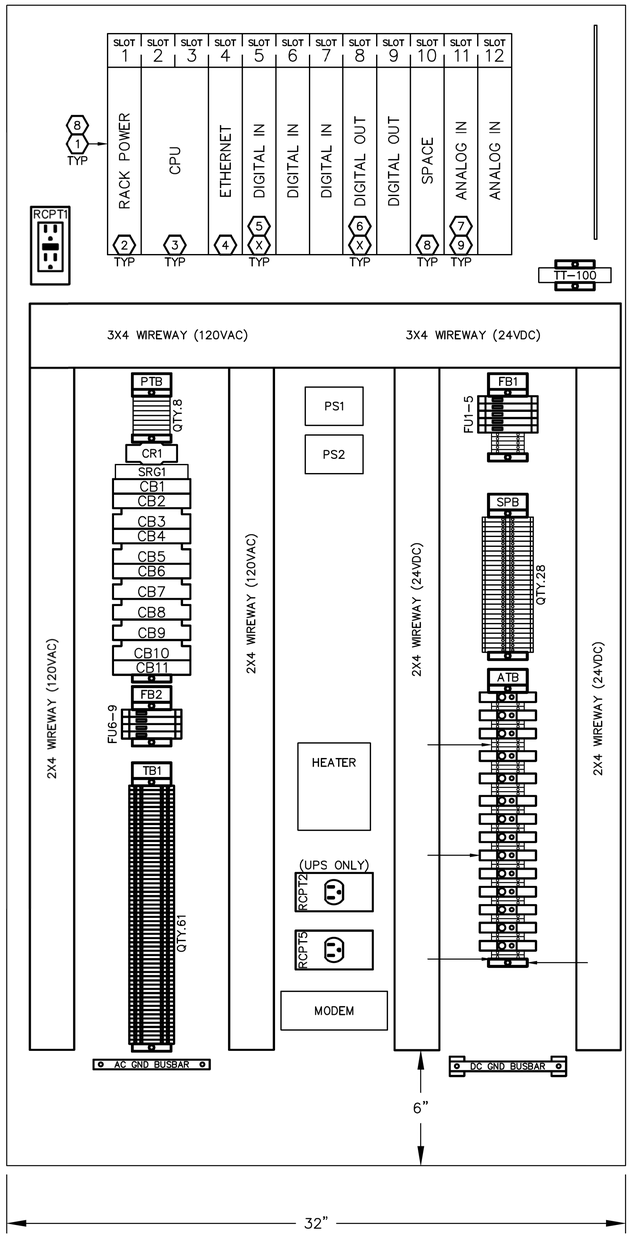

BILL OF MATERIALS

ITEM	QTY	MANUFACTURER	PART NUMBER	UL/UR NUMBER	DESCRIPTION
1	**1**	MODICON	BMEXBP1200H		12 SLOT ETHERNET BACKPLANE, HARDENED
2	1	MODICON	BMXCPS3500H		POWER SUPPLY FOR MODICON X80, HARDENED
3	1	MODICON	BMEP581020H		STANDALONE M580 CPU LEVEL 10, HARDENED
4	1	MODICON	BMENOC0301C		3-PORT ETHERNET COMMUNICATION X80 MODULE
5	**3**	MODICON	BMXDAI1604H		DIGITAL INPUT MODULE, X80, 16 CHANNEL, 120VAC, HARDENED
6	1	MODICON	BMXDRA1605H		DIGITAL OUTPUT MODULE, 16 CHANNEL, X80, HARDENED
7	**2**	MODICON	BMXAMI0810H		ANALOG INPUT MODULE, X80, 8 MULTI-RANGE CHANNEL, HARDENED
8	AR	MODICON	BMXXEM010		UNUSED SLOT CONNECTOR PROTECTIVE COVERS (KIT OF 5)
9	6	MODICON	BMXFTB2800		SCREW TYPE TERMINAL BLOCK (28 STD POINTS)
10	9	MODICON	BMXFTB2000		REMOVABLE TERMINAL BLOCK (20 STD POINTS)

Stanley Consultants INC.
1661 E. CAMELBACK
PHOENIX, AZ 85016
602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer (Civil)
42745
JAY A. HORAK
Date Signed 09-21-21
ARIZONA, U.S.A.

GENERAL NOTES:

1. ALL NAMEPLATES SHALL BE BLACK LETTERING ON WHITE BACKGROUND.
2. CONTROL PANELS SHALL BE FURNISHED IN ACCORDANCE WITH THE REQUIREMENTS AS SHOWN ON THE DRAWINGS, AND AS SPECIFIED IN DIVISION 17000, SECTIONS 17051, 17052, 17053, 17260, AND 17262.
3. CONTRACTOR TO PROVIDE CONTROL PANEL SCHEMATICS AS PART OF PANEL SUBMITTAL.
4. NEMA 4X, 316 SS, 14 GAUGE PANEL.
5. SOLAR SHIELDS TO BE INSTALLED PER THE REQUIREMENTS OF SPECIFICATION 17260.
6. CONTROL PANEL TO BE CONSTRUCTED AND LABELED TO THE REQUIREMENTS OF NEC 409.3, 4.9.110, AND 409.110.3(B).

FOR CITY OF PHOENIX USE ONLY - REFERENCE CID NUMBER: #

REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	REMARKS	DWG NUMBER
#							

63292
LANE E. INGRAM
11/15/2018
ARIZONA, U.S.A.
EXPIRES 03/31/2020

Stanley Consultants

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City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
REMOTE TELEMETRY UNIT CONTROL PANEL
LCP-PLC-LS76

CITY PROJECT NO. WS90400067
DATE 03/2018
E SHEET 15 (38 OF 44)
CAD FILE: LS76-E015

USER: 9402 FILE: Z:\26866\11-CADD\Electrical\LS76-E015.dwg DATE: 9/21/21 TIME: 03:17pm

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INSTRUMENT IDENTIFICATION TABLE

LETTER	FIRST LETTER: MEASURED OR INITIATING VARIABLE	SUCCEEDING LETTERS: READOUT OUTPUT OR PASSIVE FUNCTION
A	ANALYSIS	ALARM
B	BURNER, COMBUSTION	CLOSE, STOP, DECREASE
C	CONDUCTIVITY, COMPUTER	CONTROL
D	DENSITY, DIFFERENTIAL	OPEN, START, INCREASE
E	VOLTAGE (EMP)	SENSOR (PRIMARY ELEMENT)
F	FLOW RATE, RATIO (FRACTION)	FORWARD
G	MOISTURE	GLASS, GAUGE, GATE
H	HAND	HIGH, OPENED
I	CURRENT (ELECTRICAL)	INDICATE
J	POWER, SCAN	–
K	TIME, TIME SCHEDULE, TIME RATE OF CHANGE	CONTROL STATION
L	LEVEL	LOW, CLOSED
M	MOTOR, MANUAL	MOMENTARY, MIDDLE, INTERMEDIATE
N	INTRUSION	ON OPERATE, RUNNING
O	–	ORIFICE, RESTRICTION, OVERLOAD
P	PRESSURE, VACUUM	POINT (TEST) CONNECTION
Q	QUANTITY, INTEGRATE, TOTALIZE	–
R	RADIATION	RECORD
S	SPEED, FREQUENCY, MOTION, SAFETY	SWITCH
T	TEMPERATURE	TRANSMIT
U	MULTIVARIABLE	MULTIFUNCTION
V	VIBRATION, VALVE	VALVE, DAMPER, LOUVER
W	WEIGHT, FORCE, TORQUE	WELL
X	UNCLASSIFIED, X-AXIS	UNCLASSIFIED
Y	EVENT, STATE, PRESENCE, Y-AXIS	RELAY, COMPUTE, CONVERT
Z	POSITION, DIMENSION, Z-AXIS	DRIVER, ACTUATOR, OR UNCLASSIFIED FINAL CONTROL ELEMENT

DEMOLITION

BASE INSTRUMENTATION SYMBOLS

FIELD MOUNTED

FACE OF MCC OR PANEL MOUNTED

INTERIOR OF PANEL MOUNTED

FIELD INDICATOR

PANEL INDICATOR

OPERATOR INTERFACE FUNCTION

AUXILLARY INTERFACE FUNCTION

PLC FUNCTION

IN-LINE

TAPPED OR SAMPLED

EXPOSED, SUBMERGED PROBE OR GAS DETECTOR

ANALYSIS INSTRUMENTS

ALKY = ALKALINITY
BOD = BIOCHEMICAL OXYGEN DEMAND
CH_4 = METHANE
CO_2 = CARBON DIOXIDE
COMB = COMBUSTIBLE GAS
CL_2 = CHLORINE
CLTR = CHLORINE TOTAL RESIDUAL
CLFR = CHLORINE FREE RESIDUAL
CO = CARBON MONOXIDE

DE = DENSITY
DO = DISSOLVED OXYGEN

F = FLUORIDE
$FeCL_3$ = FERRIC CHLORIDE

H_2S = HYDROGEN SULFIDE
H_2SO_4 = SULFURIC ACID
H_3PO_4 = PHOSPHORIC ACID
HC = HYDROCARBONS
HDNS = HARDNESS
HUM = HUMIDITY

MOH = METHANOL

NH = AMMONIA
NO_3^4 = NITRIC OXIDE
N2 = NITROGEN

O_2 = OXYGEN
OP = ORTHO PHOSPHATE
ORP = OXIDATION REDUCTION POTENTIAL
OUR = OXYGEN UPTAKE RATE
OZ = OZONE

PH = pH

SD = SOLIDS DENSITY
SO2 = SULPHUR DIOXIDE

TOC = TOTAL ORGANIC CARBON
TOD = TOTAL OXYGEN DEMAND
TRB = TURBIDITY
TSS = TOTAL SUSPENDED SOLIDS

LEL = LOWER EXPLOSIVE LIMIT

HAND SWITCHES/PUSHBUTTONS

ACK = ACKNOWLEDGE
AM = AUTO/MANUAL
CAM = COMPUTER/AUTO/MANUAL
CLM = COMPUTER/LOCAL/MANUAL
CM = COMPUTER /MANUAL
COC = CLOSE/OPEN/COMPUTER

ESP = EMERGENCY STOP
ELOS = EMERGENCY LOCKOUT STOP

FJ = FORWARD JOG
FR = FORWARD/REVERSE
FS = FAST/SLOW
FOR = FORWARD/OFF/REVERSE
FOS = FAST/OFF/SLOW
FWD = FORWARD

HO = HAND/OFF
HOA = HAND/OFF/AUTO
HOC = HAND/OFF/COMPUTER
HOR = HAND/OFF/REMOTE
HOAR = HAND/OFF/AUTO/REMOTE

LC = LOCAL/COMPUTER
LT = LAMP TEST
LOC = LOCAL/OFF/COMPUTER
LOR = LOCAL/OFF/REMOTE
LOS = LOCKOUT STOP
LR = LOCAL/REMOTE

OAC = OPEN/AUTO/CLOSE
OC = OPEN/CLOSE
OCC = OPEN/CLOSE/COMPUTER
OO = ON/OFF
OSC = OPEN/STOP/CLOSE
POT = POTENTIOMETER
REV = REVERSE
RJ = REVERSE JOG
ROT = RUN/OFF/TEST
RS = RESET

SEL = SELECT
SIL = SILENCE
SLOS = START/LOCKOUT STOP
SM = SYSTEM/MANUAL
SP = STOP
SS = START/STOP
ST = START

TST = TEST

UD = UP/DOWN

SIGNAL CONDITIONERS

* = FUNCTION

AVG = AVERAGE
1:1 = REPEAT
1:X = BOOST (X=MULTIPLIER)
> = SELECT HIGHEST SIGNAL
< = SELECT LOWEST SIGNAL
X = BIAS
% = GAIN ATTENUATE
Δ = DIFFERENCE
Σ = SUM
$\times$ = MULTIPLY
$\div$ = DIVIDE
F(x) = CHARACTERIZED
$\sqrt{}$ = SQUARE ROOT
X^N = RAISED TO THE NTH POWER

SIGNAL CONVERTERS

* = INITIAL VARIABLE/CONVERTED VARIABLE

E = VOLTAGE
F = FREQUENCY
I = CURRENT
M = MOTOR
P = PNEUMATIC
PF = PULSE FREQUENCY
PD = PULSE DURATION
R = RESISTANCE

INDICATOR LIGHTS

LAH = LEVEL ALARM HIGH
MA = MOTOR OVERLOAD ALARM
MN = MOTOR RUN STATUS
PAH = PRESSURE ALARM HIGH
SA = STROBE ALARM
YA = VFD FAULT

SIGNAL LINE LEGEND

ELECTRIC SIGNAL
HYDRAULIC SIGNAL
PNEUMATIC SIGNAL
FIBER OPTIC MEDIUM
SOFTWARE LINK (E.G. RS232, 485)
CAPILLARY TUBE

CONTROL SYSTEM INPUTS & OUTPUTS

PULSE INPUT
PULSE OUTPUT
ANALOG INPUT
ANALOG OUTPUT
DIGITAL INPUT
DIGITAL OUTPUT

ELECTRICAL INTERLOCKS

= A UNIQUE NUMBER (1 OR 2 DIGITS) ASSIGNED AS REFERENCE TO THE PARTICULAR INTERLOCK

NOTE: IN THE INTERLOCK LEGEND, LOCATED AT THE BOTTOM OF A P&ID, A BRIEF DESCRIPTION OF THE INTERLOCK'S FUNCTION IS PROVIDED AS WELL AS A REFERENCE TO THE CONTROL SCHEMATIC DRAWING NUMBER WHICH REFERENCES THE INTERLOCK.

R
NOHC

NC = NORMALLY CLOSED
NO = NORMALLY OPEN
NOHC = NORMALLY OPEN HELD CLOSED
R = RELAY WITH EACH SIGNAL LINE LEAVING DENOTING A POLE
R = RELAY WITH EACH SIGNAL LINE LEAVING DENOTING A POLE

7-DIGIT SERIALIZED KEY

XXXXXXX

NOTE: ALL VALVES, INSTRUMENTS, MOTORS, EQUIPMENT, ETC. ARE TO HAVE A FIXED 7-DIGIT SERIAL NUMBER. THIS NUMBER IS TO BE ASSIGNED TO THE PROJECT BY THE CITY'S PROJECT MANAGER.

EQUIPMENT PROVIDED BY OTHERS

V* DENOTES VENDOR PACKAGE BOUNDARY

V* = VENDOR PROVIDED INDIVISUAL PIECE OF EQUIPMENT
O* = OWNER PROVIDED INDIVISUAL PIECE OF EQUIPMENT

FLOW STREAM LINE LEGEND

XXXX-YY" PRIMARY FLOW STREAM
XXXX-YY SECONDARY FLOW STREAM
XXXX-YY TERTIARY FLOW STREAM

NOTE: XX IDENTIFIES THE FLOWSTREAM. SEE ABBREVIATIONS BELOW. ARROWS AND FLOW STREAM IDENTIFICATION TO BE LOCATED BEFORE AND AFTER EACH PIECE OF EQUIPMENT ON P&ID AS SPACE PERMITS. YY DENOTES LINE SIZE IN INCHES

DRAWING CONTINUATION LEGEND

NN/XX TO PROC/EQP — FLOW STREAM NO. NN TO DWG. NO. XX
FROM PROC/EQP NN/XX — SIGNAL NO. NN FROM DWG. NO. XX
FROM PROC/EQP TO PROC/EQP — FLOW STREAM TO OR FROM EQUIPMENT NOT SHOWN ON OTHER DRAWINGS.
FLOW STREAM OR SIGNAL LINE CONTINUATION ON SAME DRAWING.
LARGE BREAK
SIGNAL LINE BREAK
CONNECTION POINT

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602-333-2200

PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
42745
JAY A. HORAK
Date Signed 09/30/18
ARIZONA, U.S.A.

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	DWG NUMBER	REMARKS
#							

Registered Professional Engineer
63292
LANE E. INGRAM
11/13/2018
ARIZONA, U.S.A.
EXPIRES 03/31/2020

Stanley Consultants

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City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
INSTRUMENT TAGGING AND LABELING SYMBOLS AND LEGENDS 1

CITY PROJECT NO. WS90400067
DATE 3/2018
SHEET 1 (40 OF 44)
CAD FILE: LS76-I001

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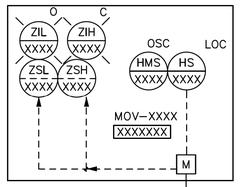
ACTUATOR SYMBOLS

- CYLINDER ACTUATOR (XX)
- DIAPHRAGM ACTUATOR (PRESSURE BALANCED) (XX)
- DIAPHRAGM ACTUATOR (SPRING OPPOSED) (XX)
- ELECTROHYDRAULIC ACTUATOR (E/H) (XX)
- ELECTROPNEUMATIC ACTUATOR (E/P) (XX)
- ELECTRIC ACTUATOR (E) (XX)
- MANUAL ACTUATOR
- POSITIONER (Z) (XX)
- PRESSURE RELIEF
- SOLENOID ACTUATOR (S) (XX)



MOTOR OPERATED VALVE

ACTUATOR LEGEND: XX INDICATES STATUS OF ACTUATOR ON LOSS OF POWER WITH THE FOLLOWING OPTIONS:
- FO = FAIL OPEN,
- FC = FAIL CLOSED,
- FP = FAIL TO PRE-SET POSITION, AND
- BLANK = FAIL TO LAST POSITION.

COMMUNICATION SYMBOLS

- RADIO TOWER
- RADIO WAVE PROPAGATION
- YAGI ANTENNA
- OMNIDIRECTIONAL ANTENNA

EQUIPMENT SYMBOLS

- BLOWER
- BURNER
- CALIBRATION COLUMN
- CHLORINATOR
- COMPRESSOR (CENTRIFUGAL)
- COMPRESSOR (RECIPROCATING, POSITIVE DISPLACEMENT)
- COMPRESSOR (ROTARY, POSITIVE DISPLACEMENT)
- COMPRESSOR
- COUPLING CONNECTION
- DAMPER
- DIFFUSER
- DISCONNECT SWITCH (YS / XXXX / XXXV)
  YS = AUXILLARY CONTACT XXXX = LOOP NO.
  XXXV = VOLTAGE
- DRAIN
- EJECTOR
- EMERGENCY EYEWASH & SHOWER
- EVAPORATOR
- FILTER (F)
- FLEXIBLE HOSE
- GRINDER
- HEAT EXCHANGER
- LOAD CELL
- MIXER (STATIC)
- MIXER
- LARGE MOTOR
- SMALL MOTOR (M)
- OIL EXPANSION CHAMBER
- PULSATION DAMPENER
- REDUCER
- ROTARY CHEMICAL FEEDER
- SEPARATOR
- SILENCER
- STRAINER
- TURBINE
- VENT TO ATMOSPHERE (V)
- CONDENSATION DRAIN (D)
- OPERATOR INTERFACE TERMINAL (OIT)
- ALARM SIREN (Y)
  Y = H-PROCESS ALARM HORN
  S-PERSONNEL SAFTEY SIREN
- STROBE (AHH / XXXX)
  AAH = ALARM STROBE
  XXXX = LOOP NO.
- THERMAL MAGNETIC CIRCUIT BREAKER (AT/XP)
  X= NUMBER OF POLES

FLOW ELEMENTS

- ACOUSTIC DOPPLER FLOW METER (ADFM)
- BATCHMETER (PROPELLER/VALVE)
- DENSITY (MICROWAVE)
- FLUME FLOW ELEMENT
- MAGNETIC FLOW ELEMENT (IN LINE) (M)
- MAGNETIC FLOW ELEMENT (INSERTION) (M)
- MASS FLOW CORIOLIS TYPE
- MASS FLOW THERMAL METER
- ORIFICE PLATE FLOW ELEMENT
- PRIMARY FLOW ELEMENT: PILOT TUBE
- ROTAMETER FLOW ELEMENT
- SONIC (CLAMP ON)
- SONIC FLOW ELEMENT (IN LINE)
- TARGET TYPE FLOW ELEMENT
- TOTALIZING ELEMENT: POSITIVE DISPLACEMENT FLOW
- TURBINE OR PROPELLER FLOW ELEMENT
- V-NOTCH WEIR
- VENTURI TUBE FLOW ELEMENT
- VORTEX FLOW ELEMENT

GATE SYMBOLS

- SLIDE GATE
- SLUICE GATE

LEVEL ELEMENTS

- BUBBLER LEVEL ELEMENT
- CAPACITANCE LEVEL ELEMENT
- CONDUCTIVITY LEVEL ELEMENT
- FLOAT LEVEL ELEMENT
- RADAR LEVEL ELEMENT
- RESISTIVE TAPE LEVEL ELEMENT
- SUBMERSIBLE LEVEL
- ULTRASONIC LEVEL ELEMENT
- SIGHT GLASS (SG)

PUMP SYMBOLS

* INDICATES SPEED
CS = COSTANT SPEED
2S = TWO SPEED
VS = VARIABLE SPEED
VT = VARIABLE STROKE
(PER METERING PUMPS ONLY)
BLANK = UNKNOWN

- CENTRIFUGAL PUMP
- DIAPHRAGM PUMP
- METERING, PERISTALTIC, OR PROPORTIONING PUMP
- PISTON PUMP
- PROGRESSIVE CAVITY PUMP
- ROTARY PUMP
- SCREW (LIFT) PUMP POSITIVE DISPLACEMENT
- SUBMERSIBLE SUMP PUMP
- VERTICAL TURBINE PUMP

VALVE SYMBOLS

- 3-WAY VALVE
- 4-WAY VALVES
- BACKFLOW PREVENTER
- BACKPRESSURE REGULATOR SELF CONTAINED
- BALL CHECK VALVE
- BALL VALVE
- BUTTERFLY VALVE
- DIAPHRAGM SEAL
- DIAPHRAGM VALVE
- FLAPPER CHECK VALVE
- FLOW STRAIGHTENER
- GATE VALVE
- GLOBE VALVE
- KNIFE VALVE (K)
- NEEDLE VALVE
- PETCOCK
- PINCH VALVE
- PLUG VALVE
- PRESSURE REGULATING VALVE SELF CONTAINED
- PRESSURE RELIEF VALVE
- RUPTURE DISK (PRESSURE RELIEF)
- RUPTURE DISK (VACUUM RELIEF)
- SWING CHECK VALVE
- TELESCOPING VALVE
- VACUUM RELIEF VALVE
- VEE BALL VALVE

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PART OF "AS-BUILT" SUBMITTAL
NO "AS-BUILT" MEASUREMENTS ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer — 42745 JAY A. HORAK — ARIZONA, U.S.A.

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REVISION	ENGINEERING COMPANY	PROJECT NO.	PROJECT NAME	DATE	CAD FILE NAME	REMARKS	DWG NUMBER

Registered Professional Engineer — 63292 LANE E. INGRAM — 11/13/2018 — ARIZONA, U.S.A.
EXPIRES 03/31/2020

Stanley Consultants

REVISIONS					DES
NO.	BY	DATE	CKD	REMARKS	TSL
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City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS-76

WEST ANTHEM LIFT STATION
SYMBOLS AND LEGEND 2

CITY PROJECT NO. WS90400067
DATE 3/2018
SHEET 2 (41 OF 44)
CAD FILE: LS76-I002

CSI COMPUTER CONTROL SYSTEM TAG EXTENSIONS

DIGITAL INPUT (STATUS)	DESCRIPTION
ATS Switch Activated	ATSActive
ATS Switch Disabled	ATSDisabled
ATS Switch in Normal Status	ATSNormal
Breaker Closed Status	BrkrClsed
Breaker Open Status	BrkrOpned
Disconnect Closed	DiscClsed
Emergency Lockout Stop Switch Status	ELOS
Emergency Mushroom Switch	EmergStop
Equipment Closed (Generic)	EqupClsed
Equipment Hand–Off–Auto Switch Status	EqupInAuto
Equipment at Maximum Capacity	MaxCap
Equipment at Minimum Capacity	MinCap
Equipment Opened (Generic)	EqupOpned
Equipment Ready	EqupReady
Equipment Running Status (Generic)	EqupRunStat
Equipment 1/2 Select Switch Status	SelectEqupOne
Equipment Start Active	EqupStart
Equipment Stop Active	EqupStop
Equipment in Test Mode	EqupTestMd
Flow Switch Status	FlowPresent
Forward Motion Status	FwdMotion
Gate Open Status	GateOpned
Gate Close Status	GateClsed
Local/Computer Switch Status	CompMode
Local/Remote Switch Status	RemMode
Panel Ready (circuit breaker common signal)	PwrFail
Pump Lead/Lag Switch Status	PumpInLead
Pump Running Status	PumpRunStat
Reverse Motion Status	RevMotion
Valve Open Status	VlvOpned
Valve Close Status	VlvClsed
VFD Bypass Mode Selected	VFDBypass
VFD Running Status	VFDRunStat

NOTE: THESE TAG EXTENSIONS ARE THE CURRENT STANDARD. THEY ARE IN USE AT THE CAVE CREEK, UNION HILLS, AND NORTH GATEWAY FACILITIES.

DIGITAL INPUT (ALARM)	DESCRIPTION
ATS Low Voltage (Voltage Loss)	ATSLoVolt
Blower in Surge Condition	BlwrSurge
Blower Shutdown due to Surge Condition	BlwrHiSurge
Building Smoke Detector Alarm	SmokeDet
Chemical Eyewash Activated	EyewashAct
Door Intrusion Switch Alarm	Intrusion
Electrical Breaker Tripped	BrkrTrip
Equipment Alarm (Common or Generic)	EqupAlm
Equipment Low Battery	LoBatt
Feed Pump Diaphragm Leak	DiaphLeak
Generator Battery Low Voltage	GenLoVolt
Generator Battery High Voltage	GenHiVolt
Generator Overcrank Detected	GenOvrcrank
Generator Overspeed Detected	GenOvrspeed
Generic System Fail	SysFail
High High Density	HiHiDensity
High High Torque Alarm	HiHiTorq
High High Vibration	HiHiVib
High High Vibration in X Direction	HiHiXVib
High High Vibration in Y Direction	HiHiYVib
High High Vibration in Z Direction	HiHiZVib
High Density	HiDensity
High Speed	HiSpd
High Torque Alarm	HiTorq
High Vibration	HiVib
High Vibration in X Direction	HiXVib
High Vibration in Y Direction	HiYVib
High Vibration in Z Direction	HiZVib
Low Speed Switch Activated	LowSpd
Main Power Failure	PwrFail
Maintenance Mode	MaintMde
Motor Amperage Low	LoMtrAmps
Motor Amperage High	HiMtrAmps
Motor Bearing High Temperature	MtrBearHiTemp
Motor Failure	MtrFail
Motor Overload Alarm	MtrOL
Motor Stator Moisture Detect	MtrLeak
Motor Winding High Temperature	MtrWindHiTemp
No Seal Water Present	NoSealWtr
Pipe Leak Detect	PipeLeak
Process Chem Concentration Low Low Level	LoLoChemConc
Process Chem Concentration Low Level	LoChemConc
Process Chem Concentration High High Level	HiHiChemConc
Process Chem Concentration High Level	HiChemConc
Process Gas Concentration Low Level	LoGasConc
Process Gas Concentration Low Low Level	LoLoGasConc
Generator Low Oil Pressure	GenLoOilPress
Generator Low Low Oil Pressure	GenLoLoOilPress
Generator High High Coolant Temperature	GenHiHiCoolTemp
Generator High Coolant Temperature	GenHiCoolTemp
Generator Low Coolant Temperature	GenLoCoolTemp
Generator Low Fuel Pressure	GenLoFuelPress
Generator Battery Charger Fault	GenBattChargFault
Generator Emergency Stop	GenEmergStop
Generator High Temperature	GenHiTemp
Generator Ready	GenReady

DIGITAL INPUT (ALARM) (CONTINUED)	DESCRIPTION
Process Gas Concentration High High Level	HiHiGasConc
Process Gas Concentration High Level	HiGasConc
Process Low Low Level	LoLoLevel
Process Low Low Press	LoLoPress
Process Low Low Temp	LoLoTemp
Process Low Flow	LoFlow
Process Low Level	LoLevel
Process Low Press	LoPress
Process Low Temp	LoTemp
Process High High DPress	HiHiDPress
Process High High Level	HiHiLevel
Process High High Press	HiHiPress
Process High High Temp	HiHiTemp
Process High DPress	HiDPress
Process High Flow	HiFlow
Process High Level	HiLevel
Process High Press	HiPress
Process High Temp	HiTemp
SCR Drive Fail	SCRDFail
Tank Leak Detect	TankLeak
Ultrasonic Meter Loss of Echo	EchoLoss
Valve Failed Open	OpenFail
Valve Failed Close	CloseFail
Variable Frequency Drive Fail	VFDFail
Sprinkler Water Flow	SprklrFlow

DIGITAL OUTPUT	DESCRIPTION
Gate Close Command	GateCls
Gate Open Command	GateOpn
Motor Forward Command	MtrFwd
Motor Reverse Command	MtrRev
Motor Start Command	MtrStart
Motor Start/Stop Command	MtrSS
Motor Stop Command	MtrStop
PLC/Serial Watchdog Bit Active	WtchDogbit
Process Normal	ProcNorm
Remote Alarm Acknowledge	RemAlmAck
Remote Chlorine Alarm	RemClAlm
Remote Common Alarm	RemCmnAlm
Remote Over–ride	RemOvride
Remote Shutdown Reset	RemReset
Remote Timer Start	TimerStart
Remote Timer Stop	TimerStop
Valve Close Command	VlvCls
Valve Open Command	VlvOpn

ANALOG INPUT	DESCRIPTION
Counter in Time	Time
Engine RPM	RPM
Equipment Position (Generic)	EqupPos
Gate Position (0–100%)	GatePos
Generator Coolant Temperature	GenCoolTemp
Generator Oil Pressure	GenOilPress
Generator Speed	Genspeed
Lamp Intensity	Intensity
Lamp Transmittance	Transmittance
MCC or Switchgear AMPS AC	Amps
MCC or Switchgear KW hours	KWH
MCC or Switchgear Power Factor	PwrFactor
MCC or Switchgear VAR–hours	VARH
MCC or Switchgear Volts AC	Volts
MCC or Switchgear Volt–Amps	Volt–Amps
MCC or Switchgear Volt–Amps Reactive	KVARS
MCC or Switchgear Watts	KW
Motor Bearing Temperature	MtrBearTemp
Motor AC Amperage	MtrAmps
Peristaltic Pump Speed	PmpSpeed
Process Chemical Concentration Measurement	ChemConc
Process Density or TSS Measurement	Density
Process Differential Pressure	DPress
Process Dissolved Oxygen Measurement	DissOxy
Process Flow Rate	Flow
Process Gas Concentration Measurement	GasConc
Process Level Measurement	Level
Process Oxidation Reduction Potential	ORP
Process pH	PH
Process Pressure Measurement	Press
Process Temperature Measurement	Temp
Process Turbidity Measurement	Turbidity
SCR Drive Speed Feedback	SCRDSpeed
Valve Position (0–100%)	VlvPos
Variable Frequency Drive AMPS	VFDAmps
Variable Frequency Drive Frequency	VFDFreq
Variable Frequency Drive Speed Feedback	VFDSpeed
Variable Frequency Drive Volts	VFDVolts
Vibration (Generic)	Vib
Vibration in X Direction	XVib
Vibration in Y Direction	YVib
Vibration in Z Direction	ZVib
Water Hardness Measurement	Hardness

ANALOG OUTPUT	DESCRIPTION
Equipment Position Control	EqupPosCtrl
Flow Pacing Control	FlowPaceCtrl
Generic Process Setpoint Control	SetpCtrl
Peristaltic Pump Speed Control	PmpSpdCtrl
SCR Drive Speed Control	SCRDSpeedCtrl
SCR Drive Stroke Control	SCRDStrokeCtrl
Valve Positioning Control	VlvPosCtrl
Variable Frequency Drive Control	VFDSpeedCtrl

COMMON SOFTWARE GENERATED TAGS	DESCRIPTION
PLC/Serial Equipment Communication Failed	CommFail
Pump or Equipment Accumulated Running Hours	Runtime

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PHOENIX, AZ 85016
602–333–2200

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NO "AS–BUILT" MEASUREMENTS
ON THIS SHEET

REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer
42745
JAY A.
HORAK
Date Signed 09-11-20
ARIZONA, U.S.A.

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Registered Professional Engineer
63292
LANE E.
INGRAM
11/13/2018
ARIZONA, U.S.A.
EXPIRES 03/31/2020

Stanley Consultants

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City of Phoenix

CITY OF PHOENIX
WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
REMOTE FACILITIES

LS–76

WEST ANTHEM LIFT STATION
SYMBOLS AND LEGEND 3

CITY PROJECT NO. WS90400067
DATE 3/2018
I SHEET 3 (42 OF 44)
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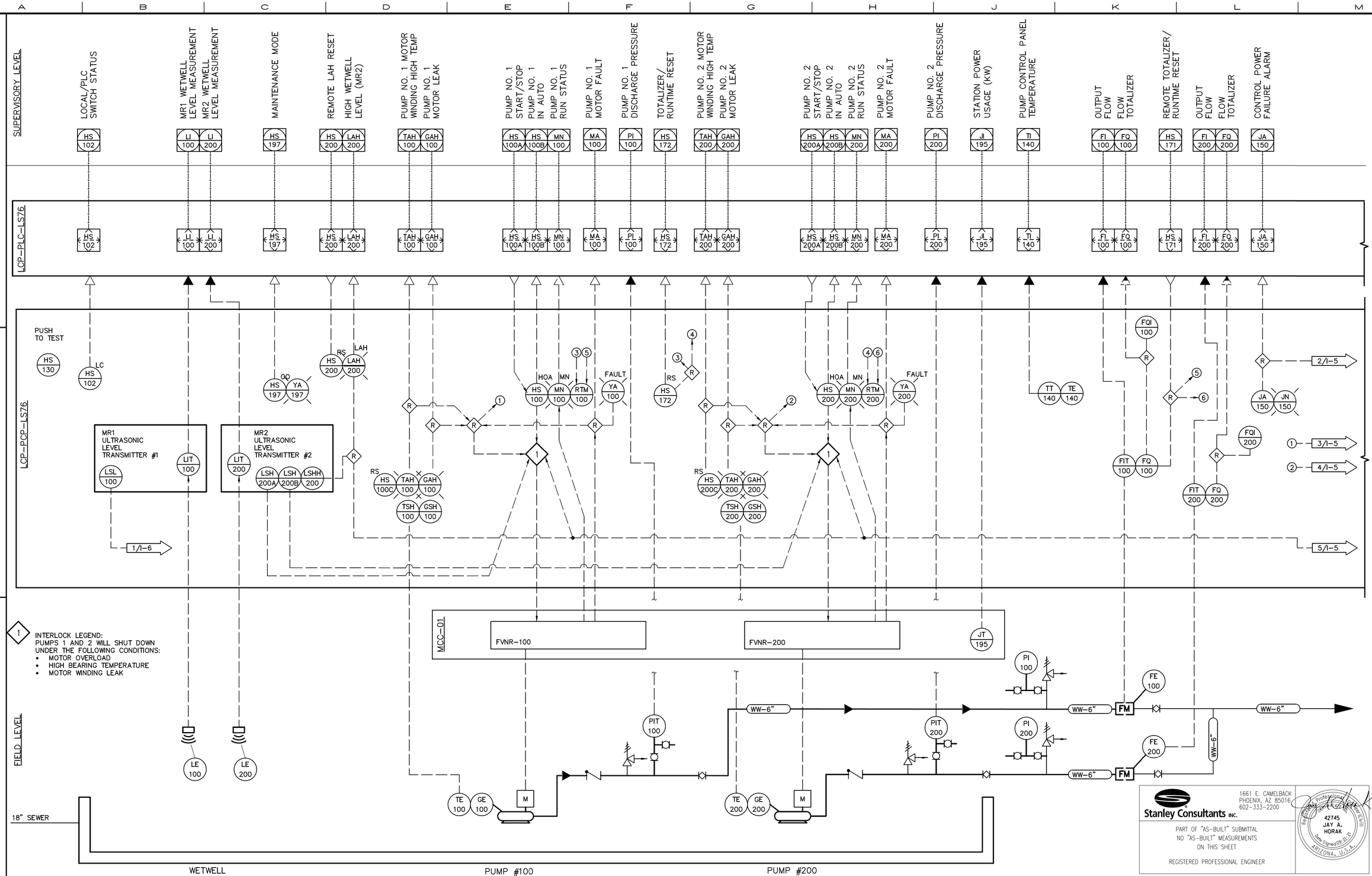

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REGISTERED PROFESSIONAL ENGINEER

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COLLECTION SYSTEMS
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LS-76

WEST ANTHEM LIFT STATION
P&ID SHEET 1

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SUPERVISORY LEVEL

RTU CABINET TEMPERATURE MEASUREMENT — TI 130

GENERATOR FAULT ALARM — YA 191

STATION ON STANDBY POWER — YA 190

INTRUSION ARM/DISARM — HA 103

GENERATOR ENCLOSURE INTRUSION ALARM — YA 185

ENTRANCE GATE INTRUSION ALARM — YA 183

ELECTRICAL EQUIPMENT INTRUSION ALARM — YA 184

LCP-PLC-LS76

TI 130 — TT 130 — TE 130

YA 191 — YA 190 — HS 103 — NS 189 PLC INTRUSION ALARM — NA 185 — NA 183 — NA 184

LCP-SEC-LS76

LCP-PCP-LS76

AUTODIALER

WETWELL LEVEL LOW	CONTROL POWER FAILURE	PUMP NO. 1 COMMON ALARM	PUMP NO. 2 COMMON ALARM	WETWELL LEVEL HIGH	SPARE	SPARE	SPARE	GENERATOR FAULT ALARM	STATION ON STANDBY POWER
LSL 100	JA 150	XA 110B	XA 120B	LAHH 200	NA 184	NA 183	NA 185	YA 191	YS 190
1	2	3	4	5	6	7	11	12	13

1/I-4
2/I-4
3/I-4
4/I-4
5/I-4

RS HS 191 YA 191 GENERATOR FAULT

RS HS 190 YA 190 STANDBY POWER

R — 4

R

R

AUTODIALER

SPARE	SPARE	SPARE	SPARE	SPARE	ELECTRICAL GEAR INTRUSION ALARM	ENTRANCE GATE INTRUSION ALARM	GENERATOR INTRUSION ALARM	SPARE	SPARE
LSL 100	JA 150	XA 110B	XA 120B	LAHH 200	NA 184	NA 183	NA 185	YA 191	YS 190

PCP INTRUSION ALARM — NS 188

YS 190 — NS 187 ATS INTRUSION ALARM

ATS-01

YS 191 — NS 185 GENERATOR ENCLOSURE INTRUSION ALARM

200KW STANDBY GENERATOR

NS 183 NORTH ENTRANCE GATE INTRUSION ALARM

NS 190 SOUTH ENTRANCE GATE INTRUSION ALARM

NY 191 SOUTH ENTRANCE GATE OPEN COMMAND

NS 184 MCC INTRUSION ALARM

NY 190 NORTH ENTRANCE GATE OPEN COMMAND

NS 186 SES INTRUSION ALARM

NS 191 MAN GATE INTRUSION ALARM

FIELD LEVEL

Stanley Consultants INC.
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REGISTERED PROFESSIONAL ENGINEER

Registered Professional Engineer — 42745 JAY A. HORAK — Date Signed 05/31/18 — ARIZONA, U.S.A.

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Registered Professional Engineer — 63292 LANE E. INGRAM — 11/13/2018 — ARIZONA U.S.A.

EXPIRES 03/31/2020

Stanley Consultants

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WATER SERVICES DEPARTMENT

COLLECTION SYSTEMS
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LS-76

WEST ANTHEM LIFT STATION
P&ID SHEET 2

CITY PROJECT NO. WS90400067

DATE 3/2018

I SHEET 5 (44 OF 44)

CAD FILE: LS76-I005

REPORT ON GEOTECHNICAL INVESTIGATION

DESIGNATION: West Anthem Wastewater Improvements Index No. WS90500276, WS90400067, WS90501005

LOCATION: Pioneer Road to Carefree Highway Maricopa County, AZ

CLIENT: Stanley Consultants, Inc.

PROJECT NO: 161708SA

DATE: May 17, 2017

SPEEDIE AND ASSOCIATES
Geotechnical ▪ Environmental ▪ Materials Engineers

TABLE OF CONTENTS

1.0 INTRODUCTION

This report presents the results of a subsoil investigation carried out along the route of the proposed West Anthem Wastewater Improvements to be located between Sheriffs Pistol Range Road at Pioneer Road and North Valley Parkway at Carefree Highway in Phoenix and Maricopa, Arizona.

Preliminary information calls for the design and construction of a 0.5 MGD lift station located 1,100+/- feet north of Sheriffs Pistol Range Road and Pioneer Road. The lift station discharges into three (two 14-inch and one 6-inch diameter) parallel force mains running south for about 5,000 lf and ends in a discharge structure at the southwest corner of I-17 and Pioneer Road. From the discharge structure, wastewater flows in an approximately 10,000 lf gravity sewer crossing under Interstate I-17 using jack-and-bore/tunnel technology and then south along North Valley Parkway and connecting to an existing 24-inch gravity sewer at North Valley Parkway and the Carefree Highway. The gravity sewer is 18-inch to 21-inch in diameter and expected to be installed at minimum cover depth on the order of 5 to 18 feet; closer to 18 feet deep near Carefree Highway. Sections passing under drainage features may be deeper.

2.0 GENERAL SITE AND SOIL CONDITIONS

2.1 Site Conditions

The pipeline will be located mainly within the right of way for North Valley Parkway starting on the south side of Carefree Highway north to approximately 1,200 feet north of Cloud Road where it will turn to the west to go under I-17 and turn north where it will follow I-17 then Pioneer Road for approximately 6,800lf. I-17 is a 4 lane divided interstate highway and Carefree Highway a 4 lane roadway, with turn lanes at the intersection. Some major and minor washes cross the road. The roadway is bounded by commercial, retail and residential development on the south end up to about 1000 feet north of 33rd Lane with vacant desert terrain to the north. The west side of I-17 consists of vacant desert terrain, the Pioneer Living History Village and a mobile home park. A brief look at historical photos indicated that the site has never been previously developed before current conditions or farmed. The old I-17 roadway was located on the west side of the current alignment. The roadway is asphalt paved with the adjacent ground surface is generally gently sloped with sparse desert trees and bushes on the surface. There are a number of underground and overhead utilities along the alignment.

2.2 Geologic Conditions

The site is **located outside known areas** that have undergone considerable subsidence due to groundwater removal. Areas of subsidence are known to produce earth fissuring, which has affected areas within several miles of the site. Subsidence is a basin wide phenomenon that would result in differential

elevation changes over long distances, which would not affect the type of buildings proposed for this site. No evidence of earth fissures was observed on the site. Fissure gullies form over subsurface irregularities such as bedrock highs, which cause tensional stresses and differential subsidence. Where such anomalies are not present, subsidence tends to be uniform over a wide area, this having minimal effect on surficial structures. The closest known earth fissures are located at 40th street and Lupine, many miles south from the site. These fissures were discovered in the 70's and are considered inactive at this time. Based on local experience, subsidence and earth fissures historically have **not** been a problem in this area.

2.3 Seismic Design Parameters

The project area is located in a seismic zone that is considered to have low historical seismicity. The Phoenix area has had only two magnitude 3.0 events in over 100 years. Liquefaction is not considered a concern as groundwater exceeds 15 meters below ground surface.

Although borings were not advanced to 100 feet, based on the nature of the subsoils encountered in the borings and geology in the area, Site Class Definition, Class C may be used for design of the structures.

2.4 General Subsurface Conditions

The geological materials are divided into three basic soil/rock types that were identified along the alignment as follows

Alluvial Soil – This unit consists of unconsolidated to semi-consolidated alluvial/flood plain sediment. The soils consist of clayey sands, silty sands with gravel, cobbles and small to medium sized boulders. The USCS refers to these as the Ebon-Pinamt-Tremant Association. These soils typically have a cobbly gravel loam surface underlain with very gravelly sandy clay loam subsoil. The surface is non-calcareous, with variable concentrations of lime with depth.

Alluvial Soil/Cemented Alluvium – This unit is a transitional area between the Alluvial Soil and Cemented Alluvium/Conglomerate. This unit includes alluvial soil, recent alluvial deposits from the active washes, and heavily cemented alluvium. The alluvial soil and recent alluvial deposits are anticipated to be relatively shallow overlying shallow cemented alluvium/conglomerate.

Cemented Alluvium/Conglomerate – This unit consists of consolidated old alluvial and valley plains sediment. The soils are heavily cemented calcareous sandy silts and clays containing gravel and cobble size rock fragments. Cementation is generally moderate to heavy, exhibiting rock-like characteristics

of a conglomerate at several locations. USCS refers to these soils as part of the Rillito-Gunsight-Pinal Association. The soils typically have a strongly calcareous gravelly loam surface underlain with strongly to very strongly calcareous gravelly sandy loam.

Where drilled, the existing pavement consists of 4 to 6 inches of asphalt over 6 to 12 inches of aggregate base. Subsoil conditions consist of clayey gravel, well graded gravel, silty gravel, silty sand, clayey sand, and sandy lean clay to the termination depths of borings at 15.4 to 60.3 feet below grade. Subordinate amounts of gravel and cobble were also noted in the soil profile along with various degrees of calcareous cementation. Soil conditions at the time of investigation were classified as 'dry' to 'moist'**.** Standard Penetration Test values generally ranged from 10 to 50+ blows per foot (bpf) in the upper 5+ feet increasing to 50+ bpf in the deeper soils. It should be noted that loose soils were encountered in borings B-2, B-5, B-6, B-7 and B-8 at a depth of 5 feet below existing grades. Fill material was also encountered in borings B-5 through B-11 at depths of 3 to 12 feet below existing grades. No groundwater was encountered during this investigation.

Due to the very dense gravelly nature of the soils, in-situ dry densities were not obtainable. Laboratory testing indicated liquid limits in the range of non-plastic to 41 with a plasticity index of non-plastic to 13.

3.0 ANALYSIS AND RECOMMENDATIONS

3.1 Analysis

Analysis of the field and laboratory data indicates that subsoils at the site are generally favorable for the support of the proposed pipeline on typical bedding required for the piping and trench loading conditions. However, if the pipeline profile lies within a potential loose/soft soil segment, some additional pipe bedding or increased manhole bases may be warranted. It is likely to encounter near saturated soils near drainage features or in areas where depressed unpaved shoulder areas have been subjected to flooding after recent heavy rains. This may require increasing pipe bedding depending on depth. It is also recommended to increase the manhole base sizes due to lower bearing capacity and increasing the size of thrust blocks due to low lateral bearing (passive pressure) capacity. Any structures required can be supported on shallow spread foundations**.**

Loose surficial soils and some wash fills may be encountered and will likely be disturbed due to various construction activities. However, the hard/dense nature of the soils at the founding level should make them suitable for support of the minor structures without the need for over-excavation and re-compaction provided they remain dry.

Groundwater is not expected to be a factor in the design or construction of shallow foundations and underground utilities. **Excavation operations may be difficult due to very dense, rocklike conditions.** It should be noted that the fact that a boring was advanced to a particular depth should not lead to the assumption that it is necessarily excavatable by conventional means. **Very dense and/or rocky conditions may require more aggressive rock removal techniques.** The contractor should be responsible for determining what equipment will be required to make excavations.

3.2 Site Preparation

The entire area to be occupied by the proposed construction should be stripped of all vegetation, debris, rubble, and obviously loose surface soils. It is recommended that for any section where loose/soft soils are expected in the upper 5 to 10 feet and/or encountered at the bottom of the trenches or manhole bases, the loose/soft soils be over-excavated down to at least 12 inches below the pipe, manhole base or at-grade equipment base. The over-excavated zone should then be replaced with compacted bedding material. This process will require close inspection during trenching to locate the loose soils and over-excavate while the trench is being excavated to avoid having to go back on the trench to remove loose soil. **A representative of the geotechnical engineer shall examine the exposed subgrade** once sub-excavation is complete and prior to backfilling to ensure removal of deleterious materials. Fill placement and quality should be as defined in the "Fill and Backfill" section of this report.

Removal and replacement of existing asphalt surfacing will likely disturb the underlying aggregate base course (ABC) and possibly subgrade. After removal of the surface, the exposed base will require fine grading and re-compaction. The exposed subgrade under the new pavement, curb, gutter and sidewalks shoulder areas should be prepared in accordance with M.A.G. Standard Specification 301. This includes proof rolling to detect unstable subgrade areas. **If stable,** it is recommended to increase the thickness of the scarification, moisture conditioning and compaction to 12 inches. The grade should be re-compacted to at least 95 percent dry density as determined by ASTM D698.

While no obvious signs of wet or unstable soils were found in the limited boring locations, it is not uncommon to find overly moist soils (above optimum) under old pavements, low shoulder areas that collect water and leaking irrigation pipes and canals. These conditions can result in pumping issues and will impact obtaining compaction of the subgrade. If isolated zones of unstable or soft subgrade are found during site grading, there are several options available to help stabilize these conditions. The first option would be to remove the unstable soils to a depth on the order of 2 feet below the finished subgrade; deeper excavations may be required if the loose areas extend deeper. The soils may be set aside to dry (if necessary) and be re-compacted once they have dried sufficiently, or other local soils or asphalt millings from the existing roadway may be used.

As an alternate to complete removal of the soils, the soils can be mixed with dry cement. Since using cement is only to dry and stabilize the soils, not part of the structural design, it is recommended to generally follow M.A.G. 311, Soil Cement. It is recommended that a minimum of 12 inches of cement stabilized soils be used below the pavement structural section. If very soft soils are encountered, increase this depth as needed to stabilize. Another option is to use a high quality geogrid such as Tensar TX7 or equal installed per manufacture recommendations and M.A.G. Standard Specifications 306 and 796 for geogrid.

Prior to placing structural fill below footing bottom elevation (if required), the exposed grade should be scarified to a depth of 8 inches, moisture-conditioned to optimum (±2 percent) and compacted to at least 95 percent of maximum dry density as determined by ASTM D-698. Pavement areas should be scarified, moisture-conditioned and compacted in a similar manner.

Prior to placing sidewalks, the exposed grade should be scarified 8 inches, moisture conditioned to at least optimum to 3 percent above optimum and lightly but uniformly compacted to 90 but not more than 95 percent of maximum dry density as determined by ASTM D-698.

3.3 Foundation Design

It is recommended that any vault/manhole structures be founded on a mat type foundation bearing on medium dense native soils (or 12 inches of compacted bedding material (or Aggregate Base, crushed stone or 1½ sack MAG Spec 728 CLSM) as indicated above in loose/soft zones) at an invert depth on the order of 10 feet below grade. If site preparation is carried out as set forth herein, a recommended allowable bearing capacity of **4,000 psf** can be utilized for design. This bearing capacity refers to the total of all loads, dead and live, and is a net pressure. It may be increased one-third for wind, seismic or other loads of short duration. All footing excavations should be level and cleaned of all loose or disturbed materials. Positive drainage away from any proposed structure must be maintained at all times.

Estimated settlements under design loads are on the order of less than 1-inch, virtually all of which will occur during construction. Post-construction differential settlements will be negligible, under existing and compacted moisture contents. Additional localized settlements of the same magnitude could occur if native supporting soils were to experience a significant increase in moisture content.

3.4 Lateral Pressures

The following lateral pressure values may be utilized for the proposed construction:

Active Pressures	
Unrestrained Walls	35 pcf
Restrained Walls	60 pcf
Passive Pressures	
Continuous Footings	300 pcf
Spread Footings or Drilled Piers	350 pcf
Coefficient of Friction (w/ passive pressure)	0.35
Coefficient of Friction (w/out passive pressure)	0.45

All backfill must be compacted to not less than 95 percent (ASTM D-698) to mobilize these passive values at low strain. **If/where s*ofter stiff/loose soil conditions are encountered in the upper 5 to 10 feet, over-sized thrust blocks are recommended where needed or use mechanically restrained joints as specified by the pipeline engineer. For thrust block design by the pipeline engineer, it is recommended to use a lateral bearing capacity of 1,500 psf for thrust block calculations in the upper 10 feet, not the 3000 psf noted in MAG Detail 380. The higher value is suitable in dense to very dense soils zones.***

3.5 Excavations

Care should be taken during excavation not to endanger nearby elements such as roadways, utilities, etc. **Depending on proximity**, existing elements may require shoring, bracing or underpinning to provide structural stability and protect personnel working in the excavation. The need for shoring or bracing is a means and methods decision by the contractor. They may elect to layback the excavations to a safe condition if there is room or to reduce the amount of excavation and backfill required.

The extent of how easily a material is excavated is largely affected by the effort applied by the contractor. Although a specific material maybe rippable with concentrated effort being applied, such operations may not be viewed as cost effective. Large fragments produced from ripping operations may require secondary fragmentation to reduce the rock to sizes suitable for fill placement.

Excavations to the levels expected will likely terminate within differing soil types. All excavations must comply with current governmental regulations including the current OSHA Excavation and Trench Safety Standards. Based on this limited soil data, the upper soils would be classified as Type C. This would require side slopes for open-cut excavation to 20+ feet depth be cut back at 1½:1 (horizontal to

vertical). It is recommended that a representative of the Geotechnical Engineer or the Contractor Qualified party examine the cut slope during excavation to reduce the risks posed by unstable conditions. The slopes should be protected from erosion due to run-off or long-term surcharge at the slope crest. Construction equipment, building materials, excavated soil and vehicular traffic should not be allowed within 10 feet or one-third the slope height, whichever is greater, from the top of slope. Adjustments to the recommended slopes may be necessary due to wet zones, loose strata and other conditions not observed in the borings. Shotcrete or soil stabilizer on the slope face may be useful in preventing erosion due to run-off and/or drying of the slope. **Due to the existing infrastructure, open trench layback may not be possible as discussed above. Therefore shoring (trench boxes) will be required in those circumstances.**

3.6 Bedding, Backfill and Fill

The native soils are suitable for trench backfill (above any required bedding) and roadway fill provided oversize rock (plus 6 inches) is removed. The trench backfill should be moisture conditioned, placed in suitable lifts and mechanically compacted as specified. **Water settling is not recommended.** Pipe bedding should meet the project specifications as specified by the governing municipality. Special granular pipe bedding or cementitious slurry meeting MAG Standard Specifications Section 728 for Controlled Low Strength Material (CLSM) may be required depending on the pipe materials and trench loading conditions. As noted above, it is recommended that for any section where loose/soft soils are encountered at the bottom of the trench, the loose/soft soils be over-excavated down to at least 12 inches below the pipe. The over-excavated zone should then be replaced with compacted bedding material. This process will require close inspection during trenching to identify any loose soils and to permit any necessary over-excavation to be performed during the initial excavation process.

The silty fine sand soils may be sensitive to excessive moisture content and will become unstable at elevated moisture content. Accordingly, it may be necessary to compact soils on the dry side of optimum, especially in asphalt pavement areas.

If imported common fill for use in site grading is required, it should be examined by a Soils Engineer to ensure that it is of low swell potential and free of organic or otherwise deleterious material. In general, the fill should have 100 percent passing the 3-inch sieve and no more than 60 percent passing the 200 sieve. For the fine fraction (passing the 40 sieve), the liquid limit and plasticity index should not exceed 30 percent and 10 percent, respectively. It should exhibit less than 1.5 percent swell potential when compacted to 95 percent of maximum dry density (ASTM D-698) at a moisture content of 2 percent below optimum, confined under a 100 psf surcharge, and inundated.

Fill should be placed on subgrade which has been properly prepared and approved by a Soils Engineer. Fill must be wetted and thoroughly mixed to achieve optimum moisture content, ±2 percent. Fill should be placed in horizontal lifts of 8-inch thickness (or as dictated by compaction equipment) and compacted to the percent of maximum dry density per ASTM D-698 set forth as follows:

A.	Manhole and Minor Structures	
	1. Below footing level	95
B.	Pavement/Sidewalk Subgrade or Fill	95
C.	Utility Trench Backfill	95 (full depth)
D.	Aggregate Base Course	
	1. Below Equipment Slabs	95
	2. Below asphalt paving	100
E.	Landscape Areas	90

Under any roadways, the backfill above the top of any pipe shall meet the requirements of MAG Standard Specification Section 601, Type I backfill using a MAG specified aggregate base or concrete slurry. **In order to reduce trench settlement potential, all fill under roadways should be compacted to 95 percent full depth.**

Accurate prediction of the amount of construction water necessary for compaction is not possible due to the varying factors. These include variable natural soil moisture, seasonal changes in moisture content, air temperature and wind speed that impact evaporation. The optimum moisture contents reported on the moisture-density relations data is based on the minus #4 materials. It will be corrected downward depending on the percentage of rock (plus #4 fraction) in the matrix. For ADOT highway projects, a range of 80 to 100 gallons per cubic yard, for winter to summer months respectively, is typically recommended.

The value for the Modulus of Soil Reaction Value (E') is dependent on the pipe backfill material utilized, the laying conditions and pipe backfill compaction. Based on the soil test data and field observations, the following Modulus of Soil Reaction Value (E') values may be used.

Table 3.6.1 Modulus of Soil Reaction (E')

Pipe Backfill Material	Compaction (%)	E' (psi)	Comments
Native Fill	95	2,000	1,2
Granular Fill	95	3,000	1,3
Undisturbed Loose Native Soils	N/A	500	4

Note:

1. Standard Proctor maximum dry density (ASTM D-698).
2. Must meet Fill and Backfill specifications. Assumes well mixed 3-inch minus native soils obtained from pipe trench/excavation. Must meet the following Unified Soil classification: (1) fine-grained soils with Liquid limit<50% and medium to no plasticity (CL,ML,ML-CL) and more than 25% retained on #200 sieve; or (2) coarse-grained soils with fines (GM,GC,SM,SC) containing more than 12% fines.
3. Must meet fill and backfill specifications. Assumes 3-inch minus coarse-grained soils with little or no fines (GW,GP,SW,SP) containing less than 12% fines or soils meeting the requirements of M.A.G. section 702 Table 702-1Type A or Type B select.
4. Assumes firm/loose to very stiff/medium dense native soils.

3.7 Corrosion

Laboratory pH values ranged from 7.5 to 8.3. Sulfate concentrations ranged from 3 to 47 ppm with chloride concentrations from 7 to 660 ppm. Resistivity tests conducted indicate that values measured from 570 to 9700 ohm-cm. Depending on areas, this reflects a mild to severe degree of corrosiveness to buried metal. Accordingly, suitable pipe wall thickness and/or corrosion protection should be selected by the designer per the trench/traffic loading and lifetime requirements of the project. A recommendation for corrosion protection is beyond the scope of work for this investigation.

3.8 Roadways

If earthwork in paved areas is carried out to finish subgrade elevation as set forth herein, the subgrade will provide adequate support for pavements. The location designation is for reference only. **The designer/owner should choose the appropriate sections to meet the anticipated traffic volume and life expectancy.** The section capacity is reported as daily ESALs, Equivalent 18 kip Single Axle Loads. Typical heavy trucks impart 1.0 to 2.5 ESALs per truck depending on load. It takes approximately 1,200 passenger cars to impart 1 ESAL.

As an alternative to a traditional asphalt or concrete pavement section, we anticipate that it will be more likely that there will be unpaved access road, typically consisting of a gravel surface to provide all-weather access. There are several methods to accomplish this depending on construction budget, anticipated traffic and willingness to provide maintenance. A thicker section of aggregate base is provided

as an option. Alternative options could also include a soil cement roadway which could have a surface treatment of decomposed granite or gravel applied.

Table 3.8.1 Pavement Sections

Area of Placement	Flexible (AC Pavement)		
	Thickness		Daily 18-kip ESALs
	AC (0.39)	ABC (0.12)	
North Valley Parkway (Arterial Street)	4.0"	6.0"	98
	5.0"	6.0"	285
	6.0"(2)	**6.0"(2)**	738
Unpaved Access Roads	-	8.0"	1.5

Notes:

1. Designs are based on AASHTO design equations and ADOT correlated R-Values.
2. **Minimum section per City of Phoenix standard details for Arterial Streets.**
3. Full depth asphalt or increased asphalt thickness can be increased by adding 1.0-inch asphalt for each 3 inches of base course replaced.

Pavement Design Parameters:

Assume:	One 18 kip Equivalent Single Axle Load(ESAL)/Truck
Life:	20 years
Subgrade Soil Profile:	
% Passing #200 sieve:	29%
Plasticity Index:	7%
k:	125 pci (assumed)
R value:	29 (per AASHTO Formula)
M_R:	17,100 (per AASHTO design)

These designs assume that all subgrades are prepared in accordance with the recommendations contained in the "Site Preparation" and "Fill and Backfill" sections of this report, and paving operations are carried out in a proper manner. If pavement subgrade preparation is not carried out immediately prior to paving, the entire area should be proof-rolled at that time with a heavy pneumatic-tired roller to identify locally unstable areas for repair.

Pavement base course material should be aggregate base per M.A.G. Section 702 Specifications. Asphalt concrete materials and mix design should conform to M.A.G. 710 for heavy traffic. It is recommended that a ½ inch or ¾ inch mix designation be used for the pavements. While a ¾ inch mix

may have a somewhat rougher texture, it offers more stability and resistance to scuffing, particularly in truck turning areas. Pavement installation should be carried out under applicable portions of M.A.G. Section 321 and municipality standards. The asphalt supplier should be informed of the pavement use and be required to provide a mix that will provide stability and be aesthetically acceptable. Some of the newer M.A.G. mixes are very coarse and could cause placing and finish problems. A mix design should be submitted for review to determine if it will be acceptable for the intended use.

For sidewalks and other areas not subjective to vehicular traffic a 4-inch section of concrete will be sufficient. For areas subject to heavier traffic, such as the entrance apron, a thicker section of 6 inches of concrete is recommended.

Portland Cement Concrete Pavement must have a minimum 28-day flexural strength 550 psi (compressive strength of approximately 3,700 psi). It may be cast directly on the prepared subgrade with proper compaction (reduced) and the elevated moisture content as recommended in the report. Lacking an aggregate base course, attention must be paid to using low slump concrete and proper curing, especially on the thinner sections. No reinforcing is necessary. Joint design and spacing should be in accordance with ACI recommendations. Construction joints should contain dowels or be tongue-and-grooved to provide load transfer. Tie bars are recommended on the joints adjacent to unsupported edges. Maximum joint spacing in feet should not exceed 2 to 3 times the thickness in inches. Joint sealing with a quality silicone sealer is recommended to prevent water from entering the subgrade allowing pumping and loss of support.

Proper subgrade preparation and joint sealing will reduce (but not eliminate) the potential for slab movements (thus cracking) on the expansive native soils. Frequent jointing will reduce uncontrolled cracking and increase the efficiency of aggregate interlock joint transfer.

In order to support the anticipated service vehicle traffic or any other heavy type trucks on an unpaved surface, it is recommended that the base consist of at least **8.0 inches** of compacted aggregate base (MAG Spec. Section 702 crushed rock AB) on **8 inches** of prepared and compacted subgrade. The subgrade should be compacted to at least 95 percent to the full depth. The AB shall be compacted to 100 percent per ASTM D 698. Depending on equipment used, more than one lift may be required to gain the density required. If desired, the surface can consist of 2 to 4 inches of decomposed granite (D.G.). A D.G. stabilizer should be considered to reduce the amount of maintenance required to maintain the surface.

Adequate drainage will be critical for long-term performance of the roadway. Special attention must be paid to proper crowning (crossfall) and/or longitudinal slope to prevent ponding on the roadway and adequate drainage provisions for the subgrade. A minimum cross slope of 5 percent is recommended for unpaved areas.

4.0 GENERAL

The scope of this investigation and report includes only regional published considerations for seismic activity and ground fissures resulting from subsidence due to groundwater withdrawal, not any site specific studies. The scope does not include any considerations of hazardous releases or toxic contamination of any type.

Our analysis of data and the recommendations presented herein are based on the assumption that soil conditions do not vary significantly from those found at specific sample locations. Our work has been performed in accordance with generally accepted engineering principles and practice for a preliminary investigation; this warranty is in lieu of all other warranties expressed or implied.

We recommend that a representative of the Geotechnical Engineer observe and test the earthwork and foundation portions of this project to ensure compliance to project specifications and the field applicability of subsurface conditions which are the basis of the recommendations presented in this report. If any significant changes are made in the scope of work or type of construction that was assumed in this report, we must review such revised conditions to confirm our findings if the conclusions and recommendations presented herein are to apply.

Respectfully submitted,
SPEEDIE & ASSOCIATES, INC.

Ray C. Markley Jr., E.I.T.

Registered Professional Engineer (Civil) CERTIFICATE NO. 37292 KEITH R. GRAVEL Date Signed 5/17/17 ARIZONA, U.S.A. Expires 03/31/2020

Keith R. Gravel, P.E.

Registered Professional Engineer (Civil) CERTIFICATE NO. 14388 GREGG ALAN CREASER DATE SIGNED 5/17/17 ARIZONA, U.S.A. Expires 06/30/2017

Gregg A. Creaser, P.E.

SPEEDIE AND ASSOCIATES
Geotechnical ▪ Environmental ▪ Materials Engineers

APPENDIX

FIELD AND LABORATORY INVESTIGATION

SOIL BORING LOCATION PLANS

SOIL LEGEND

LOG OF TEST BORINGS

TABULATION OF TEST DATA

CORROSIVE TEST DATA

FIELD AND LABORATORY INVESTIGATION

On October 5, 6, 7, 12, 13 & 14, November 30 and December 1, 2016, soil test borings were drilled at the approximate locations shown on the attached Soil Boring Location Plan. All exploration work was carried out under the full-time supervision of our geologist, who recorded subsurface conditions and obtained samples for laboratory testing. The soil borings were advanced with a truck-mounted CME-75 drill rig utilizing TubeX rock hammer. Detailed information regarding the borings and samples obtained can be found on an individual Log of Test Boring prepared for each drilling location.

Laboratory testing consisted of grain-size distribution and plasticity (Atterberg Limits) tests for classification purposes. Laboratory resistivity, pH, sulfate and chloride concentration were also conducted for corrosivity analysis. All field and laboratory data are presented in this appendix.

⊕ - APPROXIMATE SOIL BORING LOCATIONS

N

SOIL BORING LOCATION PLAN

SHEET: 1 of 8 | DR: TSW | REV: | DATE: 09/27/16 | PROJECT NO. 161708SA

WEST ANTHEM WASTEWATER IMPROVEMENTS
PIONEER ROAD TO CAREFREE HIGHWAY
MARICOPA COUNTY, ARIZONA

SPEEDIE AND ASSOCIATES
GEOTECHNICAL ▪ ENVIROMENTAL ▪ MATERIALS ENGINEERS

⌖ - APPROXIMATE SOIL BORING LOCATIONS

N

SOIL BORING LOCATION PLAN

SHEET: 2 of 8 | DR: TSW | REV: | DATE: 09/27/16 | PROJECT NO. 161708SA

WEST ANTHEM WASTEWATER IMPROVEMENTS
PIONEER ROAD TO CAREFREE HIGHWAY
MARICOPA COUNTY, ARIZONA

SPEEDIE AND ASSOCIATES
GEOTECHNICAL ▪ ENVIROMENTAL ▪ MATERIALS ENGINEERS

⊕ - APPROXIMATE SOIL BORING LOCATIONS

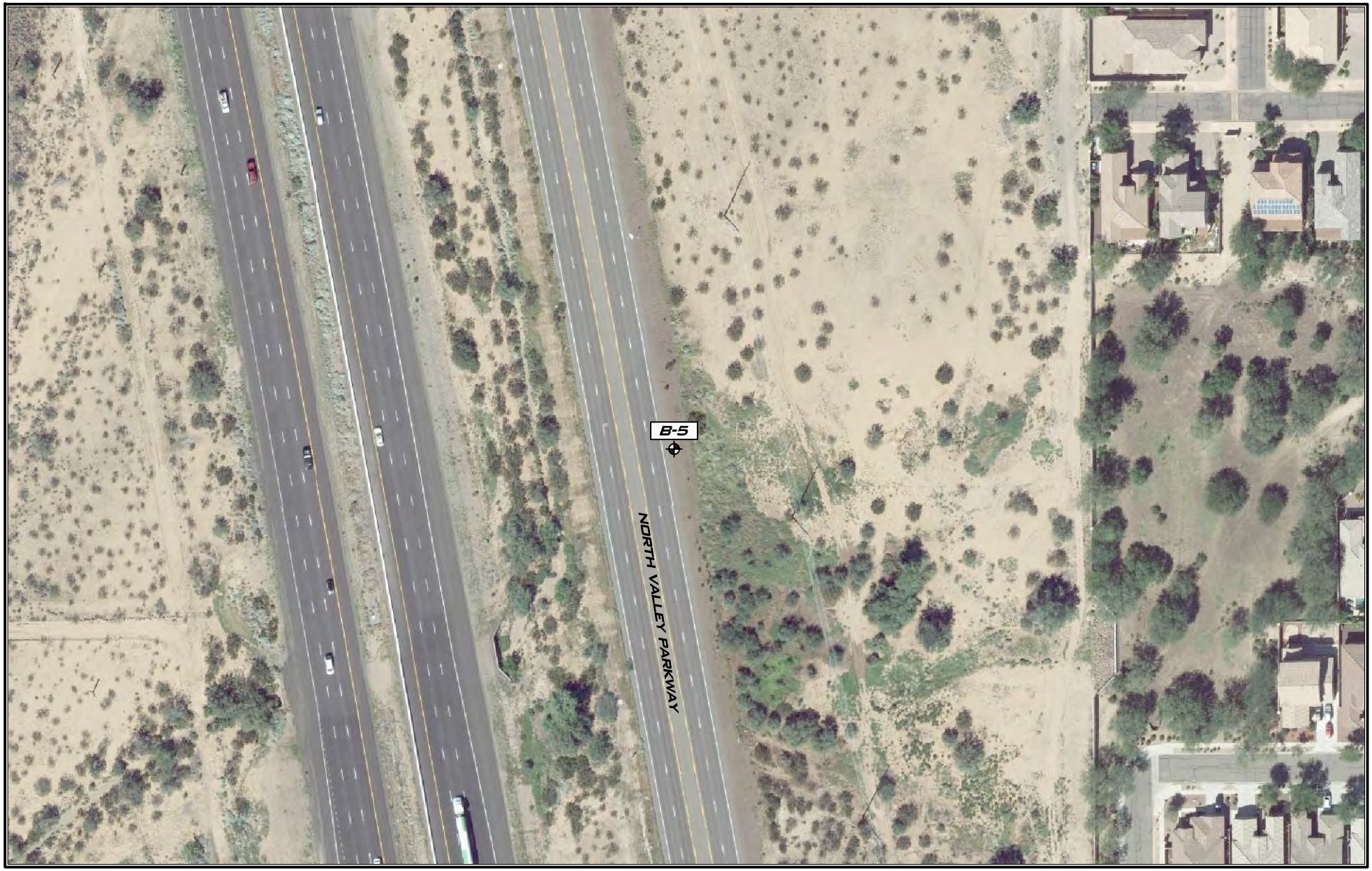
N

SOIL BORING LOCATION PLAN

SHEET: 3 of 8 | DR: TSW | REV: | DATE: 09/27/16 | PROJECT NO. 161708SA

WEST ANTHEM WASTEWATER IMPROVEMENTS
PIONEER ROAD TO CAREFREE HIGHWAY
MARICOPA COUNTY, ARIZONA

SPEEDIE AND ASSOCIATES
GEOTECHNICAL ▪ ENVIROMENTAL ▪ MATERIALS ENGINEERS



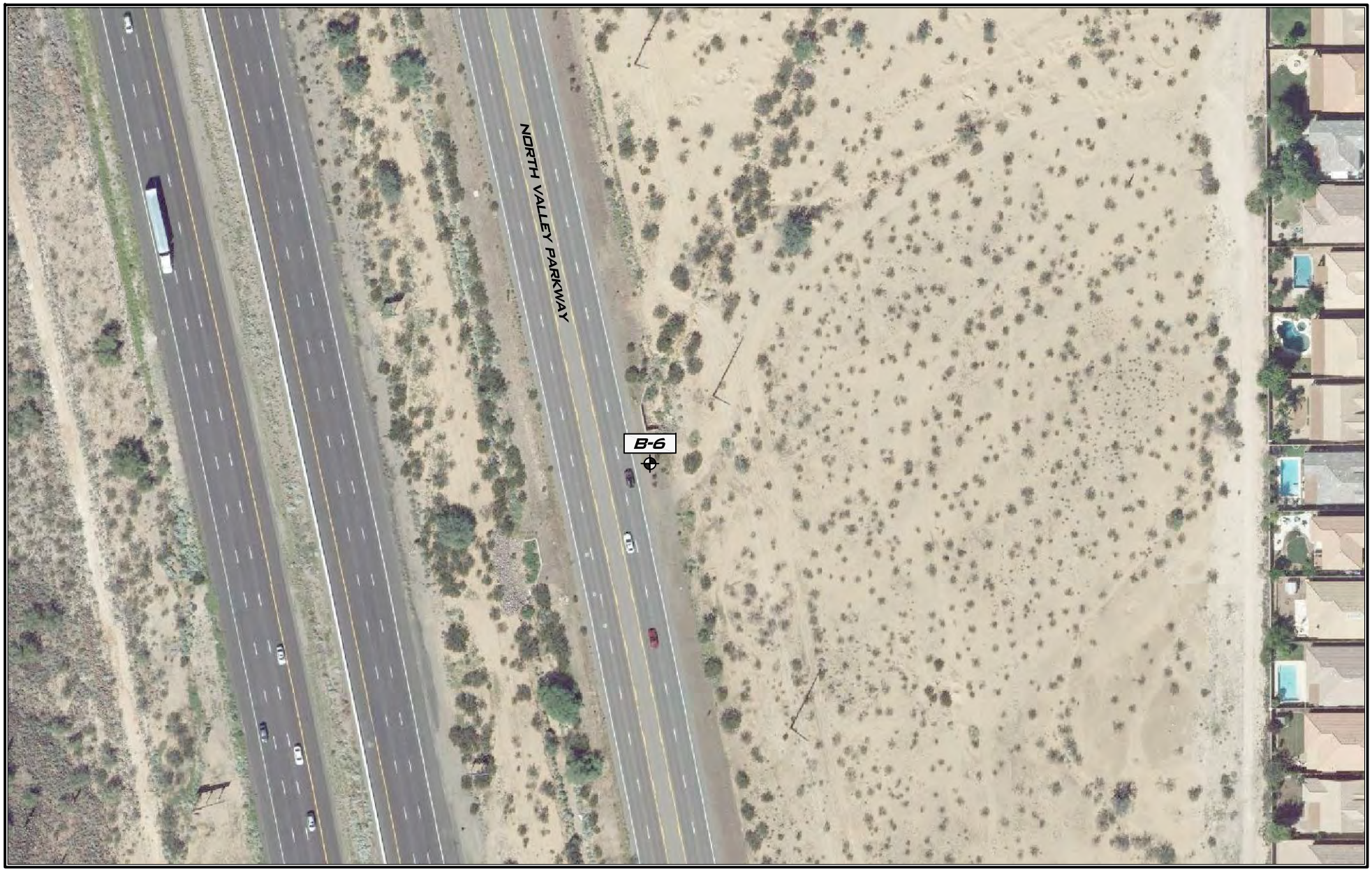
⌖ - APPROXIMATE SOIL BORING LOCATIONS

SOIL BORING LOCATION PLAN

SHEET: 4 of 8 | DR: TSW | REV: | DATE: 09/27/16 | PROJECT NO. 161708SA

WEST ANTHEM WASTEWATER IMPROVEMENTS
PIONEER ROAD TO CAREFREE HIGHWAY
MARICOPA COUNTY, ARIZONA

SPEEDIE AND ASSOCIATES
GEOTECHNICAL ▪ ENVIROMENTAL ▪ MATERIALS ENGINEERS



⌖ - APPROXIMATE SOIL BORING LOCATIONS

N

SOIL BORING LOCATION PLAN

SHEET: 5 of 8 | DR: TSW | REV: | DATE: 09/27/16 | PROJECT NO. 161708SA

WEST ANTHEM WASTEWATER IMPROVEMENTS
PIONEER ROAD TO CAREFREE HIGHWAY
MARICOPA COUNTY, ARIZONA

SPEEDIE AND ASSOCIATES
GEOTECHNICAL ▪ ENVIROMENTAL ▪ MATERIALS ENGINEERS

⌖ - APPROXIMATE SOIL BORING LOCATIONS

SOIL BORING LOCATION PLAN

SHEET: 6 of 8 | DR: TSW | REV: | DATE: 09/27/16 | PROJECT NO. 161708SA

WEST ANTHEM WASTEWATER IMPROVEMENTS
PIONEER ROAD TO CAREFREE HIGHWAY
MARICOPA COUNTY, ARIZONA

SPEEDIE AND ASSOCIATES
GEOTECHNICAL ▪ ENVIROMENTAL ▪ MATERIALS ENGINEERS

⊕ - APPROXIMATE SOIL BORING LOCATIONS

SOIL BORING LOCATION PLAN

SHEET: 7 of 8 | DR: TSW | REV: | DATE: 09/27/16 | PROJECT NO. 161708SA

WEST ANTHEM WASTEWATER IMPROVEMENTS
PIONEER ROAD TO CAREFREE HIGHWAY
MARICOPA COUNTY, ARIZONA

SPEEDIE AND ASSOCIATES
GEOTECHNICAL ▪ ENVIROMENTAL ▪ MATERIALS ENGINEERS

⊕ - APPROXIMATE SOIL BORING LOCATIONS

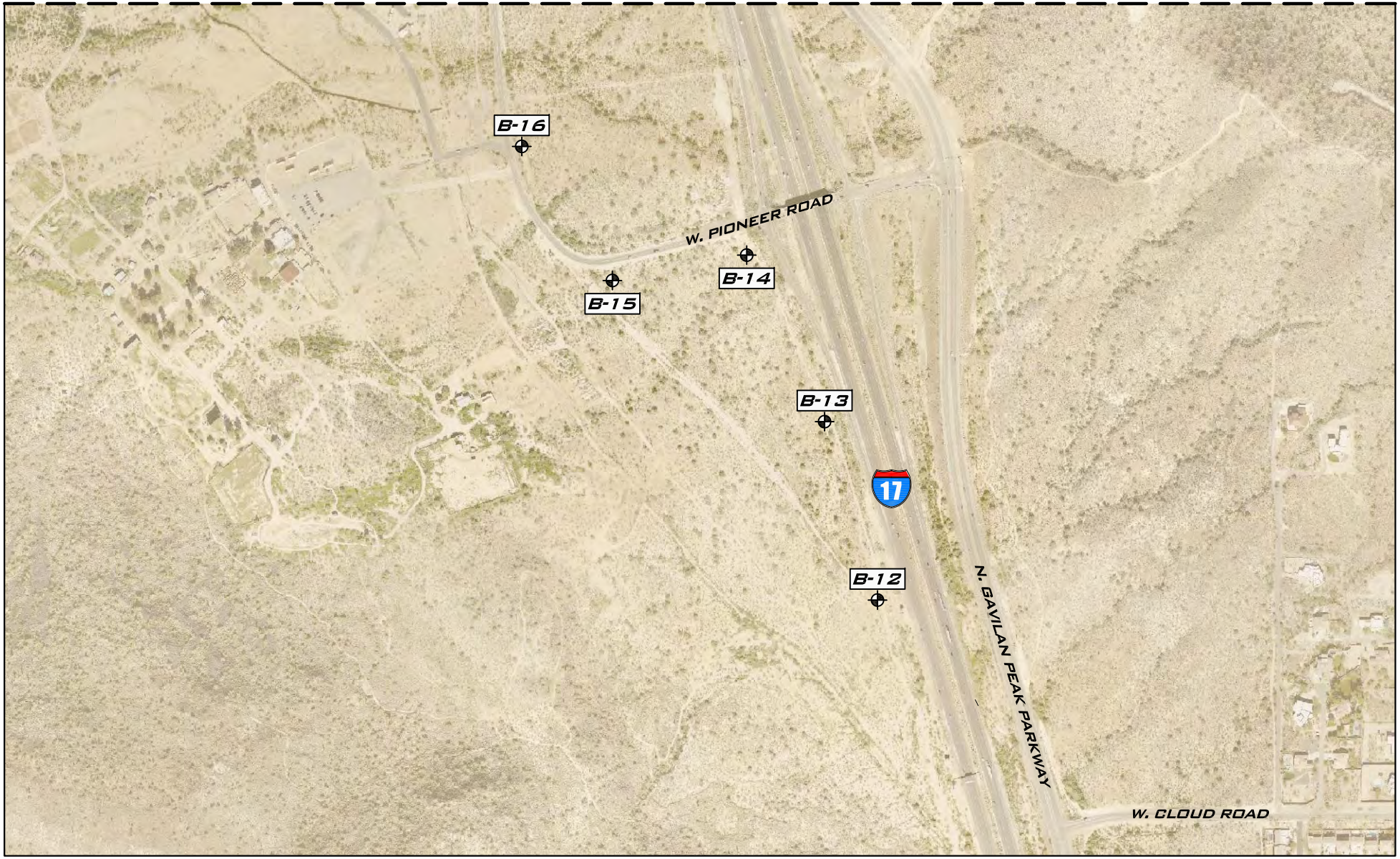
SOIL BORING LOCATION PLAN

SHEET: 8 of 8 | DR: TSW | REV: | DATE: 09/27/16 | PROJECT NO. 161708SA

WEST ANTHEM WASTEWATER IMPROVEMENTS
PIONEER ROAD TO CAREFREE HIGHWAY
MARICOPA COUNTY, ARIZONA

SPEEDIE AND ASSOCIATES
GEOTECHNICAL ▪ ENVIROMENTAL ▪ MATERIALS ENGINEERS

MATCHLINE SHEET 2



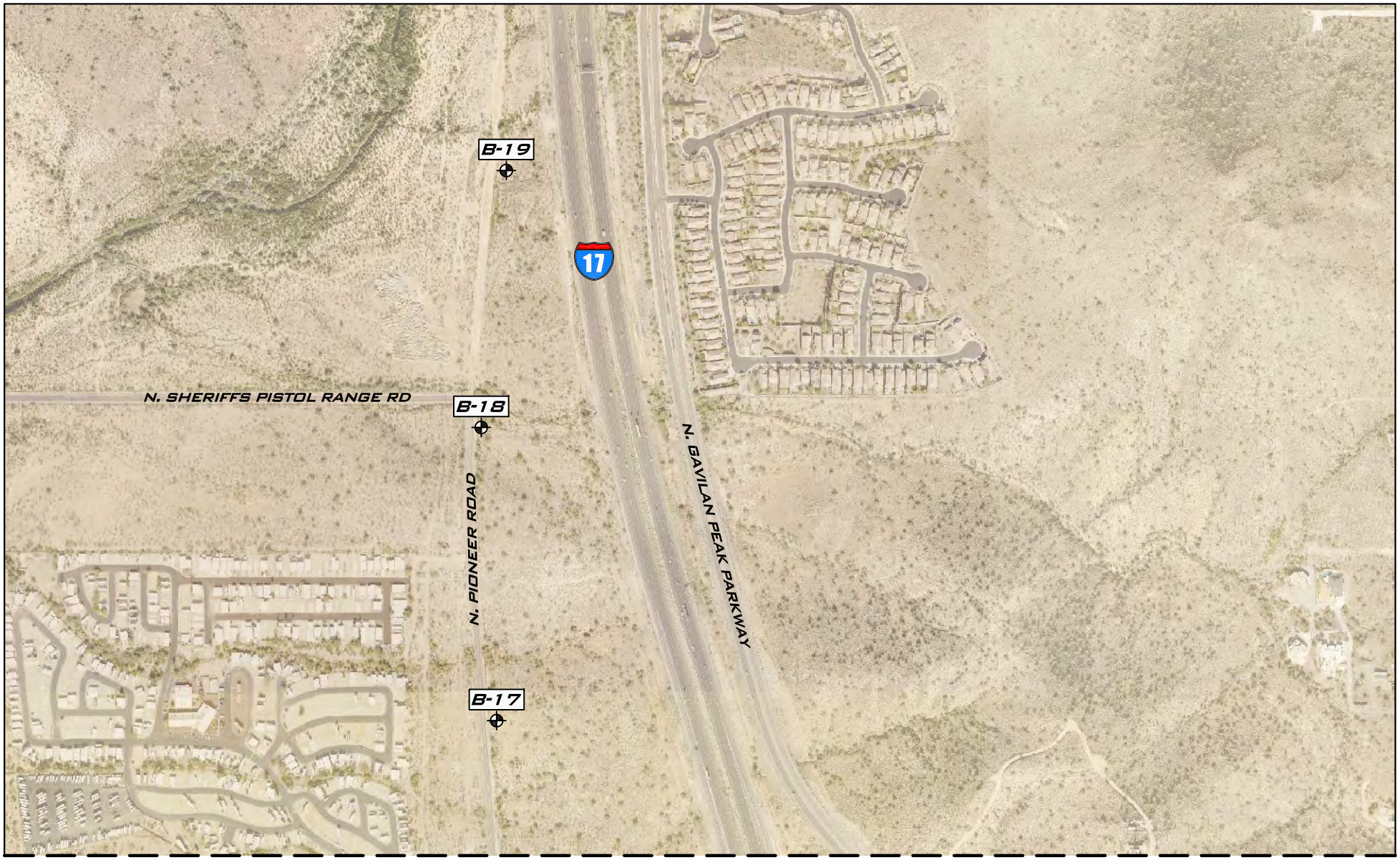
⌖ - APPROXIMATE SOIL BORING LOCATIONS

SOIL BORING LOCATION PLAN

SHEET: 1 of 2 | DR: TSW | REV: | DATE: 11/18/16 | PROJECT NO. 161708SA

WEST ANTHEM WASTEWATER IMPROVEMENTS
CLOUD ROAD TO LIFT STATION SITE (WEST I-17)
PHOENIX, ARIZONA

SPEEDIE AND ASSOCIATES
GEOTECHNICAL ▪ ENVIROMENTAL ▪ MATERIALS ENGINEERS



- APPROXIMATE SOIL BORING LOCATIONS

SOIL BORING LOCATION PLAN

SHEET: 2 of 2 | DR: TSW | REV: | DATE: 11/18/16 | PROJECT NO. 161708SA

WEST ANTHEM WASTEWATER IMPROVEMENTS
CLOUD ROAD TO LIFT STATION SITE (WEST I-17)
PHOENIX, ARIZONA

SPEEDIE AND ASSOCIATES
GEOTECHNICAL ▪ ENVIROMENTAL ▪ MATERIALS ENGINEERS

SOIL LEGEND

SAMPLE DESIGNATION		DESCRIPTION	
	AS	**Auger Sample**	A grab sample taken directly from auger flights.
	BS	**Large Bulk Sample**	A grab sample taken from auger spoils or from bucket of backhoe.
	S	**Spoon Sample**	Standard Penetration Test (ASTM D-1586) Driving a 2.0 inch outside diameter split spoon sampler into undisturbed soil for three successive 6-inch increments by means of a 140 lb. weight free falling through a distance of 30 inches. The cumulative number of blows for the final 12 inches of penetration is the Standard Penetration Resistance.
	RS	**Ring Sample**	Driving a 3.0 inch outside diameter spoon equipped with a series of 2.42-inch inside diameter, 1-inch long brass rings, into undisturbed soil for one 12-inch increment by the same means of the Spoon Sample. The blows required for the 12 inches of penetration are recorded.
	LS	**Liner Sample**	Standard Penetration Test driving a 2.0-inch outside diameter split spoon equipped with two 3-inch long, 3/8-inch inside diameter brass liners, separated by a 1-inch long spacer, into undisturbed soil by the same means of the Spoon Sample.
	ST	**Shelby Tube**	A 3.0-inch outside diameter thin-walled tube continuously pushed into the undisturbed soil by a rapid motion, without impact or twisting (ASTM D-1587).
	--	**Continuous Penetration Resistance**	Driving a 2.0-inch outside diameter "Bullnose Penetrometer" continuously into undisturbed soil by the same means of the spoon sample. The blows for each successive 12-inch increment are recorded.

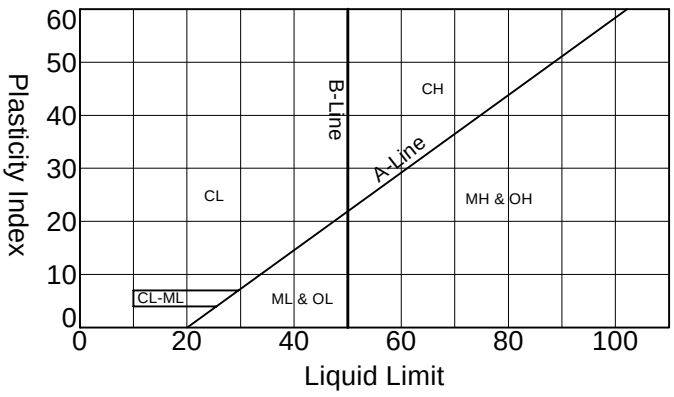
CONSISTENCY			RELATIVE DENSITY	
Clays & Silts	Blows/Foot	Strength (tons/sq ft)	Sands & Gravels	Blows/Foot
Very Soft	0 - 2	0 - 0.25	Very Loose	0 - 4
Soft	2 - 4	0.25 - 0.5	Loose	5 - 10
Firm	5 - 8	0.5 - 1.0	Medium Dense	11 - 30
Stiff	9 - 15	1 - 2	Dense	31 - 50
Very Stiff	16 - 30	2 - 4	Very Dense	> 50
Hard	> 30	> 4		

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE)	GRAVEL AND GRAVELLY SOILS (MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE)	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS (MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE)	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS (MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE)	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL OR MODIFIED SYMBOLS MAY BE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS OR TO PROVIDE A BETTER GRAPHICAL PRESENTATION OF THE SOIL

MATERIAL SIZE	PARTICLE SIZE			
	Lower Limit		Upper Limit	
	mm	Sieve Size ◆	mm	Sieve Size ◆
SANDS				
Fine	0.075	#200	0.42	#40
Medium	0.420	#40	2.00	#10
Coarse	2.000	#10	4.75	#4
GRAVELS				
Fine	4.75	#4	19	0.75" ×
Coarse	19	0.75" ×	75	3" ×
COBBLES	75	3" ×	300	12" ×
BOULDERS	300	12" ×	900	36" ×

◆U.S. Standard ×Clear Square Openings



Rig Type: **CME-75**
Boring Type: **TubeX**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0	Loose Brown CLAYEY GRAVEL (GC-Dry to Moist) with 1-5% Cobble	S-1	2.5	NT	NT	
5	Very Dense, 5-15% Cobble	S-2	6.3	NT	NT	77/9"
8.0						
10	Very Dense Light Brown WELL GRADED GRAVEL (GW-Dry) with 10-20% Cobble	S-3	11.0	NT	NT	77/12"
15.0		S-4	15.8	NT	NT	97/9"
15	Very Dense Brown CLAYEY GRAVEL (GC-Dry to Moist) with 10-20% Cobble					
20		S-5	20.3	NT	NT	50/3"
25	5-15% Cobble	S-6	25.5	NT	NT	50/6"
30		S-7	31.5	NT	NT	82/12"
35		S-8	35.3	NT	NT	50/4"
35.0	Very Dense Brown WELL GRADED GRAVEL (GW-Dry) with 5-15% Cobble					
40		S-9	40.5	NT	NT	50/6"
40.0	Very Dense Brown CLAYEY GRAVEL (GC-Dry) with 5-15% Cobble					
45		S-10	45.4	NT	NT	50/5"
50		S-11	50.3	NT	NT	50/4"
50.0	Very Dense Brown WELL GRADED GRAVEL (GW-Dry) with 5-15% Cobble					
55		S-12	55.8	NT	NT	97/9"
60		S-13	60.3	NT	NT	50/3"
60.2	End of Boring					

Boring Date: **10-5-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 1**

West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17

Rig Type: **CME-75**
Boring Type: **TubeX**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification		Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 / 25 / 50)
0	5" Asphalt Concrete	0.4					
	10" Aggregate Base	1.3					
	Dense Brown CLAYEY SAND (SC-Dry to Moist) with Some Gravel		S-1	2.5	NT	NT	
5	Medium Dense		S-2	6.5	NT	NT	
		8.0					
10	Medium Dense Brown SILTY GRAVEL (GM-Dry to Moist)		RS-3	11.0	NT	NT	
	1-5% Cobble		S-4	15.1	NT	NT	50/2"
15	Very Dense, 5-15% Cobble						
20	1-5% Cobble		S-6	21.5	NT	NT	74/12"
			~~BS-5~~	~~22.0~~	~~NT~~	~~NT~~	
25	Dry		S-7	26.5	NT	NT	55/12"
30			S-8	31.5	NT	NT	79/12"
35	5-15% Cobble		S-9	36.0	NT	NT	77/12"
40			S-10	40.8	NT	NT	82/9"
45			S-11	45.8	NT	NT	79/10"
50	Reddish Brown, 1-5% Cobble	52.0	S-12	51.5	NT	NT	85/12"
	Hard Brown SANDY LEAN CLAY (CL-Moist) with Little Gravel		AS-13	54.0	NT	NT	
55			S-14	56.5	NT	NT	86/12"
		58.0					
60	Very Dense Brown CLAYEY GRAVEL (GC-Moist) with 5-15% Cobble	60.3	S-15	60.3	NT	NT	50/3"
	End of Boring						

Boring Date: **10-12-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 2**

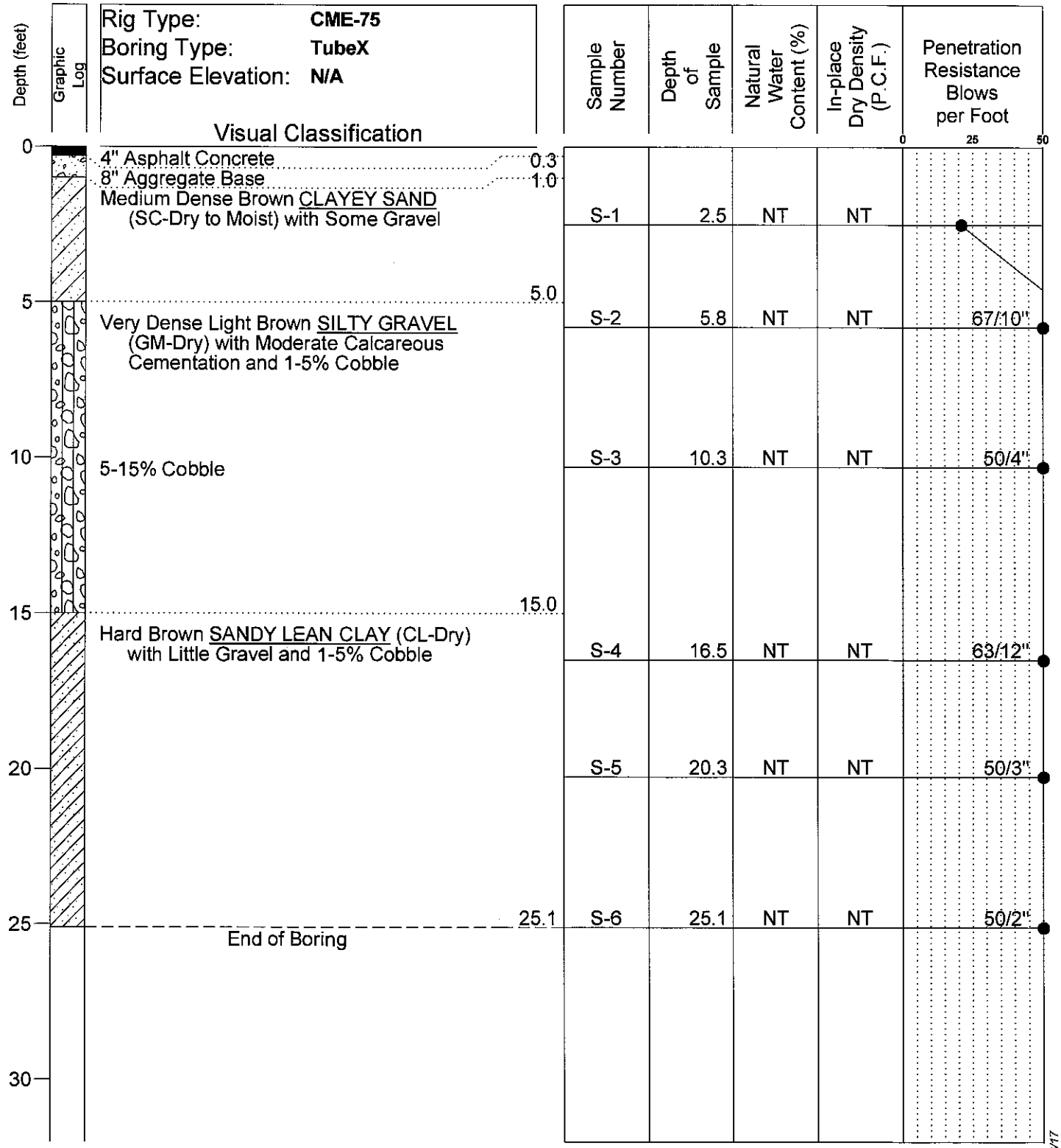
West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17



Boring Date: **10-14-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 3**

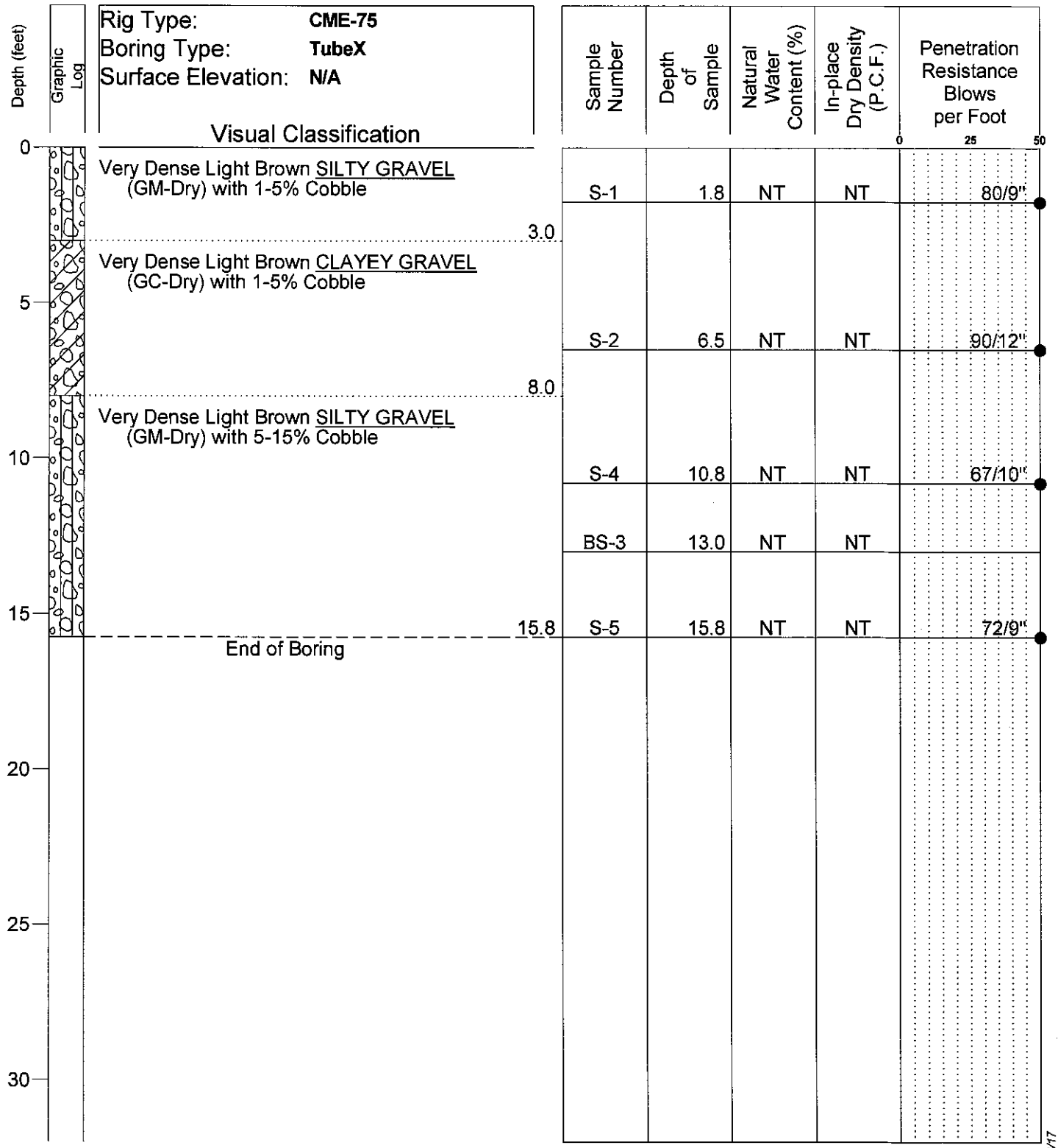
West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17



Boring Date: **10-7-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 4**

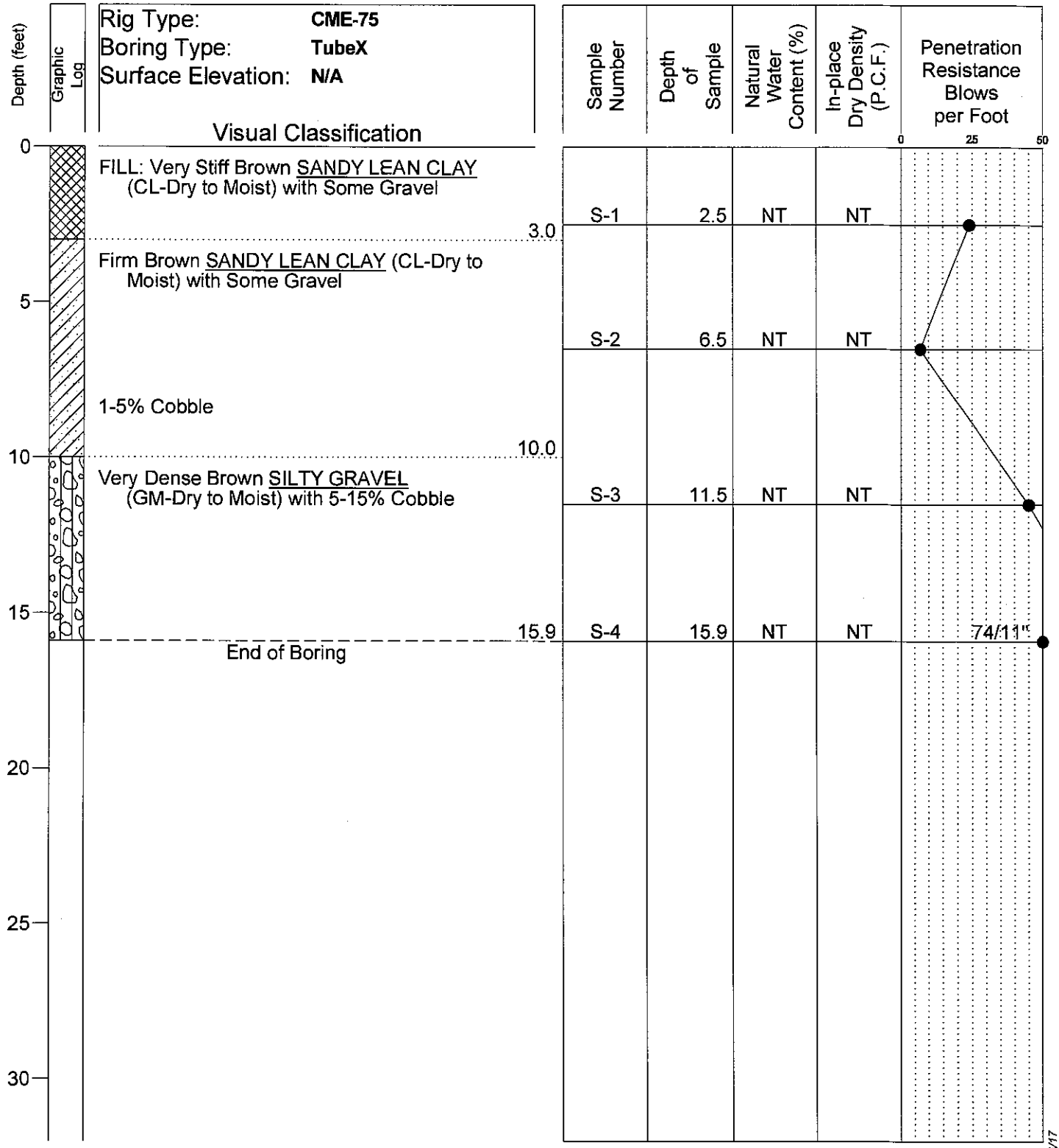
West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17



Boring Date: **10-7-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 5**

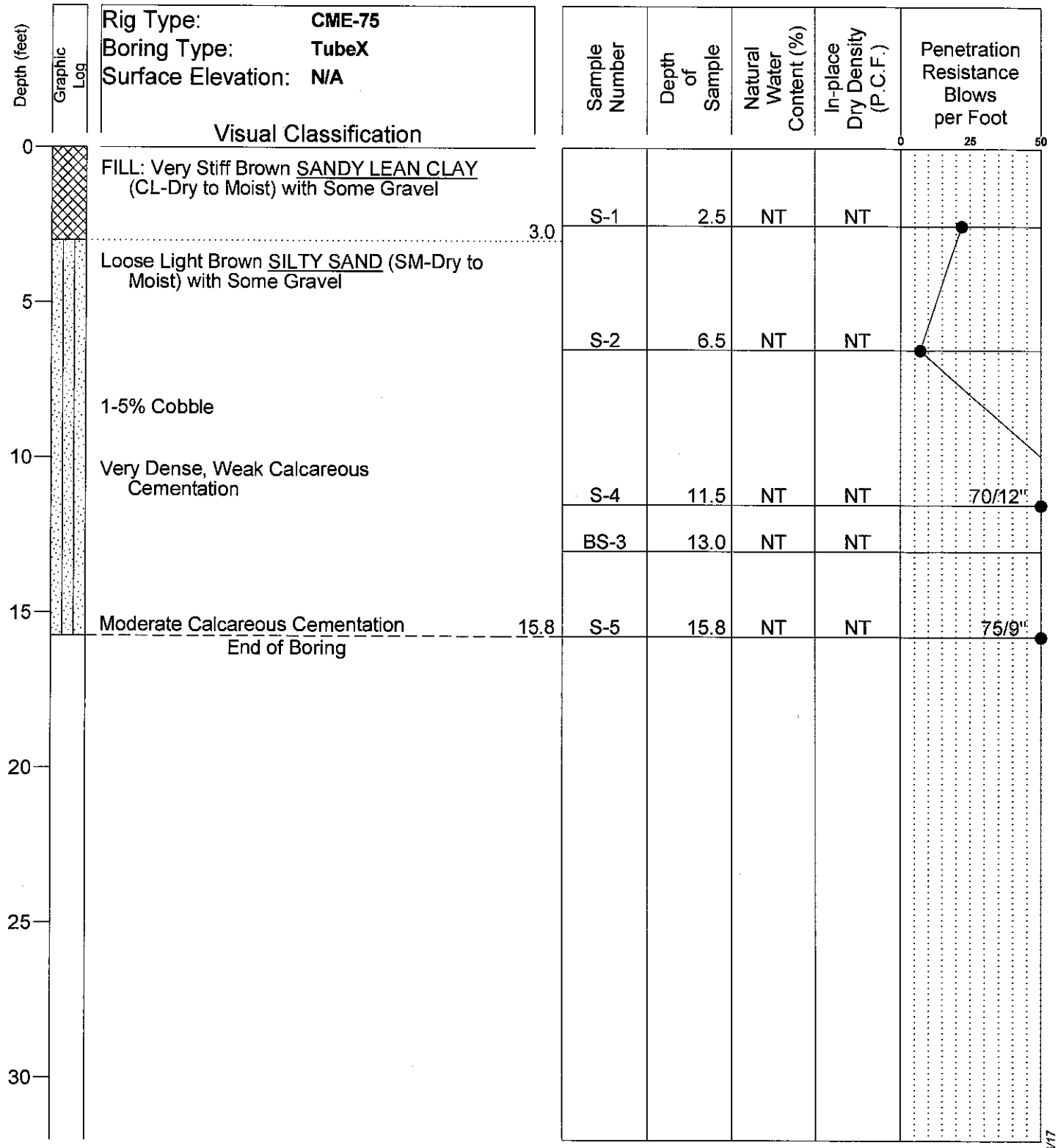
West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17



Boring Date: **10-7-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 6**

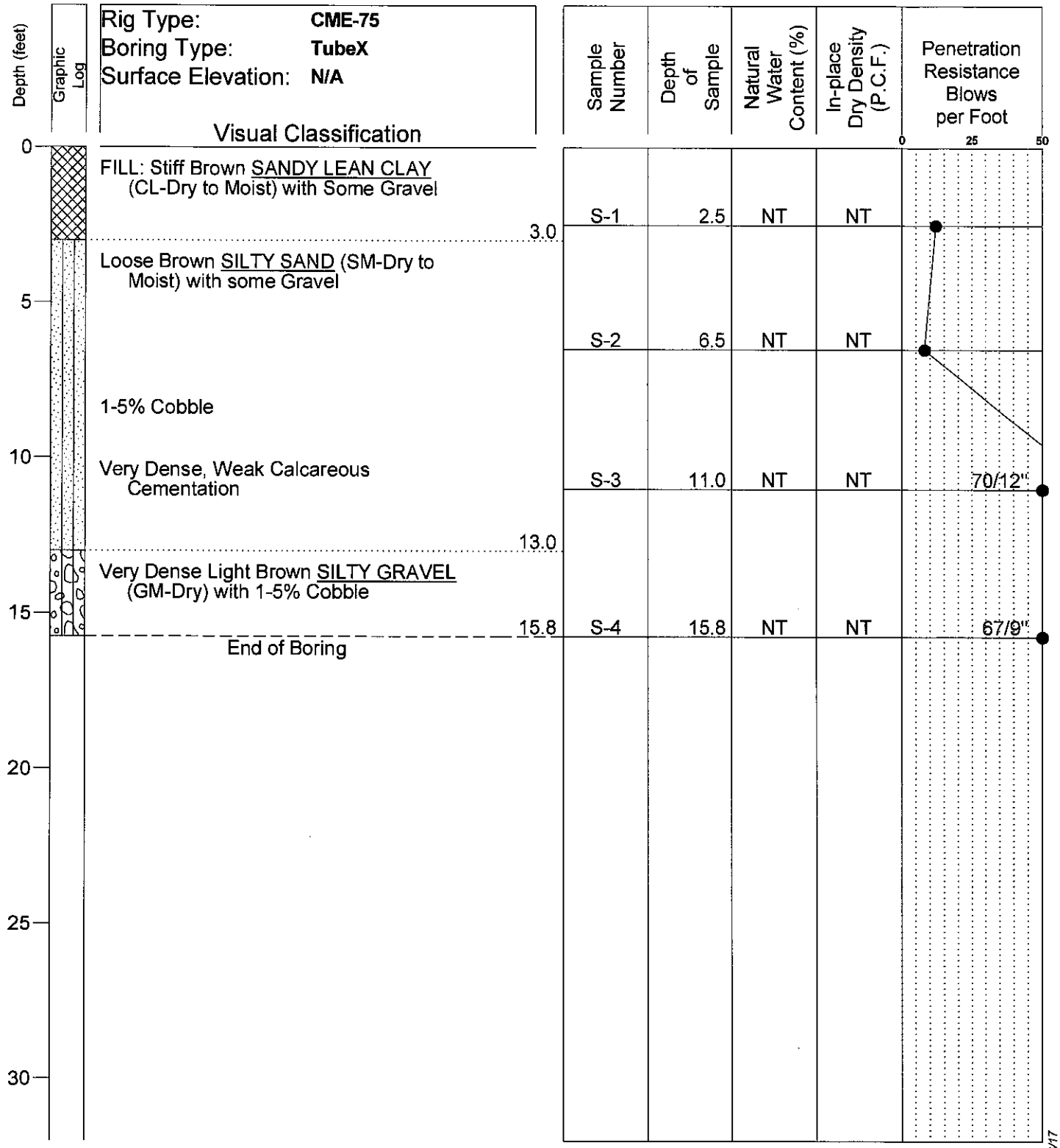
West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17



Boring Date: **10-7-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 7**

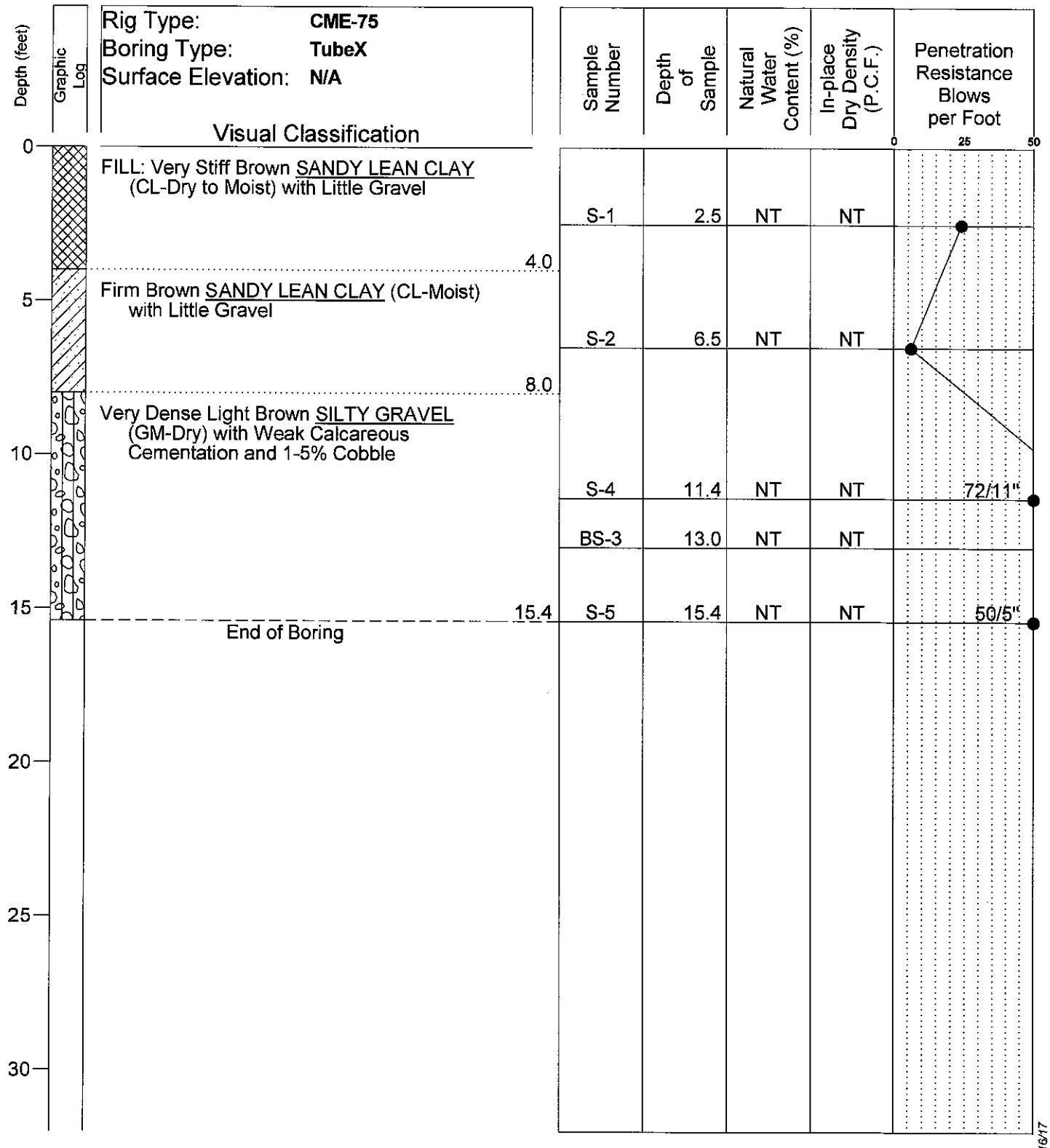
West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17



Boring Date: **10-7-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 8**

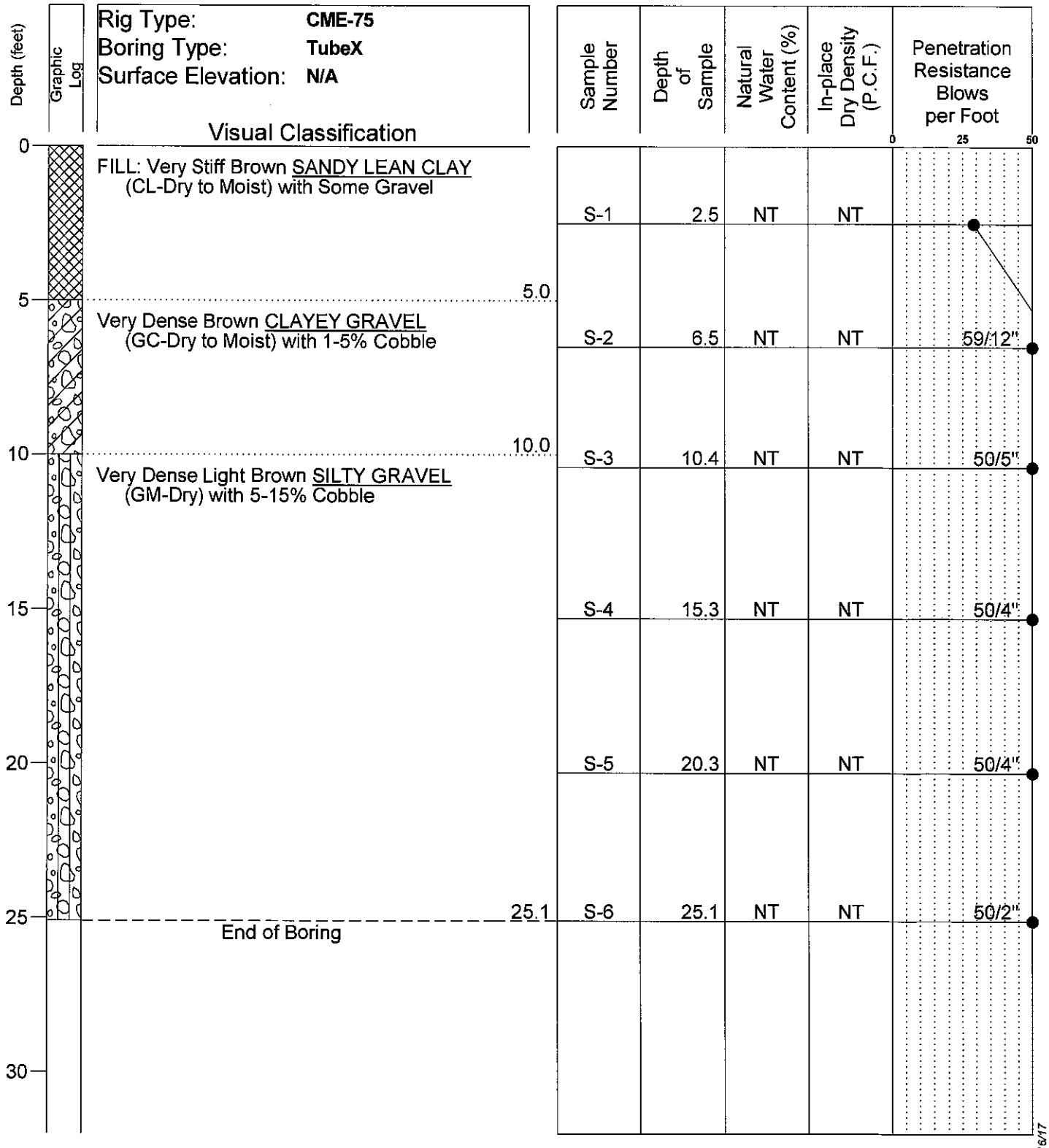
West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17



Boring Date: **10-14-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B- 9**

West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17

Rig Type: **CME-75**
Boring Type: **TubeX**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 25 50)
0	4" Asphalt Concrete (0.3)					
	8" Aggregate Base (1.0)					
	FILL: Hard Brown SANDY LEAN CLAY (CL-Dry to Moist) with Some Gravel	S-1	2.5	NT	NT	
5	(6.0)	S-2	6.5	NT	NT	
	Hard Brown SANDY LEAN CLAY (CL-Dry to Moist) with Some Gravel					
10	(10.0)	S-3	10.8	NT	NT	82/9"
	Very Dense Light Brown SILTY GRAVEL (GM-Dry) with 1-5% Cobble					
15	5-15% Cobble	S-4	15.4	NT	NT	50/5"
		S-5	20.1	NT	NT	50/2"
20						
		S-7	25.1	NT	NT	50/2"
25		BS-6	28.0	NT	NT	
		S-8	30.1	NT	NT	50/2"
30	(30.1) End of Boring					

Boring Date: **10-14-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-10**

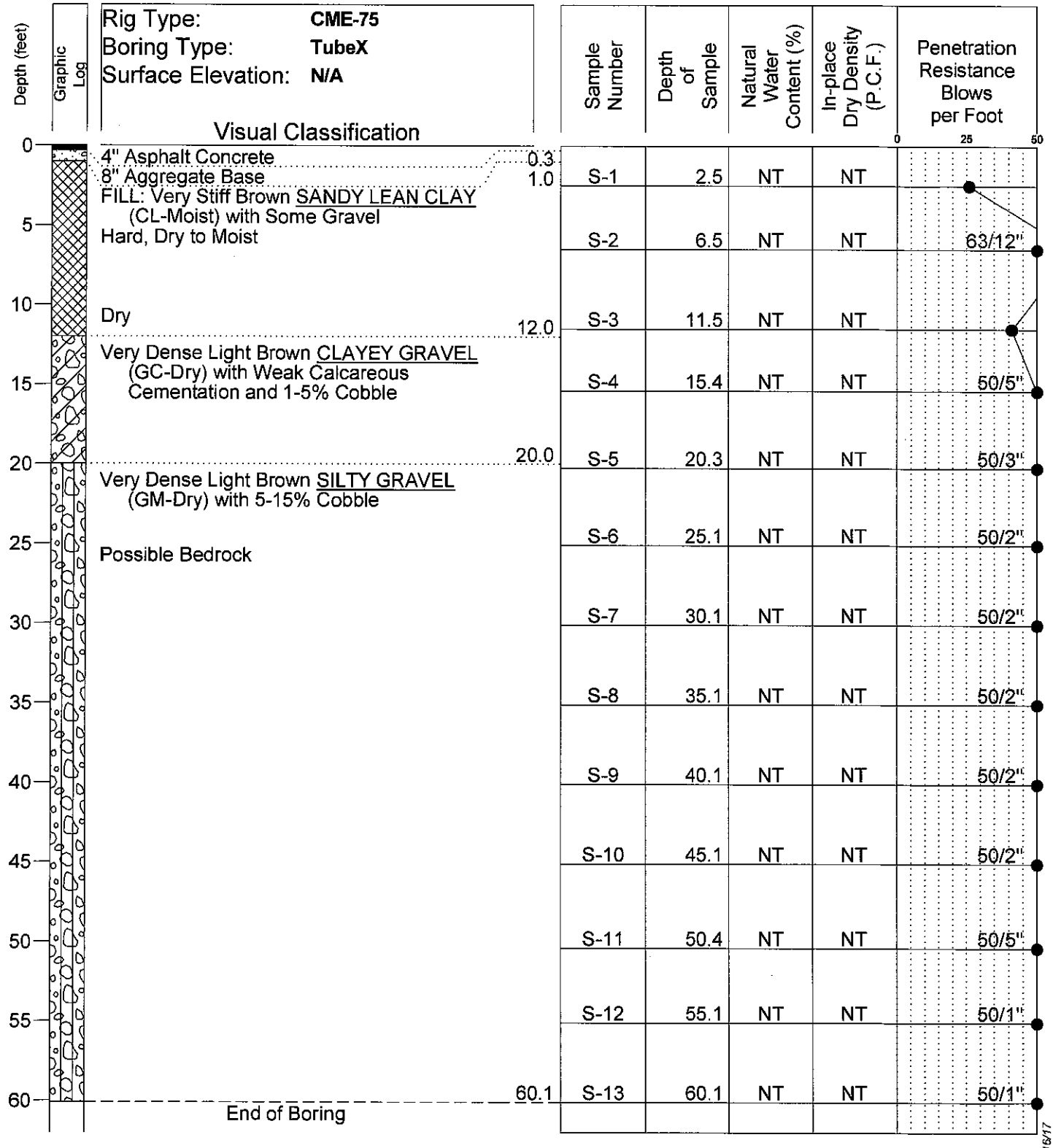
West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17



Boring Date: **10-13-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-11**

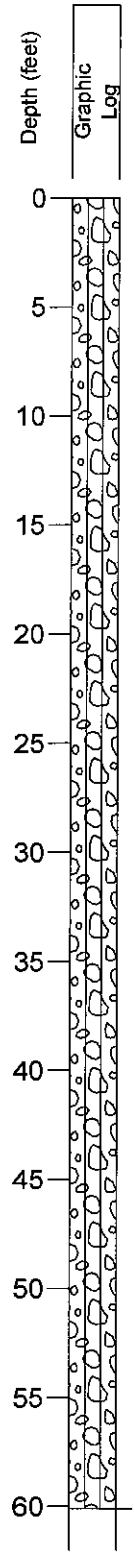
West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/15/17



Rig Type: **CME-75**
Boring Type: **TubeX**
Surface Elevation: **N/A**

Visual Classification

0 — Very Dense Light Brown SILTY GRAVEL (GM-Dry) with 5-15% Cobble

25 — Possible Bedrock

60.1 — End of Boring

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
S-1	1.3	NT	NT	50/4"
S-2	5.3	NT	NT	50/6"
S-3	10.3	NT	NT	50/3"
S-4	15.3	NT	NT	50/3"
S-6	20.1	NT	NT	50/2"
~~BS-5~~	~~21.0~~	~~NT~~	~~NT~~	
S-7	25.1	NT	NT	50/1"
S-8	30.1	NT	NT	50/2"
S-9	35.1	NT	NT	50/2"
S-10	40.1	NT	NT	50/1"
S-11	45.1	NT	NT	50/1"
S-12	50.1	NT	NT	50/2"
S-13	55.1	NT	NT	50/1"
S-14	60.1	NT	NT	50/1"

Boring Date: **10-6-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-12**

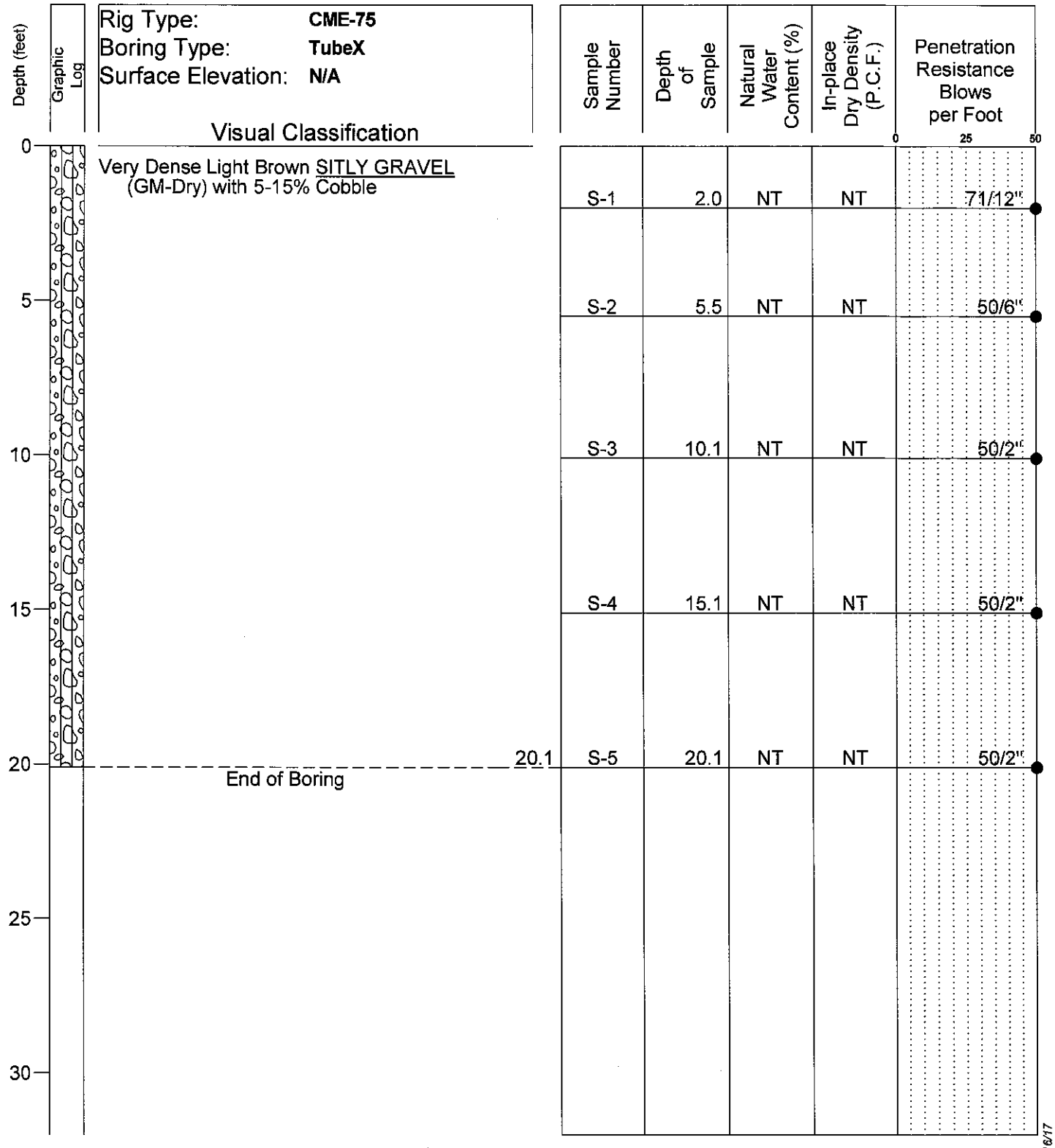
West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17



Boring Date: **12-1-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-13**

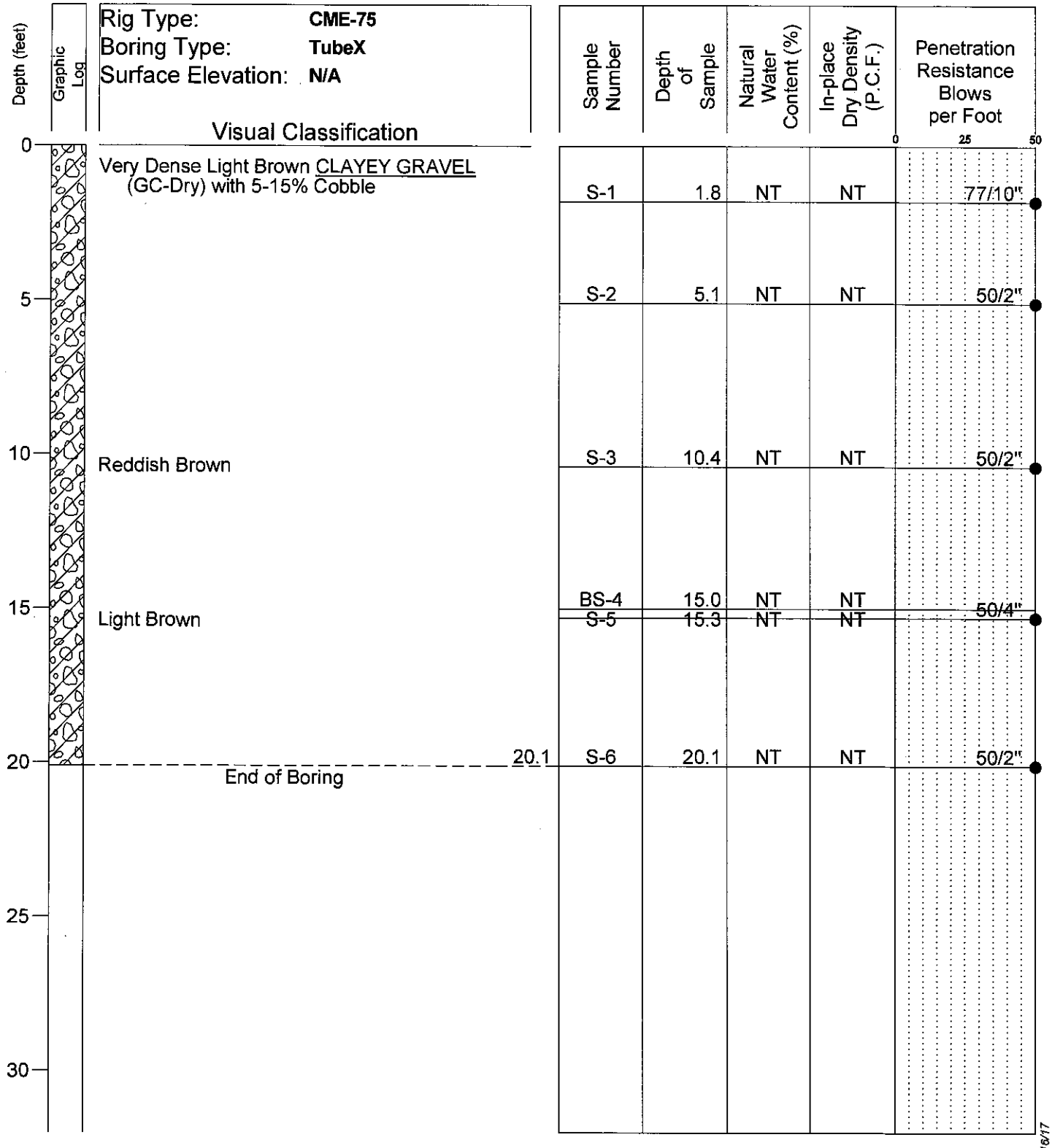
West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17



Boring Date: **12-1-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-14**

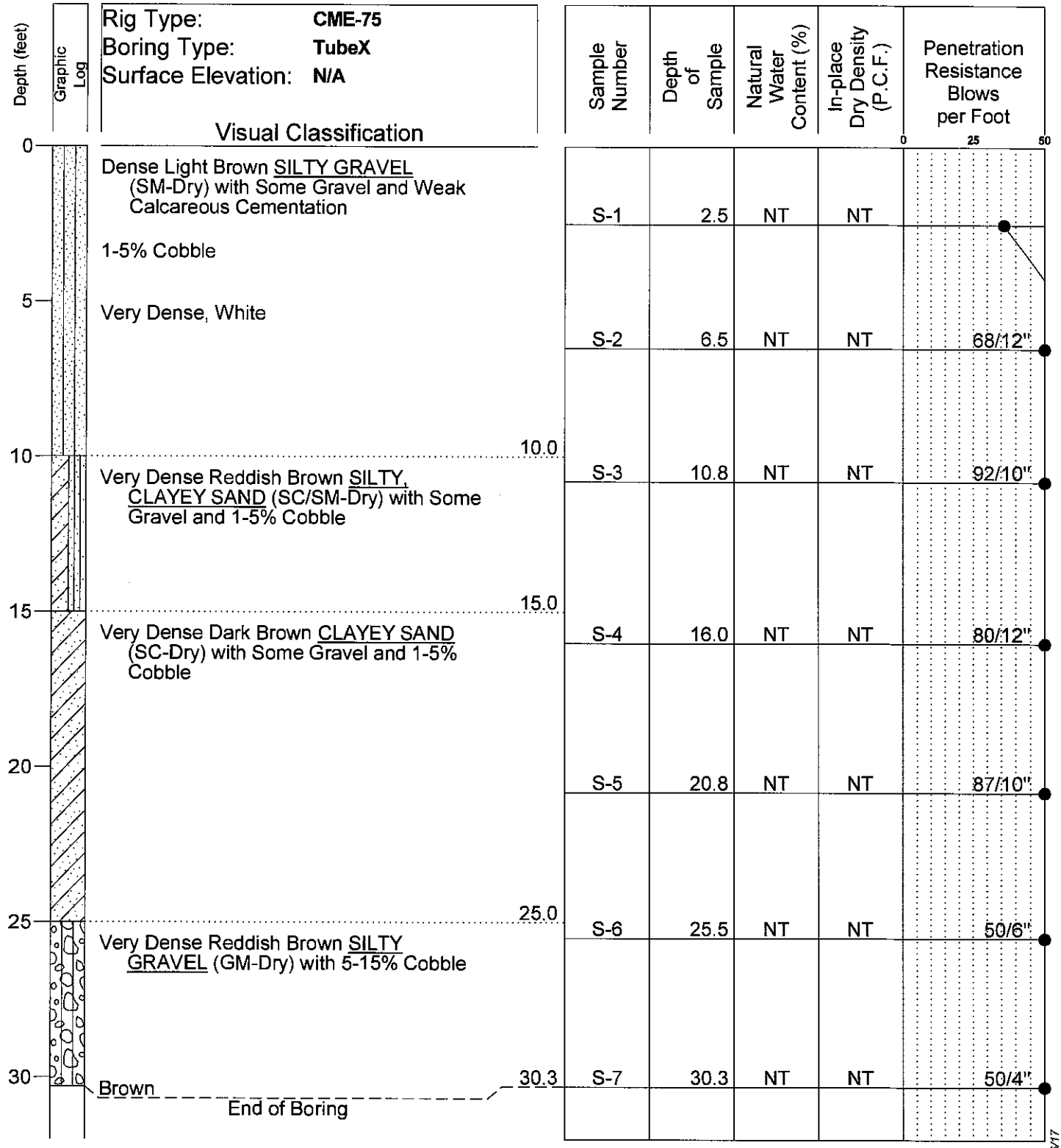
West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17



Boring Date: **11-30-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-15**

West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17

Rig Type: **CME-75**
Boring Type: **TubeX**
Surface Elevation: **N/A**

Visual Classification

Very Dense Light Brown SILTY GRAVEL (GM-Dry) with 5-15% Cobble and Moderate Calcareous Cementation

End of Boring 17.3

Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
S-1	2.0	NT	NT	66/12"
S-2	5.5	NT	NT	50/6"
S-4	10.4	NT	NT	50/5"
BS-3	12.0	NT	NT	
S-5	15.4	NT	NT	50/5"
S-6	17.3	NT	NT	50/4"

Boring Date: **12-1-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-16**

West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17

Rig Type: **CME-75**
Boring Type: **TubeX**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 / 25 / 50)
0	Very Dense Light Brown SILTY, CLAYEY SAND (SC/SM-Dry) with Some Gravel, 1-5% Cobble and Moderate Calcareous Cementation	S-1	2.3	NT	NT	50/3"
3.0	Very Dense Light Brown SILTY GRAVEL (GM-Dry) with 5-15% Cobble and Weak Calcareous Cementation	S-2	5.3	NT	NT	50/4"
5						
10	Gray	S-3	10.3	NT	NT	50/4"
15		S-4	15.4	NT	NT	50/5"
18.3	End of Boring	S-5	18.3	NT	NT	50/4"
20						
25						
30						

Boring Date: **12-1-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-17**

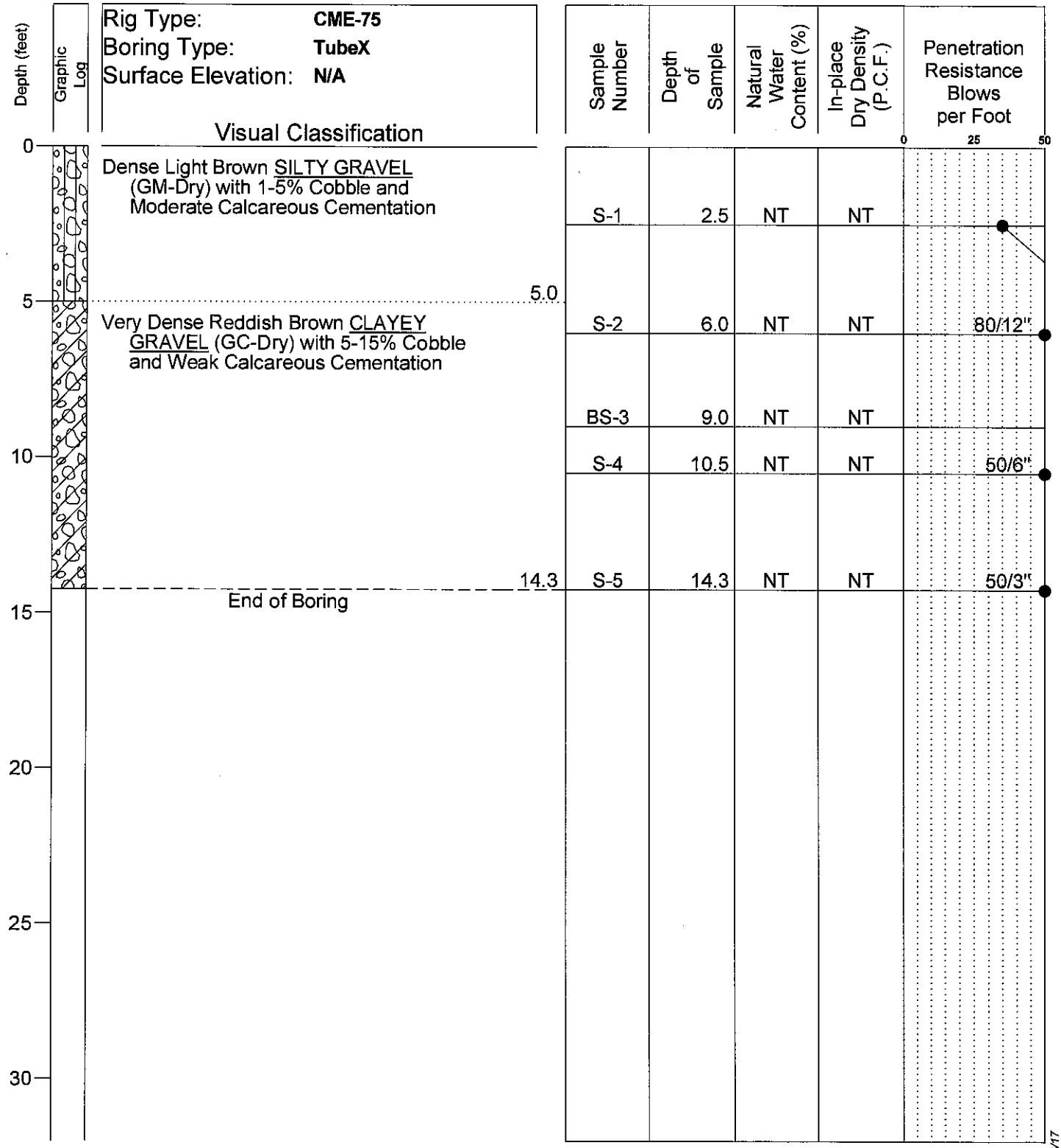
West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17



Boring Date: **12-1-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-18**

West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

_SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17

Rig Type: **CME-75**
Boring Type: **TubeX**
Surface Elevation: **N/A**

Depth (feet)	Visual Classification	Sample Number	Depth of Sample	Natural Water Content (%)	In-place Dry Density (P.C.F.)	Penetration Resistance Blows per Foot (0 – 25 – 50)
0	Medium Dense Light Brown WELL GRADED SAND with SILT (SW/SM-Dry) with Some Gravel and Moderate Calcareous Cementation	S-1	2.5	NT	NT	
5	1-5% Cobble	BS-2	5.0	NT	NT	
5.0	Medium Dense Light Brown SILTY GRAVEL (GM-Dry) with 1-5% Cobble and Moderate Calcareous Cementation	S-3	6.5	NT	NT	
10	Very Dense, 5-15% Cobble	S-4	11.5	NT	NT	84/12"
13.0	Hard Reddish Brown SANDY LEAN CLAY (CL-Dry) with Little Gravel	S-5	15.8	NT	NT	80/9"
20		S-6	21.5	NT	NT	86/12"
25.0	Very Dense Brown CLAYEY SAND (SC-Dry) with Little Gravel	S-7	26.0	NT	NT	92/12"
30.0	Hard Brown SANDY LEAN CLAY (CL-Dry) with Little Gravel	S-8	30.5	NT	NT	50/6"
35		S-9	35.5	NT	NT	50/6"
40.0	Very Dense Brown CLAYEY GRAVEL (GC-Dry) with 1-5% Cobble	S-10	40.3	NT	NT	50/3"
45		S-11	45.5	NT	NT	50/6"
50.0	Hard Brown SANDY LEAN CLAY (CL-Dry) with Little Gravel and Trace Limestone	S-12	50.4	NT	NT	50/5"
55	No Limestone	S-13	55.5	NT	NT	50/6"
60.4	Dark Brown End of Boring	S-14	60.4	NT	NT	50/5"

Boring Date: **11-30-16**
Field Engineer/Technician: **R. Markley**
Driller: **Gabe**
Contractor: **Geomechanics SW**

Water Level

Depth	Hour	Date
Free Water was Not Encountered		

NT = Not Tested

SPEEDIE AND ASSOCIATES

Log of Test Boring Number: **B-19**

West Anthem Wastewater Improvements

Pioneer Road to Carefree Highway

Anthem, Arizona

Project No.: **161708SA**

SPEEDIE 161708SA.GPJ GENGEO.GDT 5/16/17

TABULATION OF TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE INTERVAL (ft)	NATURAL WATER CONTENT (Percent of Dry Weight)	IN-PLACE DRY DENSITY (Pounds Per Cubic Foot)	PARTICLE SIZE DISTRIBUTION (Percent Finer)					ATTERBERG LIMITS			UNIFIED SOIL CLASSIFICATION	SPECIMEN DESCRIPTION
						#200 SIEVE	#40 SIEVE	#10 SIEVE	#4 SIEVE	3" SIEVE	LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX		
B- 2	BS-5	BULK	17.0 - 22.0	NT	NT	12	27	59	76	100	39	26	13	SW-SM	WELL-GRADED SAND with SILT and GRAVEL
B- 4	BS-3	BULK	8.0 - 13.0	NT	NT	2	15	52	64	100	NP	NP	NP	SP	POORLY GRADED SAND with GRAVEL
B- 6	BS-3	BULK	8.0 - 13.0	NT	NT	32	58	85	94	100	41	30	11	SM	SILTY SAND
B- 8	BS-3	BULK	8.0 - 13.0	NT	NT	24	46	71	83	100	27	24	3	SM	SILTY SAND with GRAVEL
B-10	BS-6	BULK	23.0 - 28.0	NT	NT	5	26	75	95	100	NP	NP	NP	SW-SM	WELL-GRADED SAND with SILT
B-12	BS-5	BULK	16.0 - 21.0	NT	NT	8	38	83	94	100	NP	NP	NP	SP-SM	POORLY GRADED SAND with SILT
B-14	BS-4	BULK	11.0 - 15.0	NT	NT	19	38	68	86	100	26	21	5	SC-SM	SILTY, CLAYEY SAND
B-16	BS-3	BULK	7.0 - 12.0	NT	NT	16	35	64	79	100	24	21	3	SM	SILTY SAND with GRAVEL
B-18	BS-3	BULK	4.0 - 9.0	NT	NT	11	34	69	82	100	NP	NP	NP	SW-SM	WELL-GRADED SAND with SILT and GRAVEL
B-19	BS-2	BULK	0.0 - 5.0	NT	NT	11	26	54	78	100	NP	NP	NP	SW-SM	WELL-GRADED SAND with SILT and GRAVEL

Sieve analysis results do not include material greater than 3". Refer to the actual boring logs for the possibility of cobble and boulder sized materials.

NT=Not Tested

Sheet 1 of 1

West Anthem Wastewater Improvements
Pioneer Road to Carefree Highway
Anthem, Arizona
Project No. 161708SA

SPEEDIE AND ASSOCIATES

TABULATION OF TEST DATA 161708SA.GPJ GENGEO.GDT 12/15/16

CORROSIVE TEST DATA

SOIL BORING or TEST PIT NUMBER	SAMPLE NUMBER	SAMPLE TYPE	SAMPLE INTERVAL (ft)	PERCENT FINER #200 SIEVE	pH	RESISTIVITY (Ohm-Centimeters)	PPM SULFATE (SO4)	PPM CHLORIDE (CL)	SULFIDE (+ or -)	REDOX (millivolts)	UNIFIED SOIL CLASSIFICATION	SPECIMEN DESCRIPTION
B- 2	BS-5	BULK	17.0 - 22.0	12	7.56	1176	3	17	NT	NT	SW-SM	WELL-GRADED SAND with SILT and GRAVEL
B- 4	BS-3	BULK	8.0 - 13.0	2	8.15	3668	3	41	NT	NT	SP	POORLY GRADED SAND with GRAVEL
B- 6	BS-3	BULK	8.0 - 13.0	32	7.54	567	18	160	NT	NT	SM	SILTY SAND
B- 8	BS-3	BULK	8.0 - 13.0	24	7.96	692	47	660	NT	NT	SM	SILTY SAND with GRAVEL
B-10	BS-6	BULK	23.0 - 28.0	5	7.96	8304	3	27	NT	NT	SW-SM	WELL-GRADED SAND with SILT
B-12	BS-5	BULK	16.0 - 21.0	8	8.22	9688	22	24	NT	NT	SP-SM	POORLY GRADED SAND with SILT
B-14	BS-4	BULK	11.0 - 15.0	19	8.26	3813	6	10	NT	NT	SC-SM	SILTY, CLAYEY SAND
B-16	BS-3	BULK	7.0 - 12.0	16	8.35	3075	3	7	NT	NT	SM	SILTY SAND with GRAVEL
B-18	BS-3	BULK	4.0 - 9.0	11	8.3	1799	15	36	NT	NT	SW-SM	WELL-GRADED SAND with SILT and GRAVEL

West Anthem Wastewater Improvements
Pioneer Road to Carefree Highway
Anthem, Arizona
Project No. 161708SA

SPEEDIE AND ASSOCIATES

SPEEDIE
AND ASSOCIATES
Geotechnical • Environmental • Materials Engineers

October 16, 2017

Larry J. Leischner
Stanley Consultants
1661 East Camelback Road
Suite 400
Phoenix, AZ 85016

RE: Project No. 161708SA
West Anthem Wastewater Improvements
Pioneer Road to Carefree Highway
Phoenix, AZ
Seismic Refraction Surveys

Mr. Leischner:

Pursuant to your request Speedie and Associates has consulted with Geological Consultants Inc. to perform a Seismic Refraction Survey to determine excavatability along the proposed pipeline alignment at the above reference site. Please refer to the attached report GCI Project No. 2017-136. In addition S&A has completed a report on Geotechnical Investigation for the entire site our project No. 161708SA.

If you have any questions please do not hesitate to call.

Respectfully submitted,
SPEEDIE & ASSOCIATES, INC.

Kenneth M. Euge II

Keith R. Gravel, P.E.

Report Prepared for:

Speedie & Associates
3331 East Wood Drive
Phoenix, AZ 85040

Prepared for: Mr. Gregg Creaser, P.E.
President

Speedie Project No. 161708SA

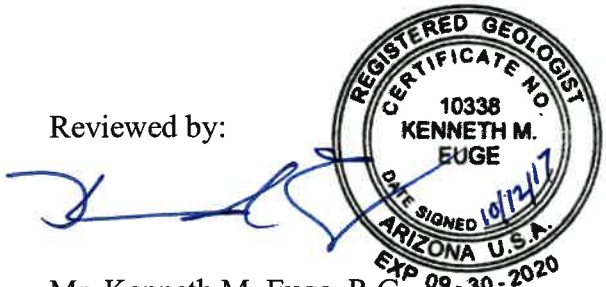
Report Prepared by:

Geological Consultants Inc.
2333 West Northern Avenue, Suite 1A
Phoenix, Arizona 85021

Prepared by:

Ms. Martina G. Velasquez
Project Geoscientist

Reviewed by:



Mr. Kenneth M. Euge, R.G.
Principal Geologist

SEISMIC REFRACTION SURVEY

WEST ANTHEM WASTEWATER IMPROVEMENTS
I-17, CAREFREE HIGHWAY TO PIONEER ROAD
CITY OF PHOENIX, ARIZONA

GCI Project No. 2017-136

October 11, 2017

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SEISMIC REFRACTION SURVEY

WEST ANTHEM WASTEWATER IMPROVEMENTS

I-17, CAREFREE HIGHWAY TO PIONEER ROAD
CITY OF PHOENIX, ARIZONA

1.0 INTRODUCTION

This report presents results of a seismic refraction geophysical field investigation and analysis to assess general subsurface conditions at the location of the proposed West Anthem Wastewater Treatment Plant (WWTP) Improvements for a buried effluent disposal pipeline alignment in north Phoenix, Arizona (Figure 1). Eighteen seismic refraction survey lines were used to evaluate the subsurface conditions of the effluent pipeline alignment west of the I-17 freeway north of Pioneer Road and south of Pioneer Road at the proposed bored freeway crossing to the east side of the North Valley Parkway alignment, south to the Carefree Highway (Figure 2). The specific seismic survey line locations were selected following a joint reconnaissance of the property and discussions regarding the general requirements for this project with Messrs. Gregg Creaser, P. E. President and Kenny Euge, II, Project Coordinator of Speedie & Associates and Mr. Kenneth M. Euge, Sr., R.G. Principal Geologist with Geological Consultants Inc. Seismic refraction survey field work was completed on September 19 and October 5, 2017. This report is provided to supplement the geotechnical investigation conducted by Speedie & Associates (2016).

In general, the seismic survey lines are underlain by a loose to dense, weakly to moderately cemented alluvial soil underlain in some areas by a dense, more strongly cemented zone overlying a hard caliche-cemented unit, or in some areas, a very weathered to unweathered bedrock unit. See Table 1 for interpreted units at each seismic line.

Seismic survey line data are used to develop reasonable interpretations of subsurface conditions within specified areas of the project site. The objectives of the seismic refraction geophysical surveys are to provide for, by indirect means, a higher level of confidence to:

- Indirectly characterize earth fill, natural soil, bedrock, or bedrock-like materials that may be present within and adjacent to the proposed West Anthem WWTP Improvements project site.

- Evaluate the thicknesses of existing soil overburden alluvium and depths to underlying dense to caliche-cemented alluvium and very weathered to unweathered bedrock.

The Scope of Work performed to accomplish the objectives of this study included:

- Mobilizing and demobilizing personnel and equipment to and from the job site.
- Completion of eighteen seismic refraction surveys and preliminary field analysis of survey results. Figure 2 depicts the locations of the seismic refraction survey lines. A seismic refraction survey could not be conducted at or in the vicinity of Speedie drill hole B-1 due to the presence of extensive buried utilities and excessive traffic noise.
- A rough position survey using a hand-held GPS receiver to locate the seismic lines relative to the site topography and cultural features observed at the site.
- Computer analysis of field data and interpretation of results was performed to complete the assessment of the materials present, their relative quality and their excavateability.
- Preparation of this report to document the seismic refraction survey, its findings, interpretations, conclusions, and recommendations.

The seismic survey was designed to investigate a representative area of the West Anthem WWTP Improvements site to address concerns relative to the site soil conditions and to determine the depth of bedrock (if present) that may be encountered at and in the vicinity of excavations proposed at this site, and qualitatively assess the relative ease of excavation of the soils, and bedrock that may be encountered. Velocity, thickness, and depth computations of different horizons, or zones, are provided to generally characterize site materials within the depth of interest expected at the project site. No direct subsurface explorations, such as test pits, were made by Geological Consultants Inc. as part of this seismic refraction survey. However, soil borings were advanced by Speedie and Associates prior to the seismic surveys.

2.0 CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the cursory site reconnaissance, seismic surveys, and the data interpretations, the following conclusions and recommendations are provided:

2.1 **Site Geology**: The West Anthem WWTP Improvements project location is located within an area of the middle to late Tertiary age, Early Miocene period volcanic field that surrounds the I-17 corridor between Anthem and north Phoenix, Arizona. The volcanic units were deposited on an underlying pre-Cambrian age igneous and metamorphic bedrock basement that was subjected to subsequent tectonic activity that tilted and faulted the volcanic bedrock (Leighty & Huckleberry, 1998). Meta-volcanic bedrock is exposed in the vicinity of the Interstate Highway (I-17)-Pioneer Road overpass where the pipeline alignment crosses the I-17 and North Valley Parkway alignment from west to east. The tilted and faulted the volcanic bedrock and the underlying basement bedrock are partially buried by late Tertiary age basin fill and then covered by young Quaternary age alluvial fan and fan terrace deposits.

The meta-volcanic bedrock, which could be encountered beneath alluvial overburden deposits in the Pioneer Road overpass area, are varicolored, fine-grained, massive to thick-bedded and very hard. Where exposed in outcrops, the bedrock is broken by close-spaced joint and fracture discontinuities and it is well weathered and broken. However, at depth the bedrock is expected to vary from poorly indurated to very well indurated. The contact boundary between the bedrock and the overburden alluvial deposits is marked by a variable thickness zone of weathered bedrock and alluvial fan deposits that are strongly cemented with caliche to a rocklike consistency.

A variety of younger volcanic bedrock units have been deposited in this area on top of the basement bedrock are exposed in the hills west of I-17, northwest of the Carefree Highway overpass. The bedrock includes vesicular basaltic and andesitic lava flows and volcano-clastic tuff beds. On the east side of the I-17 alignment, along the North Valley Parkway alignment, these younger bedrock units could be encountered at shallow depths beneath a cover of variably cemented alluvial fan deposits and locally, very young ephemeral stream channel deposits.

The young surficial soil deposits of the alluvial fans and terraces are moderately to poorly sorted silty sands and gravel. These soils are loose to very dense and weakly cemented. Old alluvial fan deposits could be encountered beneath the thin surficial soil cover. The old alluvial fan deposits are reportedly composed of moderately consolidated silty sand

and sandy silt, poorly indurated sandstone with sandy conglomerates with gravel to boulder-size rock fragments. The soils are moderately to strongly cemented with caliche and may locally be cemented to a rocklike (calcrete) consistency.

2.2 **Seismic Survey Results**: Interpreted stratigraphy derived from the seismic survey data is depicted in Figures 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, and 37. These figures include the average seismic velocities of the materials encountered along the seismic line, a thickness profile of the different velocity zones, and the calculated velocity zone boundaries. Our interpretations of the geologic materials represented by the measured seismic velocities are summarized in Table 1. High seismic velocity zones ($\geq$ 6,000 feet per second (fps)), including alluvial deposits cemented with caliche to a rocklike consistency and/or weathered to unweathered bedrock, were interpreted from the seismic refraction data obtained at seismic survey lines WA-06 thru WA-18, inclusive.

Table 1
Seismic Survey Line Calculated Depth/Velocity Ranges
West Anthem WWTP Improvements
Pioneer Road to Carefree Highway, Phoenix Arizona

Survey Line No.	Depth Range at Shot Point (ft)			Average Seismic Velocity (ft/sec)	Interpreted Geologic Description	Qualitative Rippability
	A	B	C			
WA-02	0 - 2.8	0 - 2.5	0 - 4.0	1,514	Loose to Dense, Weakly Cemented Alluvial Soil	Slight
	2.8 - 30+	2.5 - 30+	4.0 - 30+	4,490	Strongly Cemented Alluvial Soil or Weathered Bedrock	Marginal
WA-03	0 - 2.3	0 - 4.6	0 - 7.8	1,390	Loose to Dense, Weakly Cemented Alluvial Soil	Slight
	2.3 - 30+	4.6 - 30+	7.8 - 30+	4,872	Strongly Cemented Alluvial Soil or Weathered Bedrock	Marginal
WA-04	0 - 3.2	0 - 3.0	0 - 0.6	1,413	Loose to Dense, Weakly Cemented Alluvial Soil	Slight
	3.2 - 30+	3.0 - 30+	0.6 - 30+	5,557	Very Dense, Caliche-Cemented, Near Rocklike, Alluvial Soil or Weathered Bedrock	Marginal to Severe

Survey Line No.	Depth Range at Shot Point (ft)			Average Seismic Velocity (ft/sec)	Interpreted Geologic Description	Qualitative Rippability
	A	B	C			
WA-05	0 - 1.4	0 - 3.0	0 - 3.1	1,158	Loose to Firm, Weakly Cemented Alluvial Soil	Slight
	1.4 - 11.0	3.0 - 10.2	3.1 - 8.8	1,707	Dense, Weakly to Moderately Cemented Alluvial Soil	Slight
	11.0 - 30.0+	10.2 - 30+	8.8 - 30+	4,517	Strongly Cemented Alluvial Soil or Weathered Bedrock	Marginal
WA-06	0 - 1.7	0 - 5.7	0 - 8.7	1,377	Loose to Dense, Weakly Cemented Alluvial Soil	Slight
	1.7 - 21.1	5.7 - 23.8	8.7 - 18.2	3,189	Very Dense, Strongly Cemented Alluvial Soil or Weathered Bedrock	Marginal
	21.1 - 30+	23.8 - 30+	18.2 - 30+	6,089	Hard, Caliche-Cemented, Near Rocklike, Alluvial Soil or Weathered Bedrock	Severe
WA-07	0 - 14.6	0 - 13.4	0 - 13.7	1,925	Dense, Weakly to Moderately Cemented Alluvial Soil or Very Weathered Bedrock	Slight
	14.6 - 30+	13.4 - 30+	13.7 - 30+	6,365	Hard, Caliche-Cemented, Near Rocklike, Alluvial Soil or Weathered Bedrock	Severe
WA-08	0 - 17.7	0 - 15.0	0 - 14.1	2,100	Dense, Weakly to Moderately Cemented Alluvial Soil or Very Weathered Bedrock	Slight
	17.7 - 30+	15.0 - 30+	14.1 - 30+	8,152	Moderately to Slightly Weathered Bedrock	Severe
WA-09	0 - 3.4	0 - 3.0	0 - 3.5	1,836	Dense, Weakly to Moderately Cemented Alluvial Soil or Very Weathered Bedrock	Slight
	3.4 - 30+	3.0 - 30+	3.5 - 30+	6,968	Hard, Caliche-Cemented, Near Rocklike, Alluvial Soil or Weathered Bedrock	Severe
WA-10	0 - 4.7	0 - 5.0	0 - 6.8	2,372	Dense, Weakly to Moderately Cemented Alluvial Soil or Very Weathered Bedrock	Slight
	4.7 - 30+	5.0 - 30+	6.8 - 30+	7,940	Moderately to Slightly Weathered Bedrock	Severe

Survey Line No.	Depth Range at Shot Point (ft)			Average Seismic Velocity (ft/sec)	Interpreted Geologic Description	Qualitative Rippability
	A	B	C			
WA-11	0 - 7.5	0 - 6.7	0 - 4.0	1,630	Dense, Weakly to Moderately Cemented Alluvial Soil	Slight
	7.5 - 38.7	6.7 - 36.6	4.0 - 33.0	4,440	Strongly Cemented Alluvial Soil or Weathered Bedrock	Marginal
	38.7+	36.6+	33.0+	13,587	Slightly Weathered to Unweathered Bedrock	Severe
WA-12	0 - 1.0	0 - 2.5	0 - 1.5	1,856	Dense, Weakly to Moderately Cemented Alluvial Soil or Very Weathered Bedrock	Slight
	1.0 - 14.4	2.5 - 11.4	1.5 - 11.5	5,209	Strongly Cemented Alluvial Soil or Weathered Bedrock	Marginal
	14.4 - 30+	11.4 - 30+	11.5 - 30+	9,235	Slightly Weathered Bedrock	Severe
WA-13	0 - 2.6	0 - 2.2	0 - 2.8	1,138	Loose to to Dense, Weakly Cemented Alluvial Soil	Slight
	2.6 - 24.0	2.2 - 26.6	2.8 - 13.0	4,165	Strongly Cemented Alluvial Soil or Weathered Bedrock	Marginal
	24.0 - 30+	26.6 - 30+	13.0 - 30+	10,519	Slightly Weathered Bedrock	Severe
WA-14	0 - 0.7	0 -5.2	0 - 4.7	2,857	Very Dense, Strongly Cemented Alluvial Soil or Weathered Bedrock	Slight to Marginal
	0.7 - 3.1	5.2 - 14.0	4.7 - 11.3	4,943	Strongly Cemented Alluvial Soil or Weathered Bedrock	Marginal
	3.1 - 30+	44.0 - 30+	11.3- 30+	8,561	Moderately to Slightly Weathered Bedrock	Severe
WA-15	0 - 1.0	0 -2.0	0 - 4.0	2,628	Very Dense, Moderately Cemented Alluvial Soil or Weathered Bedrock	Slight to Marginal
	1.0 - 30.0	2.0 - 36.5	4.0 - 23.0	4,830	Strongly Cemented Alluvial Soil or Weathered Bedrock	Marginal
	30.0+	36.5+	23.0 - 30+	7,604	Moderately to Slightly Weathered Bedrock	Severe

Survey Line No.	Depth Range at Shot Point (ft)			Average Seismic Velocity (ft/sec)	Interpreted Geologic Description	Qualitative Rippability
	A	B	C			
WA-16	0 - 2.2	0 - 2.1	0 - 4.1	1,873	Dense, Weakly to Moderately Cemented Alluvial Soil or Very Weathered Bedrock	Slight
	2.2 - 38.7	2.1 - 34.0	0.7 - 26.7	6,173	Hard, Caliche-Cemented, Near Rocklike, Alluvial Soil or Weathered Bedrock	Severe
	38.7+	34.0+	26.7+	13,333	Slightly Weathered to Unweathered Bedrock	Severe
WA-17	0 - 7.4	0 - 5.3	0 - 6.2	4,798	Strongly Cemented Alluvial Soil or Weathered Bedrock	Marginal
	7.4 - 30+	5.3 - 30+	6.2 - 30+	8,389	Moderately to Slightly Weathered Bedrock	Severe
WA-18	0 - 1.3	0 - 3.4	0 - 9.6	2,543	Very Dense, Moderately Cemented Alluvial Soil or Weathered Bedrock	Slight
	1.3 - 4.5	3.4 - 12.3	--	4,348	Strongly Cemented Alluvial Soil or Weathered Bedrock	Marginal
	4.5 - 30+	12.3 - 30+	9.6 - 30+	7,628	Moderately to Slightly Weathered Bedrock	Severe
WA-19	0 - 4.8	0 - 5.7	0 - 2.8	1,526	Dense, Weakly to Moderately Cemented Alluvial Soil or Very Weathered Bedrock	Slight
	4.8 - 30+	5.7 - 30+	2.8 - 30+	3,102	Strongly Cemented Alluvial Soil or Weathered Bedrock	Severe

Based on our interpretations of the seismic data, the conclusions presented regarding the depth to various velocity zones are believed to be reasonable at the location of the seismic survey line. The conditions characterized by indirect seismic methods along the seismic survey line probably represent subsurface conditions that could be found within the project site. The calculated depth/velocity ranges are summarized in Table 1.

2.3 Estimated Soil/Cemented Soil/Rock Strength: Estimates of the strength of the soil and bedrock material underlying the proposed West Anthem Wastewater Improvements pipeline alignment are summarized in Tables 2, 3, and 4.

Table 2
Upper Seismic Wave Velocity Zone 1
Estimated Soil/Cemented Soil/Rock Strength (Weaver, 1975)
West Anthem WWTP Improvements
Pioneer Road to Carefree Highway, Phoenix Arizona

Seismic Survey Line Number	Seismic P-Wave Velocity Range (ft./sec.)	Unconfined Compressive Strength (psi) (Estimated)	Rock Hardness Description*
WA-02 to WA-16; WA-18 & WA-19	< 3,935	246 - 435	Very Soft Rock (VSR)
--	3,935 - 4,920	435 - 1,450	Soft Rock (SR)
--	4,920 - 6,070	1,450 - 2,900	Hard Rock (HR)
--	6,070 - 7,050	2,900 - 10,150	Very Hard Rock (VHR)
--	> 7,050	> 10,150	Extremely Hard Rock

* Includes soil cemented to rocklike consistency.

Table 3
Middle Seismic Wave Velocity Zone 2
Estimated Soil/Cemented Soil/Rock Strength (Weaver, 1975)
West Anthem WWTP Improvements
Pioneer Road to Carefree Highway, Phoenix Arizona

Seismic Survey Line Number	Seismic P-Wave Velocity Range (ft./sec.)	Unconfined Compressive Strength (psi) (Estimated)	Rock Hardness Description*
WA-05, WA-06	< 3,935	246 - 435	Very Soft Rock (VSR)
WA-11, WA-13, WA-15, WA-18	3,935 - 4,920	435 - 1,450	Soft Rock (SR)
WA-12, WA-14	4,920 - 6,070	1,450 - 2,900	Hard Rock (HR)
WA-16	6,070 - 7,050	2,900 - 10,150	Very Hard Rock (VHR)
--	> 7,050	> 10,150	Extremely Hard Rock (EHR)

* Includes soil cemented to rocklike consistency.

Table 4
Lower Seismic Wave Velocity Zone 3
Estimated Soil/Cemented Soil/Rock Strength (Weaver, 1975)
West Anthem WWTP Improvements
Pioneer Road to Carefree Highway, Phoenix Arizona

Seismic Survey Line Number	Seismic P-Wave Velocity Range (ft./sec.)	Unconfined Compressive Strength (psi) (Estimated)	Rock Hardness Description*
WA-19	< 3,935	246 - 435	Very Soft Rock (VSR)
WA-02, WA-03, WA-05,	3,935 - 4,920	435 - 1,450	Soft Rock (SR)
WA-04	4,920 - 6,070	1,450 - 2,900	Hard Rock (HR)
WA-06, WA-07, WA-09,	6,070 - 7,050	2,900 - 10,150	Very Hard Rock (VHR)
WA-08, WA-10, WA-11,WA-12, WA-13, WA-14, WA-15, WA-16, WA-17, WA-18	> 7,050	> 10,150	Extremely Hard Rock (EHR)

* Includes soil cemented to rocklike consistency.

2.4 **Qualitative Rippability / Excavateability/Drillability**: The upper and intermediate velocity zone should be relatively easy to excavate or marginal, respectively, whereas localized bedrock core-stones, if encountered, could require hard ripping to very hard ripping.

The estimated qualitative rippability/ excavateability/drillability summarized in Table 5 is based on the interpretations of the seismic survey data, understanding of the site geological conditions, and professional experience. There is no guarantee that the seismic refraction survey results or the qualitative rippability/excavateability/drillability can be duplicated by others. We recommend this information be used with caution and only as guidelines.

Because the seismic velocities used to determine qualitative rippability/excavateability/ drillability may vary from 10 to 20 percent, and due to the variability of the subsurface material, qualitative rippability/excavateability/drillability constraint categories listed in Table 5 may overlap at the transition from one constraint category to the next.

Table 5
Qualitative Excavateability Relative to Soil/Bedrock Type & P-Wave Velocity
West Anthem WWTP Senior Center
Phoenix, Arizona

Unit	Average Velocity (feet per second)	Excavateability Constraints
Fill/ Coarse-Grained, Slightly Cemented Alluvial Soil & Strongly Weathered Bedrock	< 3,000	**Slight**- Should be excavateable using conventional earthmoving and drilling/boring equipment. Gravel- to large cobble-size rock fragments could be encountered where the alluvium is excavated. Drilling and boring may be difficult uncemented to weakly cemented cobbles or boulder. If large boulders are encountered, secondary fragmentation could be necessary. Marginal excavation and drilling/boring conditions could be experienced where weakly caliche-cemented alluvium or strongly decomposed bedrock is encountered.
Moderately to Strongly Caliche Cemented Alluvium or Slightly to Moderately Weathered Bedrock	3,000 to 6,000	**Marginal-** Potentially difficult to excavate, drill, or bore with low horsepower-low torque conventional equipment where alluvial soils are cemented to near rocklike consistency and where moderately and variably weathered or decomposed bedrock is encountered. Large, blocky, cobble to boulder-size could be generated and could be difficult to excavate and drill. Large rock or core stone fragments (boulders, etc.) could require special fragmentation methods such as heavy, high impact energy hydraulic hammers mounted on large track-hoes. Fragmentation could be difficult. Moderate to high horsepower drilling/boring equipment, excavation equipment and rippers could improve production where the soil, cemented to a rocklike consistency, or bedrock is encountered. Production could be slow.
Slightly Weathered to Unweathered Bedrock	> 6,000	**Severe-** Conventional, low horsepower/torque excavation/drilling/boring equipment will likely experience refusal. Very hard rock drilling/boring methods could be necessary; drilling and boring could be very difficult and slow. Hard bedrock will be difficult to excavate. Bedrock may be locally rippable using a large tractor such as a D-9, D10, or equivalent, with a single-shank ripper or heavy backhoe/ trackhoe / rock trencher with heavy hydraulic impact hammers used along joint, and fracture planes. Large boulder-size rock fragments could be generated that could require secondary fragmentation. Production expected to be very slow. Where allowed, blasting could be used for effective fragmentation.

2.5 **Excavation Constraints**: The excavation and drilling constraints described in this report (Tables 1 and 5) are, in our opinion, reasonable for the locations where the seismic refraction surveys were conducted. The ultimate excavateability is dependent on many factors (variably cemented soils, cemented gravel to boulder soil zones, presence of large boulder and core stones, bedrock and soil physical properties, excavation methods, size and age of excavation equipment, level of effort applied by the contractor, etc.) and it may not be possible to correlate these factors with the results of the seismic refraction survey conducted for this investigation. The excavation contractor must exercise caution, and assume associated risks, when attempting to extrapolate these data to other areas where seismic surveys have not been conducted.

Prospective contractors or others involved with excavation at this site should review this report along with the excavateability performance charts and tables provided by manufacturers of rock and soil excavating equipment. This information can be used as part of their evaluation criteria for selecting equipment that may be used to excavate the alluvial units within the project area. However, the contractors using or making interpretation of this information, for any reason, do so at their sole risk.

The qualitative excavateability summarized in Table 5, along with our interpretation of the subsurface materials (Table 1) are provided so that a prospective contractor can relate seismic velocities to the subsurface materials they can expect to encounter where excavations may be proposed. Although a backhoe may be able to excavate low velocity material and a heavy, hydraulic impact, rock breakers attached to a large track-mounted excavator might be able to fragment moderate to high velocity bedrock, core-stones, strongly cemented zones, or fractured and jointed bedrock material, there are no guarantees due to the wide range of variables summarized herein that effect equipment suitability and material excavateability. Also, the progress of excavation in soils, cemented with caliche to a near rocklike consistency and/or bedrock, where encountered, should be expected to be slow. Appendix B contains tables and charts, from various sources, on the rippability/ excavateability of various materials.

No site-specific testing has been conducted at this site by Geological Consultants Inc. to verify the qualitative rippability/excavateability/drillability categories (Table 5) nor has any equipment performance evaluations been conducted relative to ripping, excavating, or drilling site materials or to determine equipment suitability for this site. However, the reader should refer to the geotechincal report and soil boring logs prepared by Speedie & Associates (2016) for additional information regarding the subsurface soil conditions.

Therefore, the contractor must exercise caution and assume associated risks if the information provided herein is used by the contractor to assist with the determination of equipment suitability for fragmentation or excavation

2.6 **Construction Vibration Considerations**: We suggest that preconstruction surveys should be considered for all existing structures located within 300 to 500 feet of the proposed excavation areas where heavy construction equipment, such as vibratory compactors, high-energy impact hammers, heavy drilling/boring machines or blasting, may be used. Likewise, we suggest construction excavation by any means, be monitored periodically during construction to assure the ground vibrations are within safe limits for the existing nearby structures and utilities. However, we recommend the construction vibration intensities be limited to less than one inch per second for residential and commercial areas and for sensitive structures or components such as buried gas and water lines unless more restrictive allowable vibration limits are specified by other regulatory authorities. The purpose of the preconstruction surveys and construction vibration monitoring is to limit liability for property owners, the contractor, and other involved parties.

If blasting is used, we recommend the blasting be conducted by a firm with personnel experienced with blasting in geological materials and site area similar to those encountered along West Anthem WWTP Improvement pipeline alignment. Although we do not recommend blasting at this site, blasting may prove to be necessary to fragment large, slightly weathered, and very hard bedrock if encountered in excavation areas.

2.7 **Safety**: We recommend adequate “safety zones” be established and maintained around the proposed excavations and construction operations during construction.

2.8 **Slope Stability Considerations**: If the vertical height of any permanent or temporary slopes (trench side slopes) excavated along the pipeline alignment or in close proximity, or adjacent to existing structures, exceed 5 feet and where the finish slope gradients are steeper than 2:1 (horizontal to vertical) or are steeper than current building and grading code requirements, the contractor must be required to provide shoring or a slope reinforcement/stabilization system, design by registered civil engineer or engineering geologist according to the local or County building code standards and according to the design recommendations provided by a registered civil (geotechnical) engineer or geologist. The purpose of the shoring / stabilization system is to provide permanent and temporary cut slopes or trench slopes that will have an adequate factor of safety against failure and to mitigate potential damage to nearby existing structures.

3.0 GEOPHYSICAL SITE INVESTIGATION

The seismic refraction survey was conducted to indirectly investigate subsurface conditions and to develop reasonable interpretations of subsurface conditions.

3.1 Site Specific Seismic Survey

Following the completion of a site reconnaissance to identify the seismic survey locations, seismic refraction surveys WA-02 through WA-19 were made at the locations depicted in Figure 2. The seismic survey was conducted to evaluate the soil overburden thickness and where possible, identify and characterize fill soil and decomposed bedrock that may be present below existing grades and in the proposed building site, and to characterize the qualitative excavateability of the soil and bedrock, where encountered. A seismic refraction survey could not be conducted at or in the vicinity of Speedie drill hole B-1 due to the presence of extensive buried electrical, cable, waterline and sewer line utilities and the excessive traffic noise.

Three shot points were used along the seismic survey lines to evaluate possible non horizontal subsurface boundary conditions (buried sloping surfaces, cementation zones, soil-change boundaries, etc.) that could be expected in this type of geological terrain, and to improve the accuracy of the seismic wave velocity determinations. The seismic refraction surveys were run over a total length (110-feet, plus 5-foot shot point offsets) sufficient to achieve adequate depth penetration (of at least 20 feet). The geometry of the seismic survey line was set up to identify the subsurface layers or zones that could influence excavation proposed at the site.

As with any type of geophysical investigation method, there are limitations to its usefulness and application. Refer to Appendix A for additional information regarding seismic refraction surveys and their limitations.

3.2 Equipment

Travel-time data for the seismic survey was obtained using Geometrics Inc. Model S12 SmartSeis™ 12-Channel Exploration Seismograph. Seismic wave arrivals are detected with digital grade vertical geophones with a dual hum-bucking coil and a frequency response above 14 Hz natural frequency. Geophones were placed beginning at Station 0 and at 10-foot intervals thereafter to the end of the seismic survey line. The seismic shock wave is produced by repeated impacts of a 16-pound sledge hammer onto a soft steel striking plate. Hammer impacts (shots) were made at five-foot offsets from each end of the seismic line traverse and at a shot

point located near the center of the survey line spread. The distance from the impact locations (shot points) to the geophones and the travel time recorded for each station is stored in the seismographs onboard computer. If the field seismic data plots indicated the possible presence of anomalous subsurface conditions or spurious noise coincident with the hammer impacts, repeated impacts are used to verify the initial data reading or to correct the data. Topographic features, outcrops, and other natural or man-made features found along the seismic survey lines that might influence the data interpretations are annotated with the field data plots.

3.3 Results

Interpretations of the seismic survey data obtained at the project site suggest the presence of a distinctive subsurface stratigraphic profile along the seismic survey line. Seismic velocities, calculated zone thicknesses, and depth to velocity zone boundaries for each interpreted bedrock, rocklike soil, or soil types are summarized in Table 1. Estimates of rock strength based on calculated seismic wave velocities are included in Tables 2, 3, and 4. The qualitative rippability/excavateability/drillability of the rocklike and soil units encountered along the seismic survey lines is summarized in Table 5. The seismic velocity profiles and distance-travel time data plots are depicted in Figures 3, 5, 7, 9, 11, 13, 15, 17, 19, 21, 23, 25, 27, 29, 31, 33, 35, and 37. The depth scale depicted on the Y-axis of the velocity layer cross-section assumes an arbitrary existing ground surface datum elevation of 0.0 feet. The cross-sections may be used to measure the depths to different velocity layer boundaries below the ground surface at any point along the seismic survey line. The estimated accuracy of the velocity layer boundaries is approximately 20 percent. Figures 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, and 38 include photographs taken at the end shot points (A and C) of the seismic survey lines.

4.0 GENERAL LIMITATIONS

The geologic observations, findings, conclusions, and recommendations presented in this report are based on (1) cursory observations of surface conditions and geologic materials where exposed and (2) analysis of the seismic refraction data gathered along the proposed pipeline alignment for the West Anthem WWTP Improvements project. The services provided by Geological Consultants Inc. were performed in accordance with generally accepted geological principals and standard practices used by members of the geological profession in this locale at the time of this study.

It must be recognized that subsurface geologic conditions may vary from place to place and from those found at locations where measurements or surveys are made by the investigator. Generalized geological and rippability/excavateability/drillability recommendations presented in this report are based on the interpretations of the results of this investigation and it may not be possible for others to accurately correlate the geology and seismic refraction survey results to test explorations or investigations conducted by others. No warranty or representation, either expressed or implied, is or should be construed regarding geological conditions at locations other than those evaluated as part of this study.

The professional opinions, conclusions and recommendations presented in this report relate only to the project and the location specified in this report. If any changes are made in the project, the conclusions and/or recommendations in this report shall not be considered valid unless the changes are reviewed and the conclusions and recommendations of this study are modified and approved in writing by Geological Consultants Inc.

5.0 BIBLIOGRAPHY

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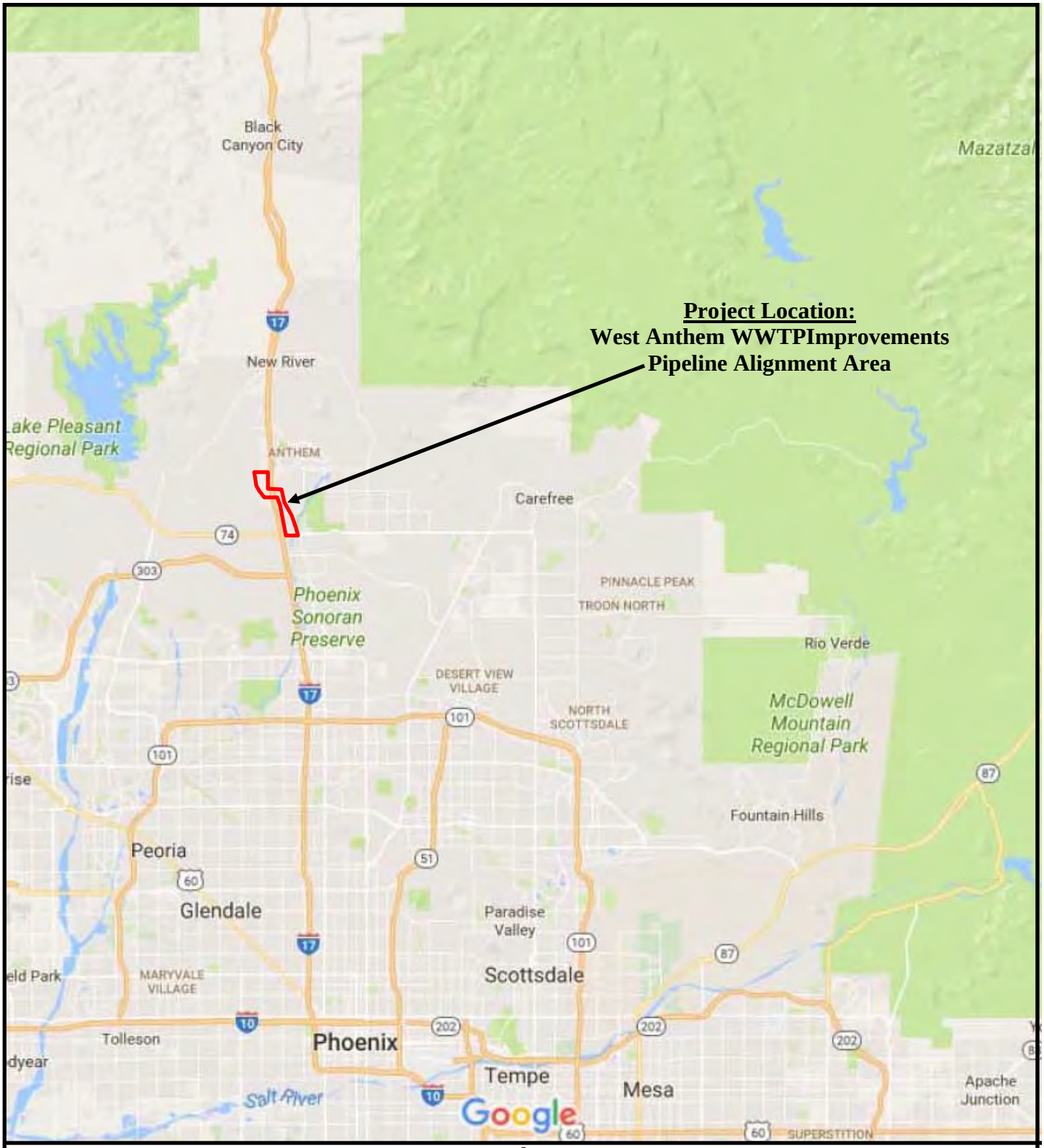
FIGURES



N

Basemap modified by GCI (10/8/2017 from Google Maps (2017) .

West Anthem WWTP Improvements
Seismic Survey
Site Location Map
Figure 1

Geological Consultants Inc.
2333 West Northern Ave. Ste 1A
Phoenix, Arizona 85021
Phone 602-864-1888
Fax 602-864-1899

Explanation: Seismic Survey Line Location (approx.)

WA-02A — **WA-02C**

Basemap from Google Earth Pro (2017) modified by GCI to depict approximated seismic survey line locations, October 6, 2016,

West Anthem Wastewater Improvements
Seismic Refraction Survey
Seismic Refraction Survey Line Location Map
Figure 2a

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Explanation: Seismic Survey Line Location (approx.)

WA-02A — WA-02C

West Anthem Wastewater Improvements
Seismic Refraction Survey
Seismic Refraction Survey Line Location Map
Figure 2b

Basemap from Google Earth Pro (2017) modified by GCI to depict approximated seismic survey line locations, October 6, 2016,

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Phone 602-864-1888
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Explanation: Seismic Survey Line Location (approx.)

WA-02A — WA-02C

West Anthem Wastewater Improvements
Seismic Refraction Survey
Seismic Refraction Survey Line Location Map
Figure 2c

Basemap from Google Earth Pro (2017) modified by GCI to depict approximated seismic survey line locations, October 6, 2016,

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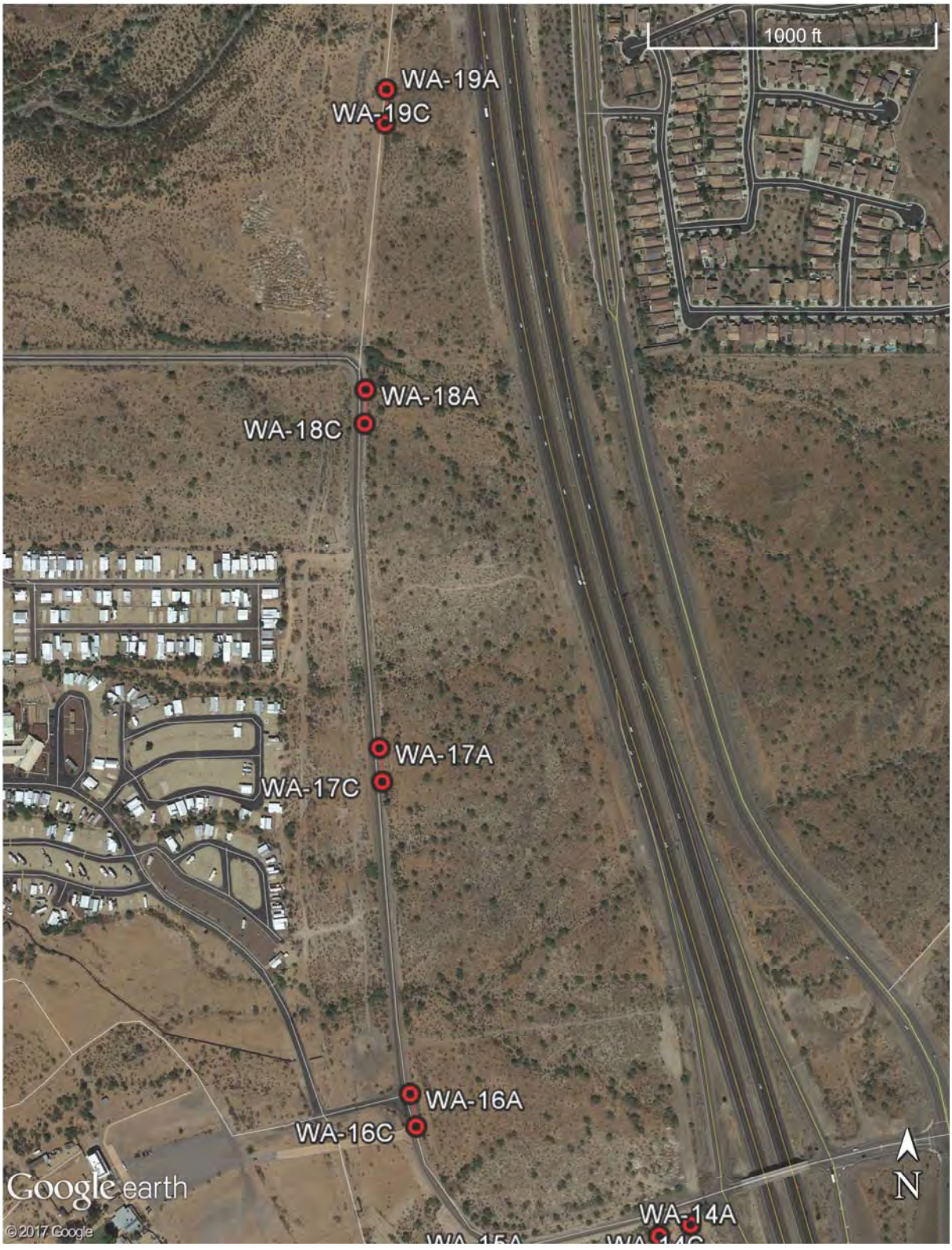
Fax 602-864-1899



Explanation: Seismic Survey Line Location (approx.)

WA-02A — WA-02C

West Anthem Wastewater Improvements
Seismic Refraction Survey
Seismic Refraction Survey Line Location Map
Figure 2d

Basemap from Google Earth Pro (2017) modified by GCI to depict approximated seismic survey line locations, October 6, 2016,

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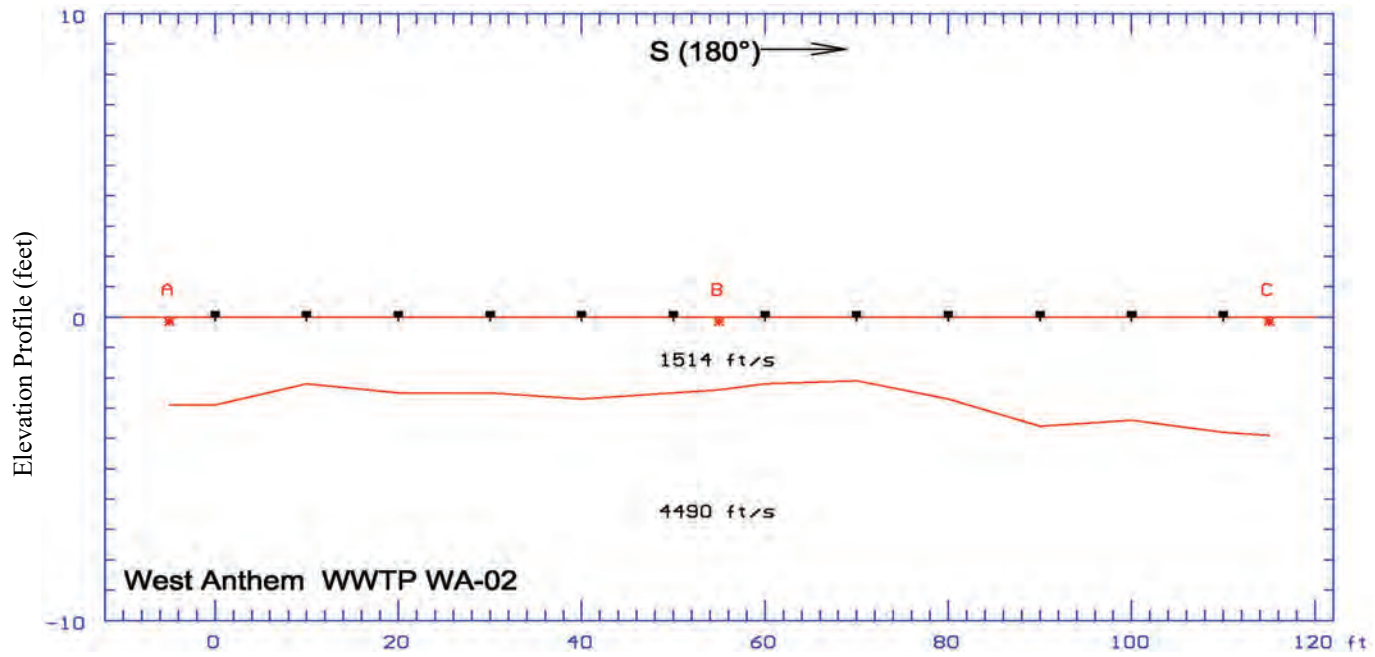
Fax 602-864-1899



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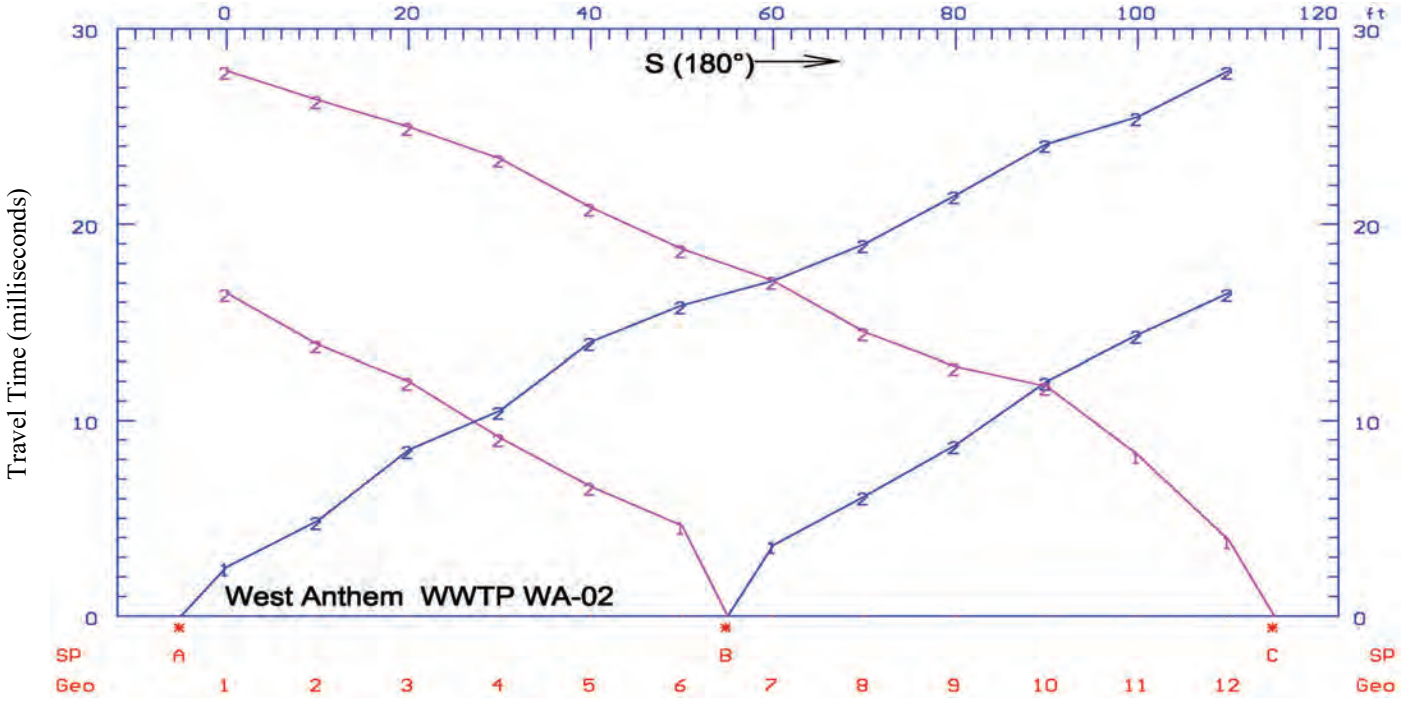

Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 4 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-02
Velocity Profile &Time-Distance Plot
Figure 3

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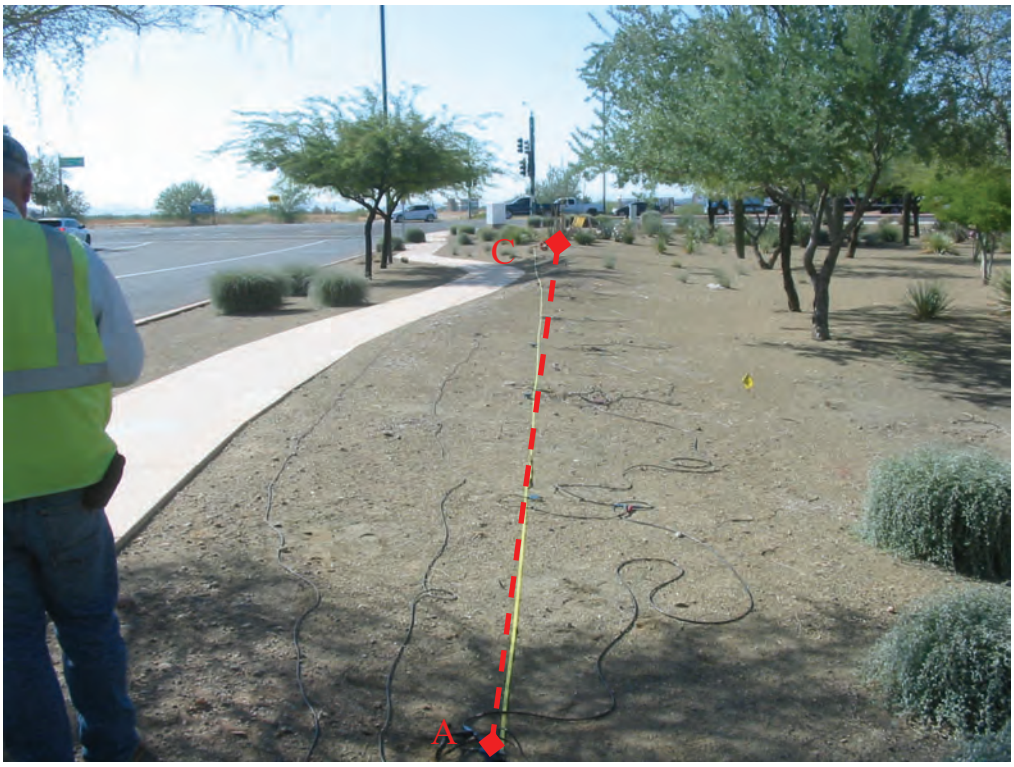

Figure 4; Photo 1: Seismic Survey Line WA-02 view looking toward the South from Shot Point A toward Shot Point C.

Figure 4; Photo 2: Seismic Survey Line WA-02 view looking toward the North from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-02 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Line WA-02

A — C

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 3 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-02
Seismic Survey Line Photographs
Figure 4

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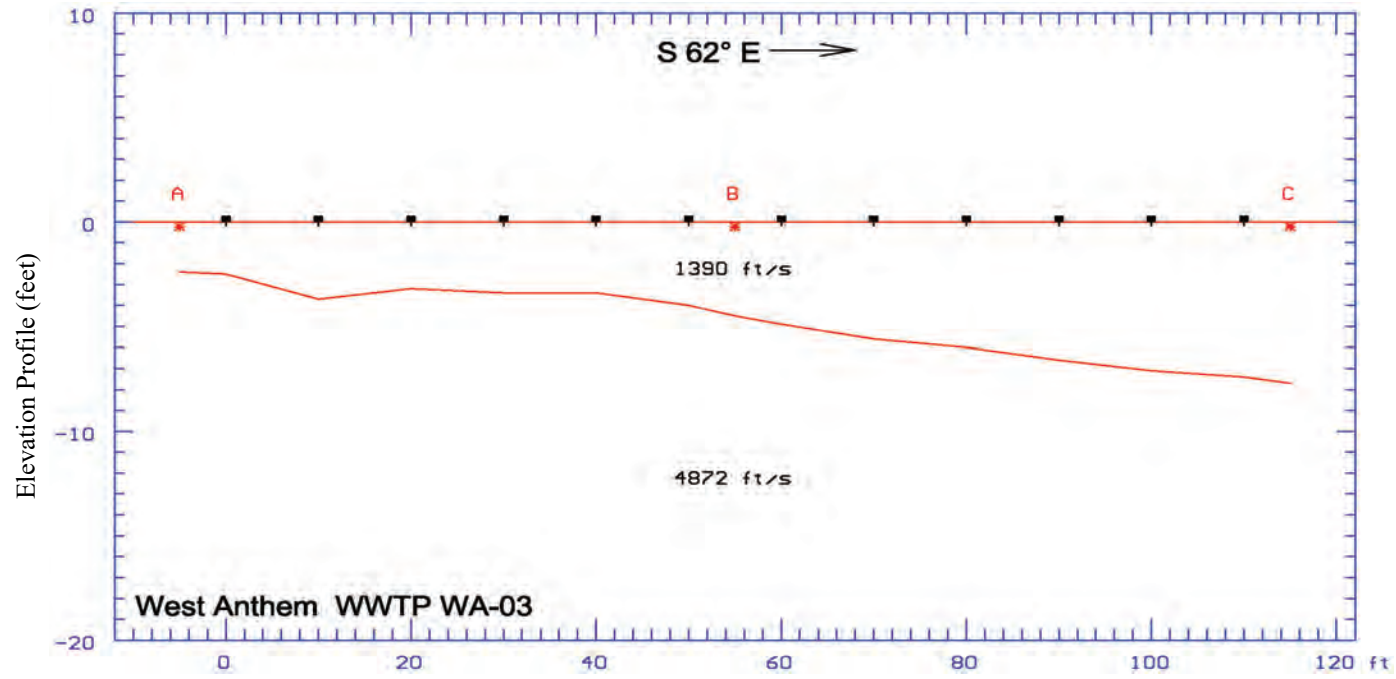

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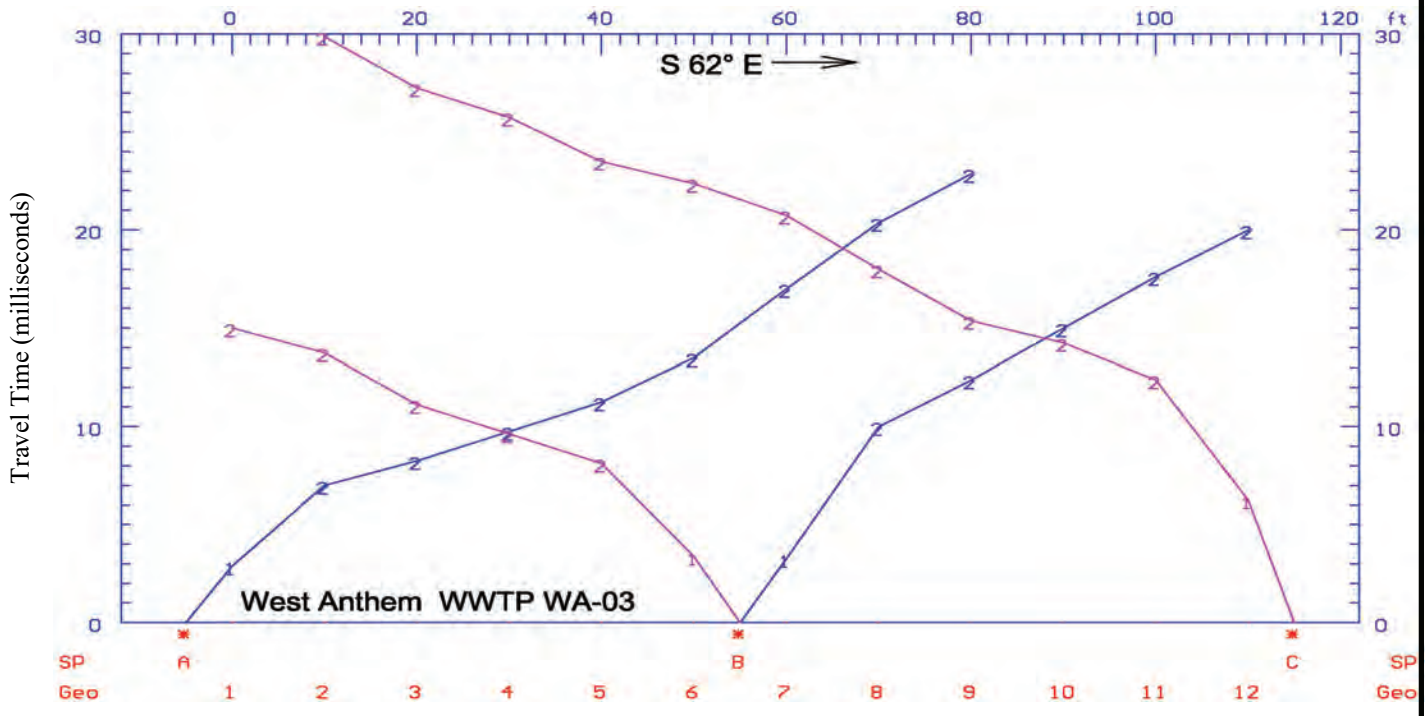

Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 6 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-03
Velocity Profile &Time-Distance Plot
Figure 5

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Fax 602-864-1899

Figure 6; Photo 1: Seismic Survey Line WA-03 view looking toward the Southeast from Shot Point A toward Shot Point C.

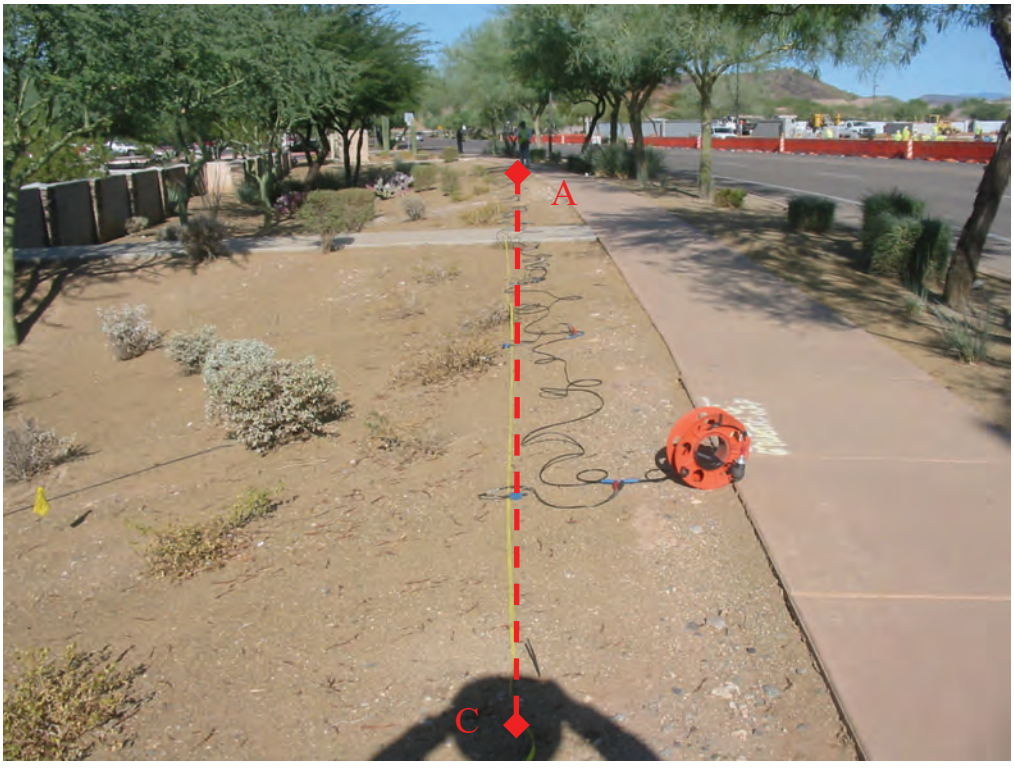

Figure 6; Photo 2: Seismic Survey Line WA-03 view looking toward the North-west from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-03 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 5 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-03
Seismic Survey Line Photographs
Figure 6

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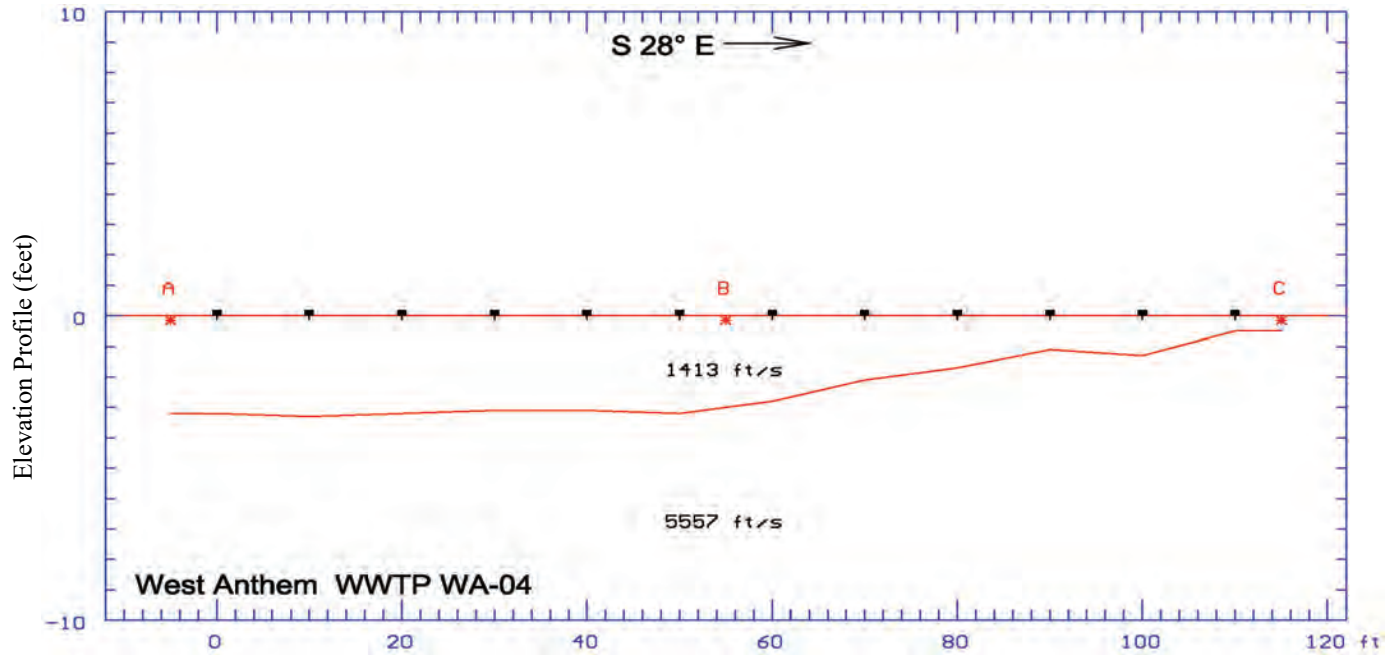

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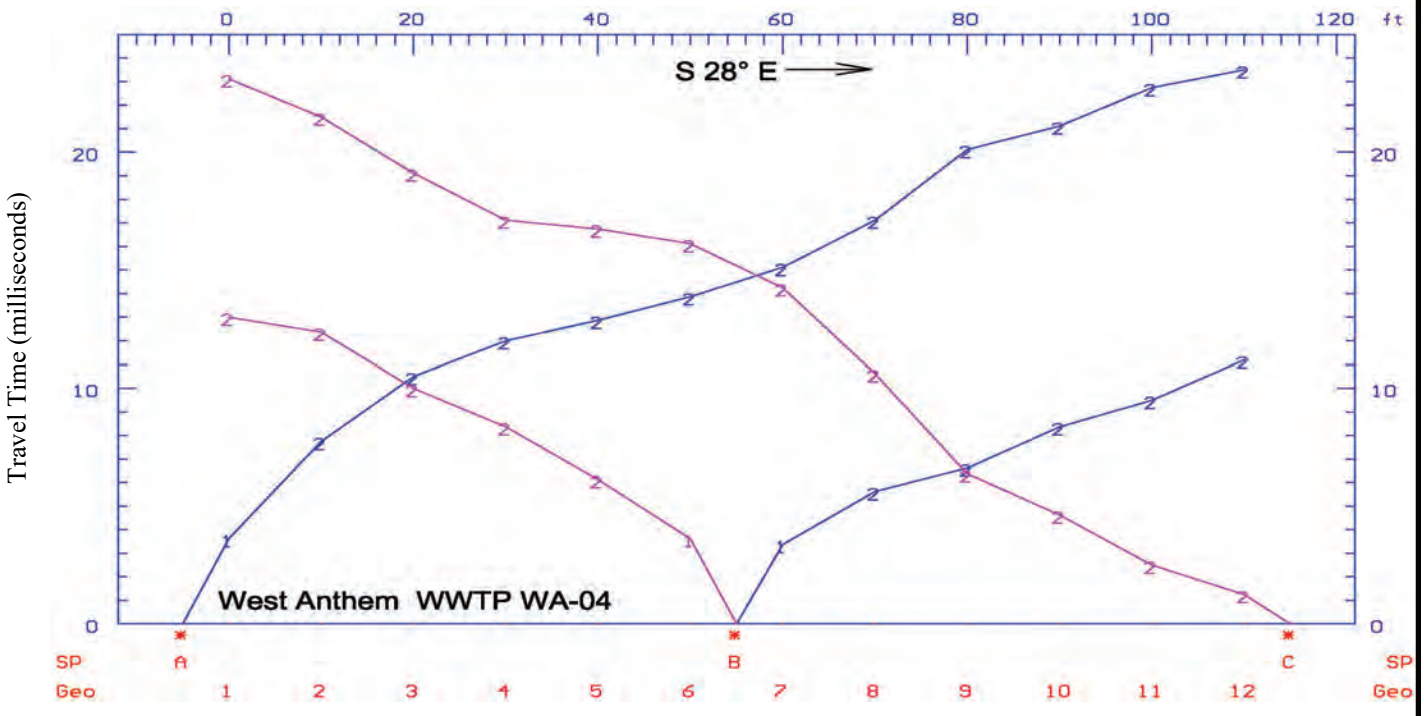

Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 8 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-04
Velocity Profile &Time-Distance Plot
Figure 7

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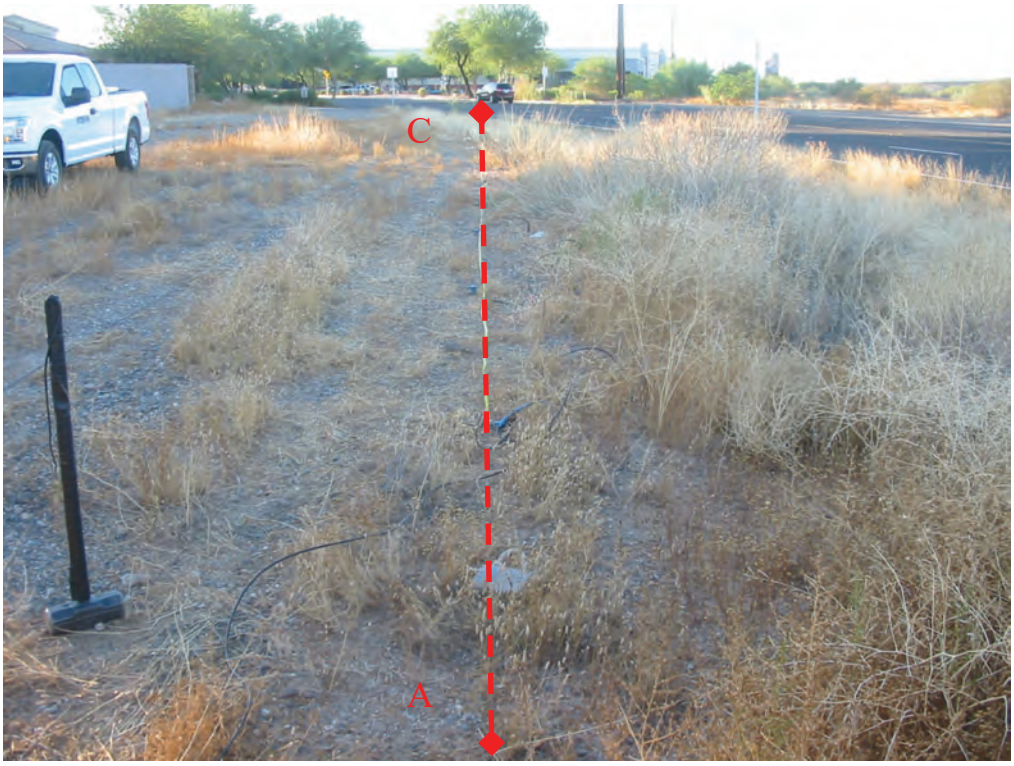

Figure 8; Photo 1: Seismic Survey Line WA-04 view looking toward the Southeast from Shot Point A toward Shot Point C.

Figure 8; Photo 2: Seismic Survey Line WA-04 view looking toward the North-west from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-04 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Line WA-04

A **C**

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 7 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-04
Seismic Survey Line Photographs
Figure 8

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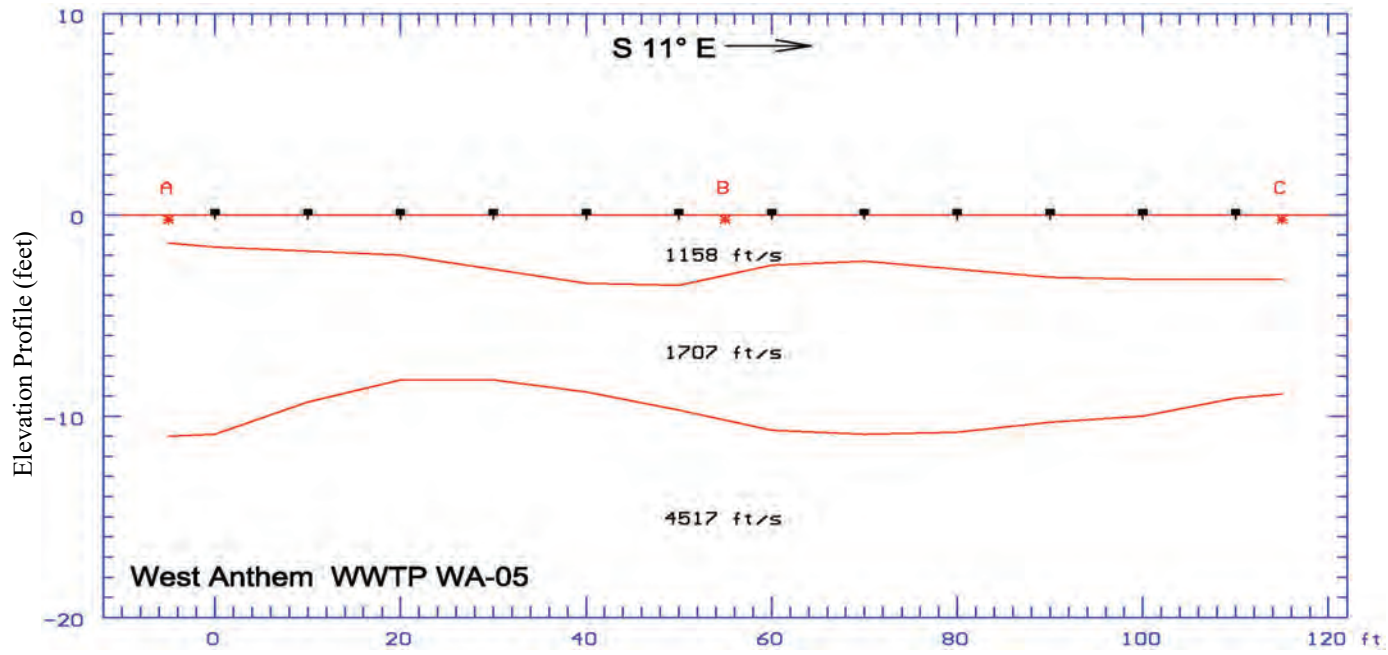

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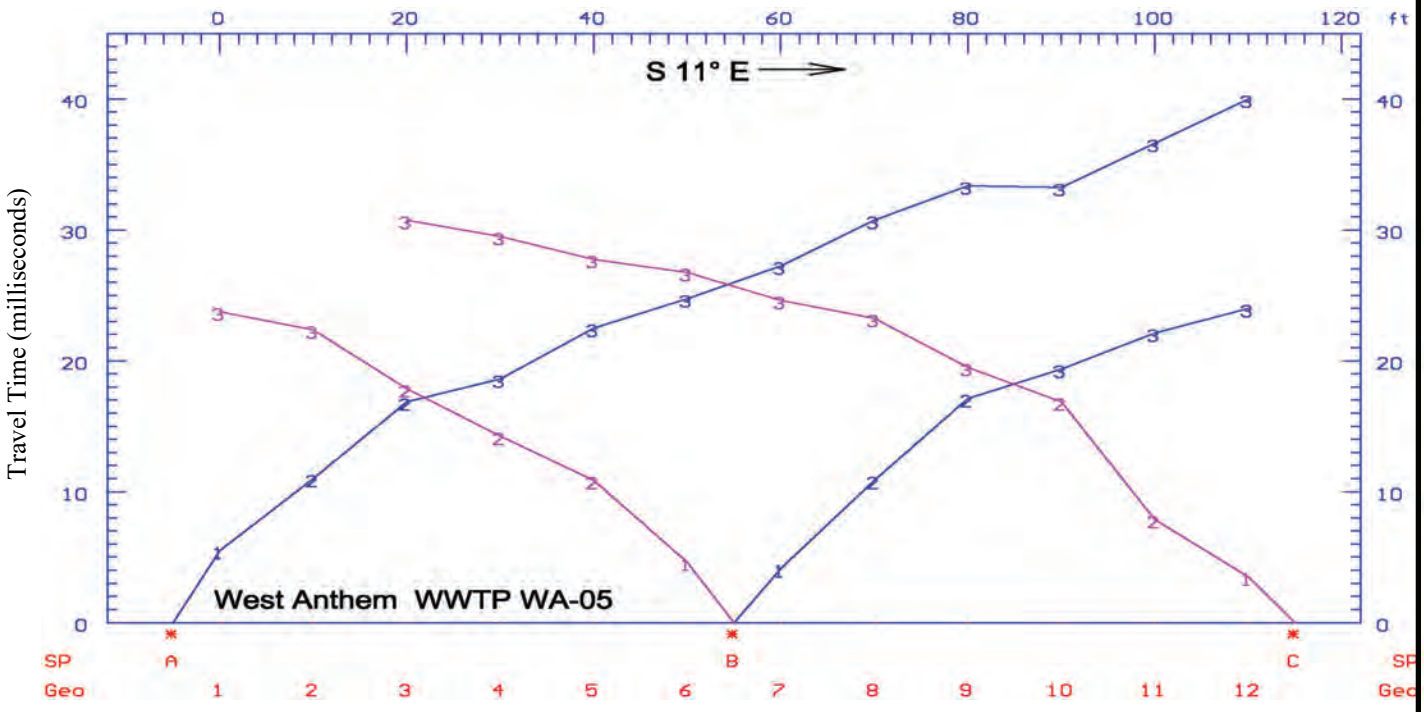

Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 10 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-05
Velocity Profile &Time-Distance Plot
Figure 9

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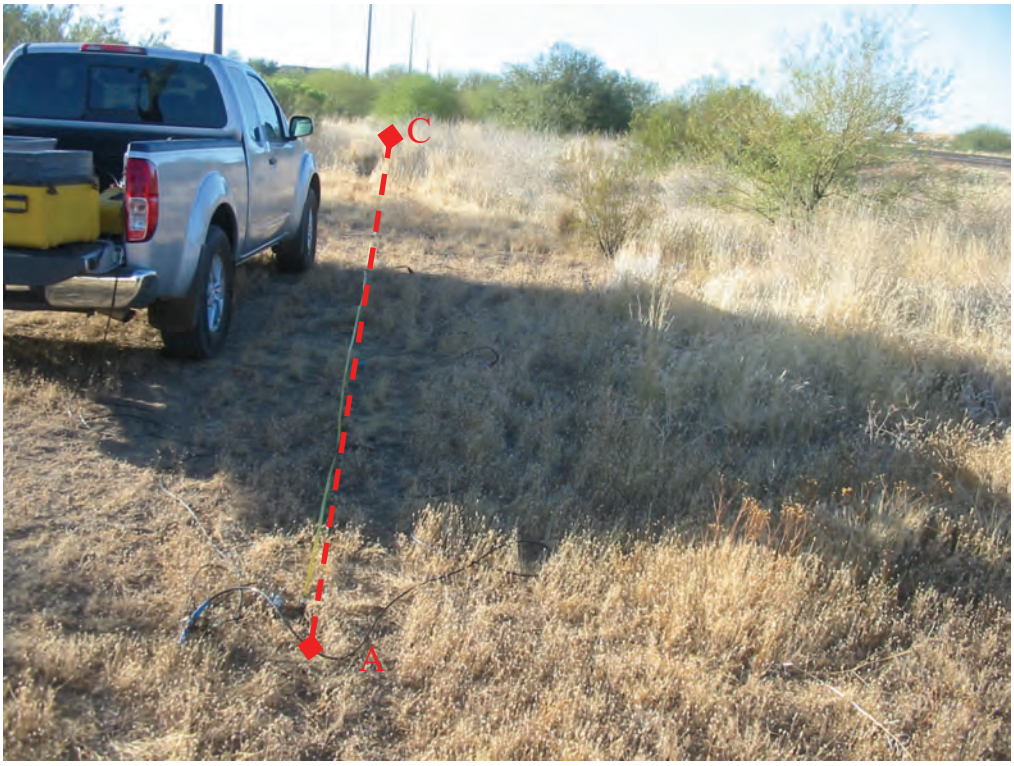

Figure 10; Photo 1: Seismic Survey Line WA-05 view looking toward the South-southeast from Shot Point A toward Shot Point C.

Figure 10; Photo 2: Seismic Survey Line WA-05 view looking toward the North-northwest from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-05 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 9 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-05
Seismic Survey Line Photographs
Figure 10

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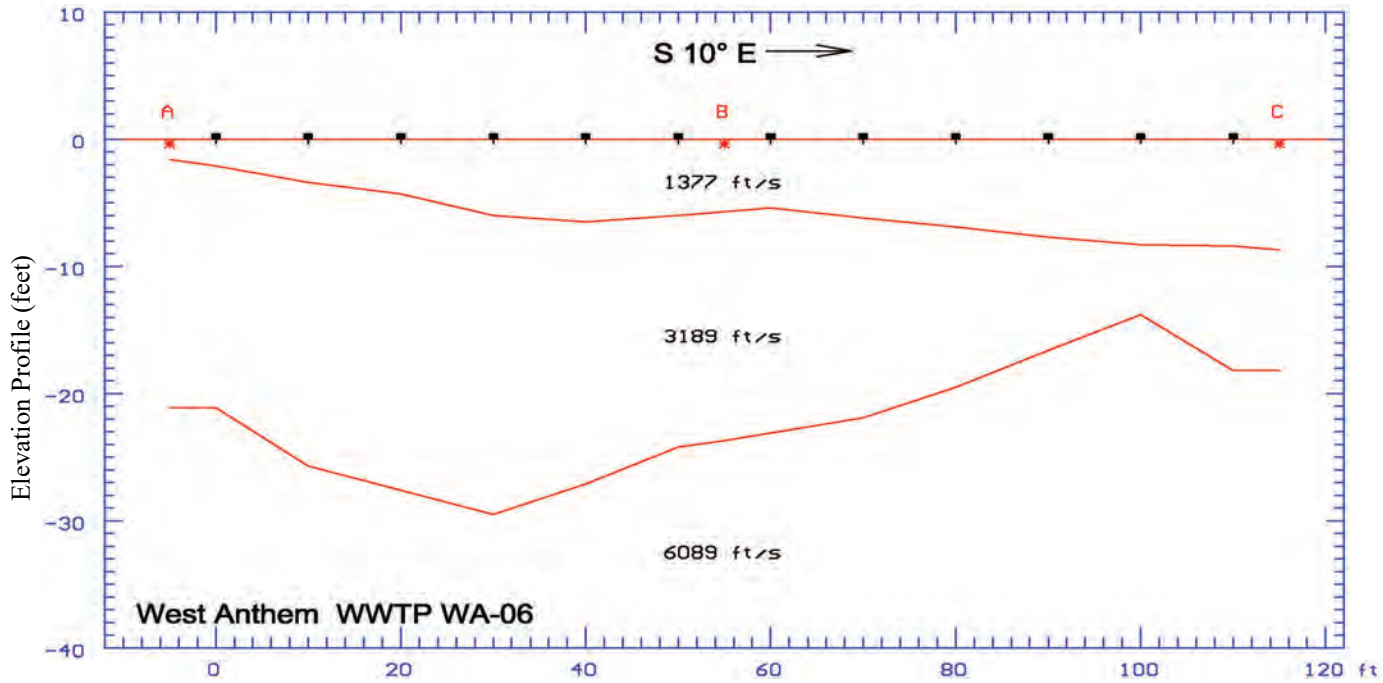

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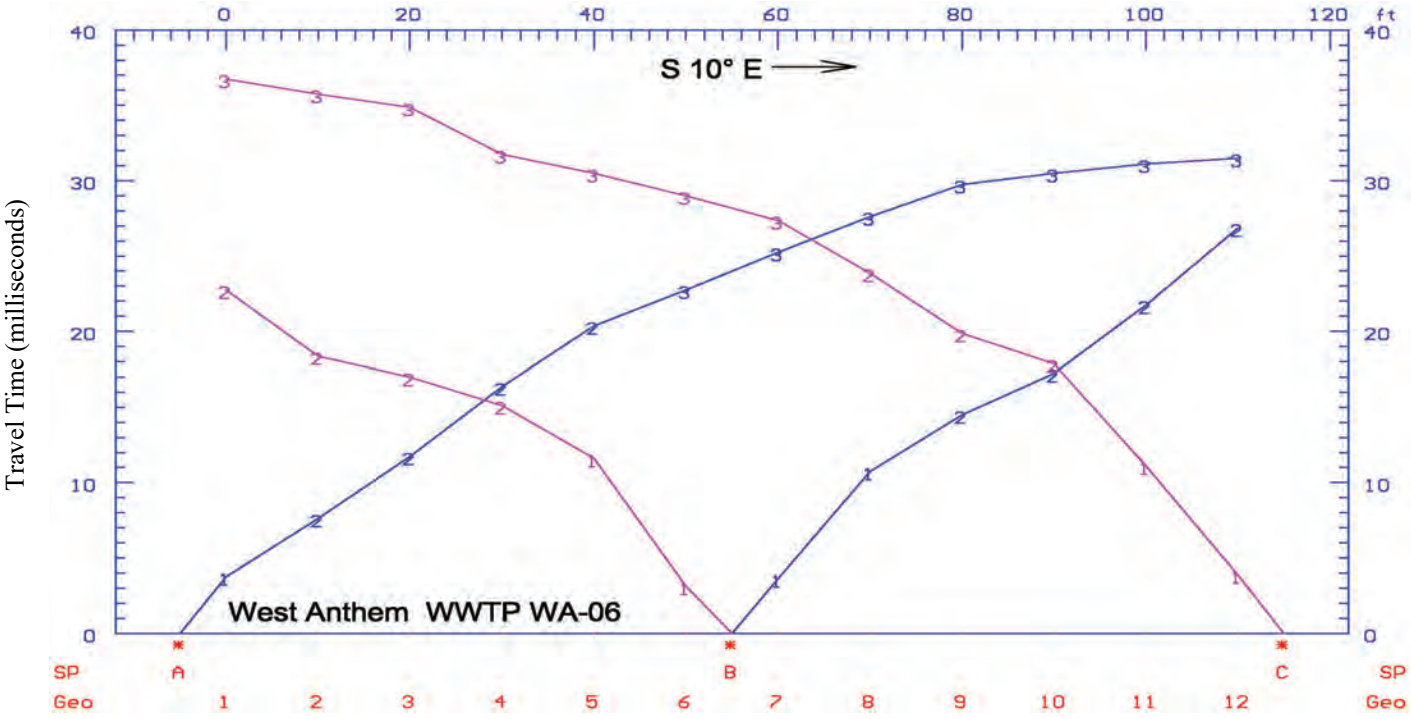

Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 12 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-06
Velocity Profile &Time-Distance Plot
Figure 11

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Figure 12; Photo 1: Seismic Survey Line WA-06 view looking toward the South from Shot Point A toward Shot Point C.

Figure 12; Photo 2: Seismic Survey Line WA-06 view looking toward the North from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-06 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Line WA-06

A — C

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 11 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-06
Seismic Survey Line Photographs
Figure 12

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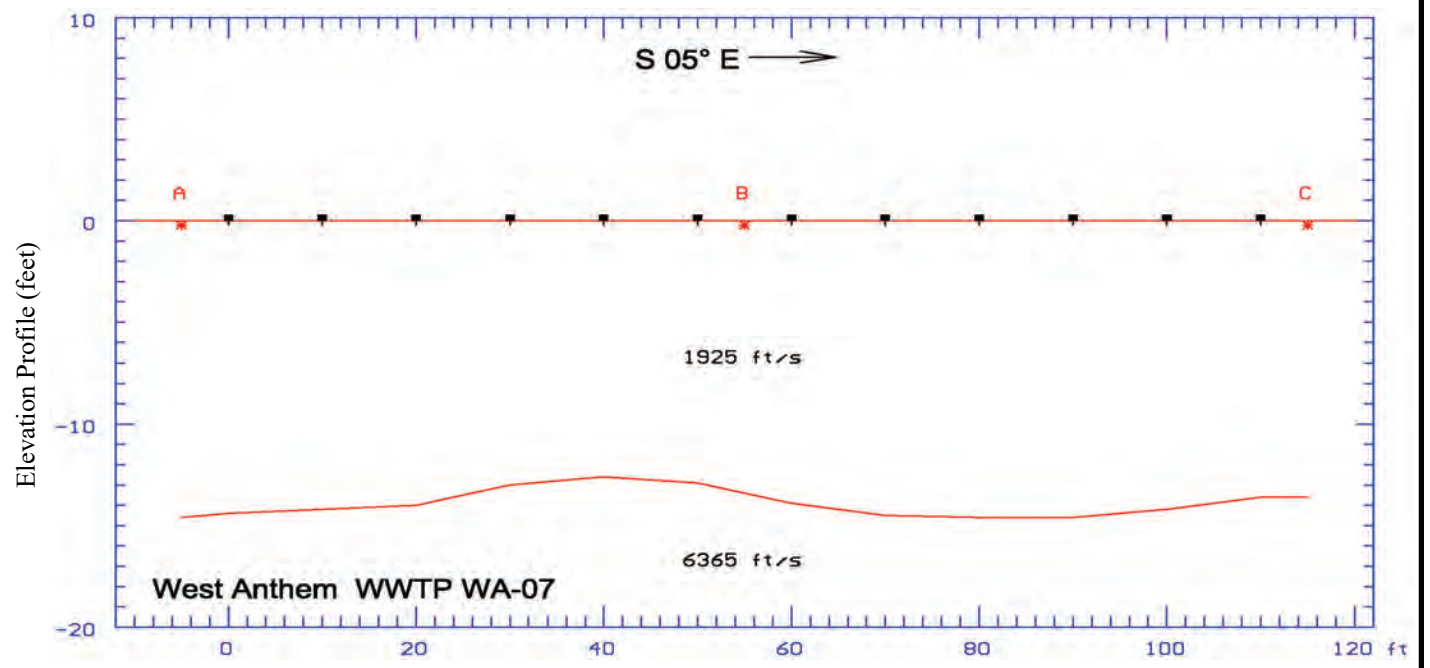

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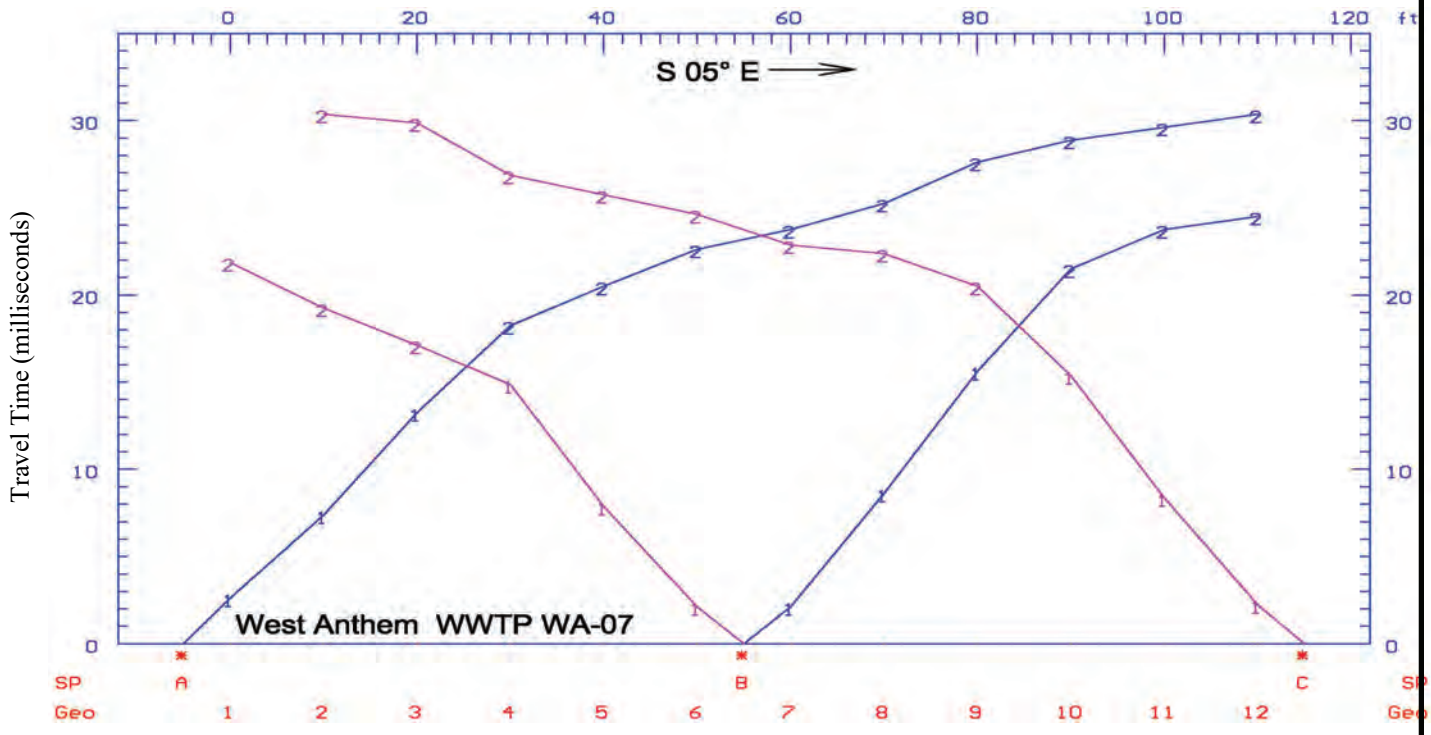

Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 14 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-07
Velocity Profile &Time-Distance Plot
Figure 13

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Figure 14; Photo 1: Seismic Survey Line WA-07 view looking toward the South from Shot Point A toward Shot Point C.

Figure 14; Photo 2: Seismic Survey Line WA-07 view looking toward the North from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-07 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Line WA-07

A C

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 13 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-07
Seismic Survey Line Photographs
Figure 14

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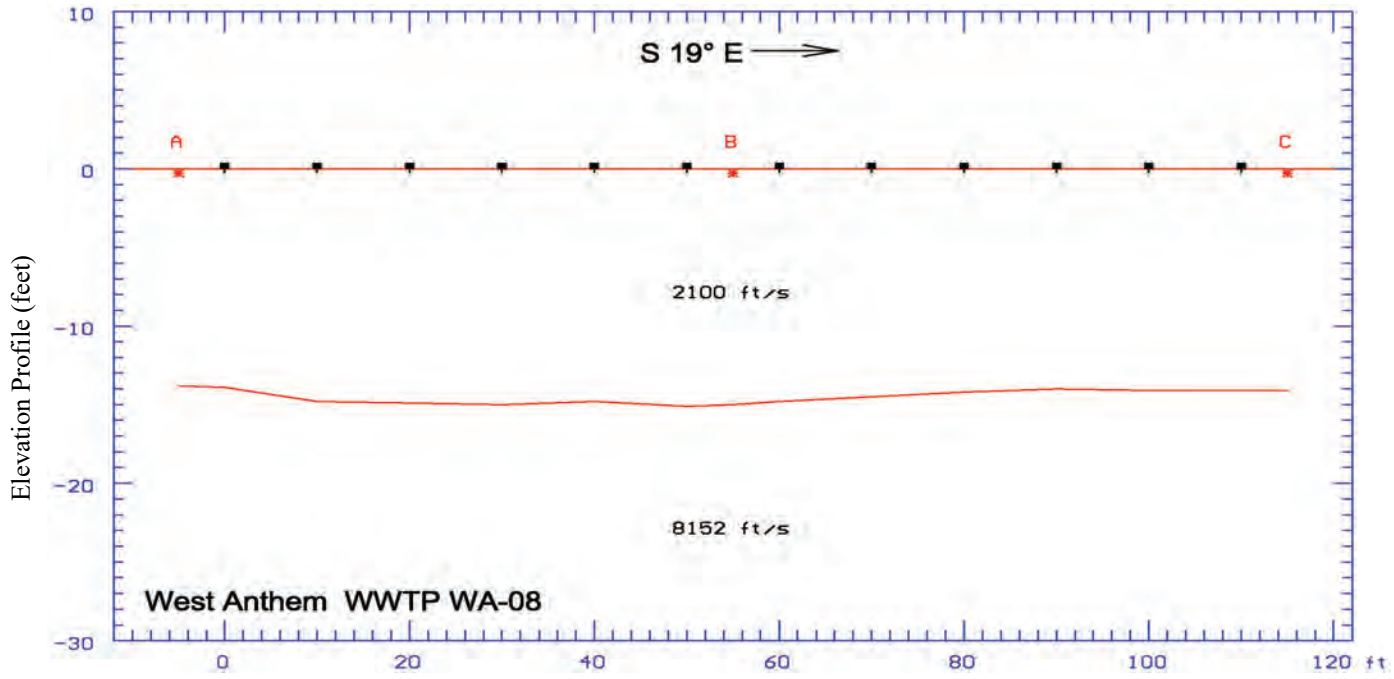

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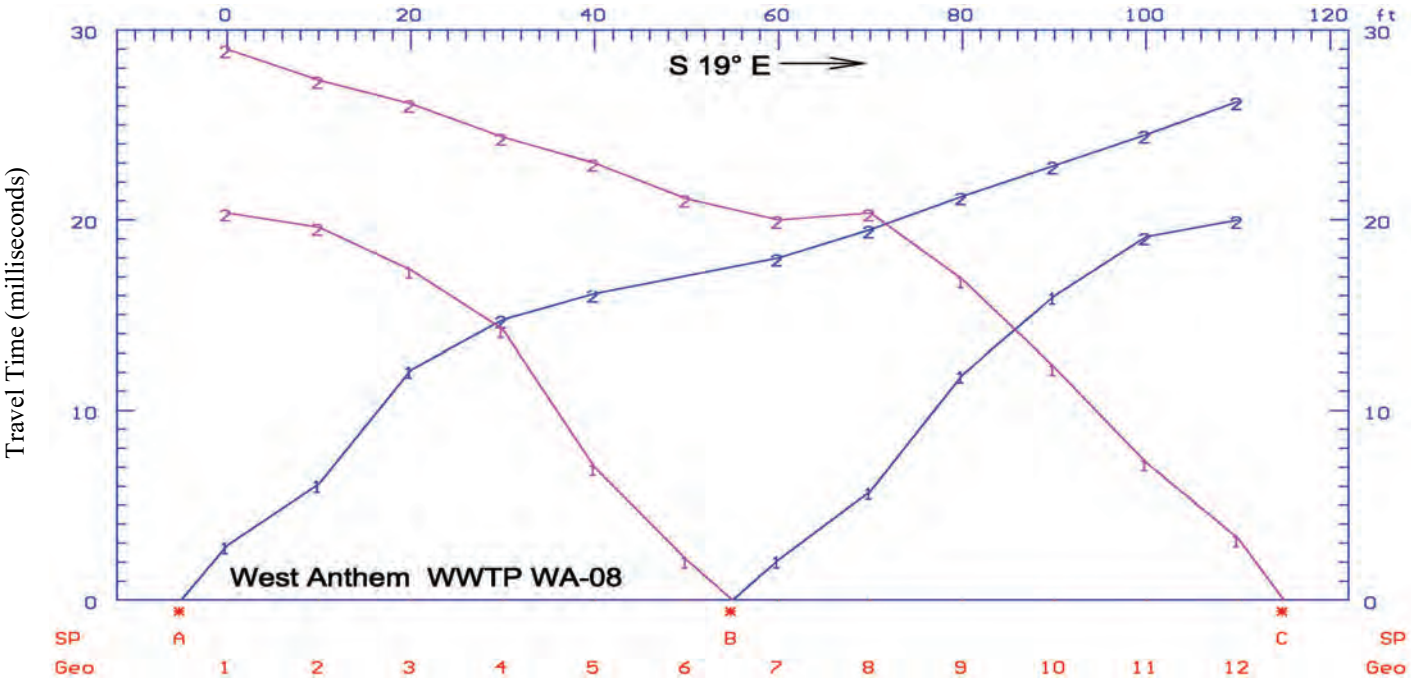

Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 16 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-08
Velocity Profile &Time-Distance Plot
Figure 15

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Figure 16; Photo 1: Seismic Survey Line WA-08 view looking toward the South-southeast from Shot Point A toward Shot Point C.

Figure 16; Photo 2: Seismic Survey Line WA-08 view looking toward the North-northwest from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-08 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Line WA-08

A **C**

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 15 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-08
Seismic Survey Line Photographs
Figure 16

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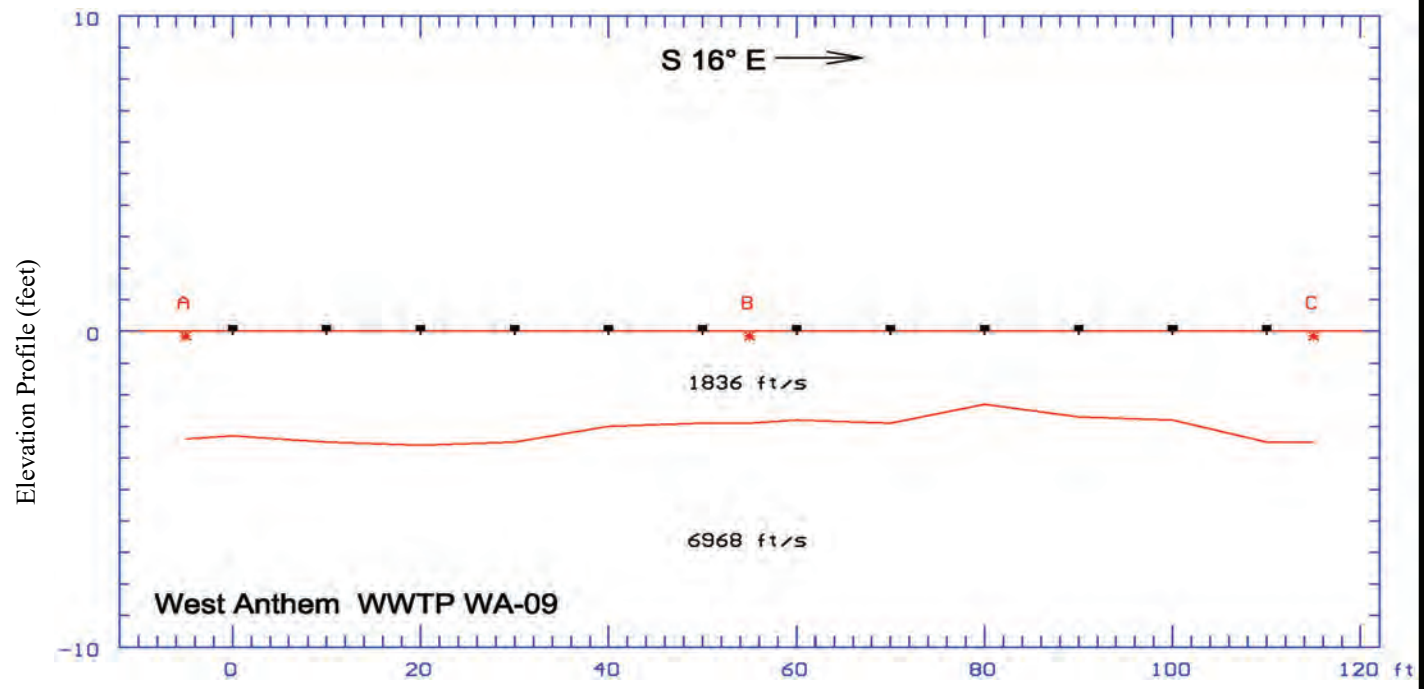
Phoenix, Arizona 85021
Phone 602-864-1888



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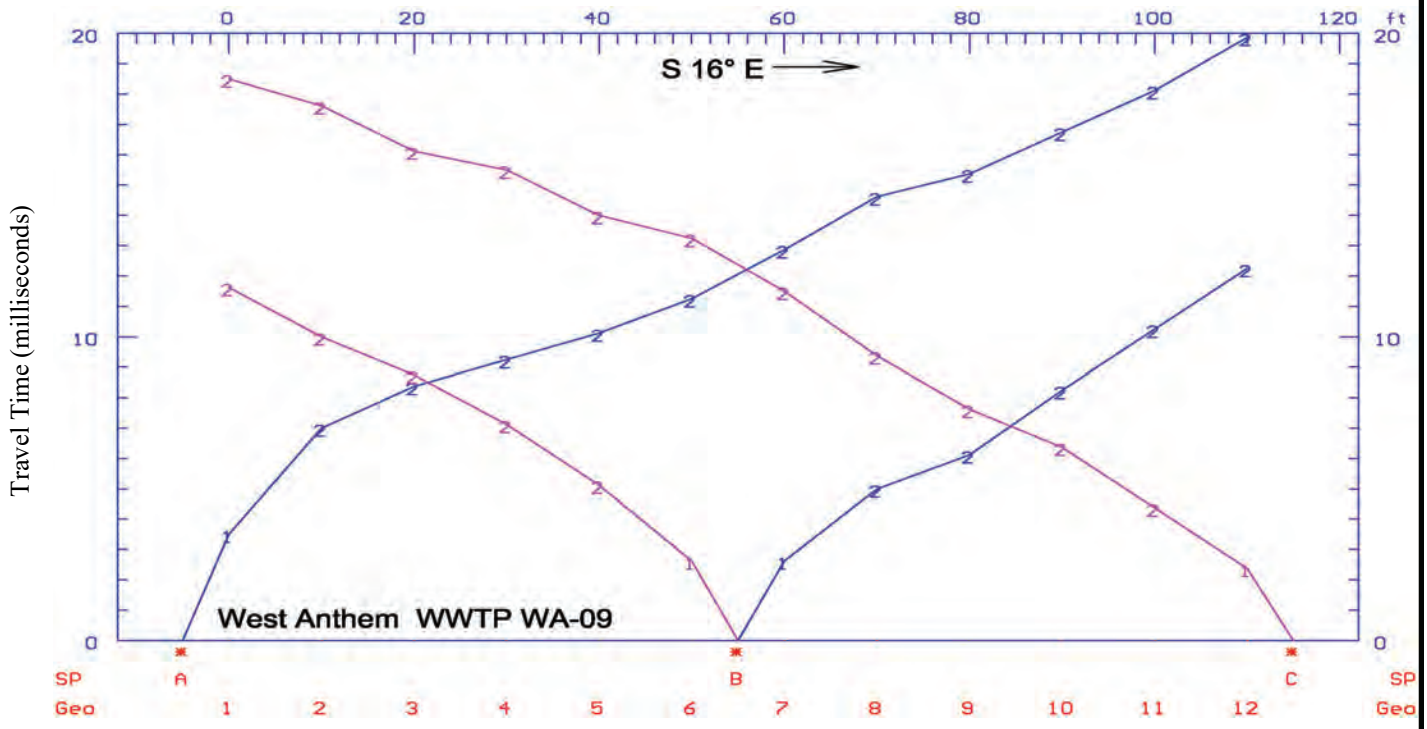

Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 18 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-09
Velocity Profile &Time-Distance Plot
Figure 17

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Figure 18; Photo 1: Seismic Survey Line WA-09 view looking toward the South-southeast from Shot Point A toward Shot Point C.

Figure 18; Photo 2: Seismic Survey Line WA-09 view looking toward the North-northwest from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-09 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Line WA-09

A **C**

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 17 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-09
Seismic Survey Line Photographs
Figure 18

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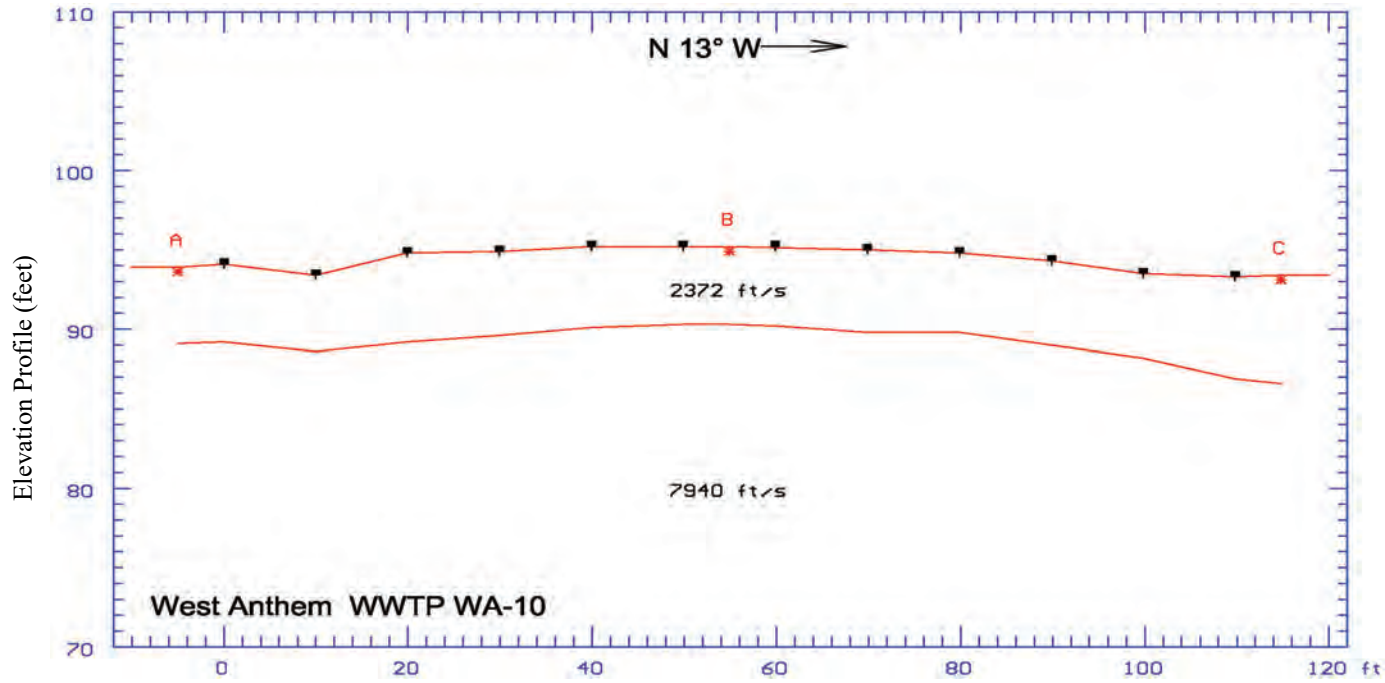

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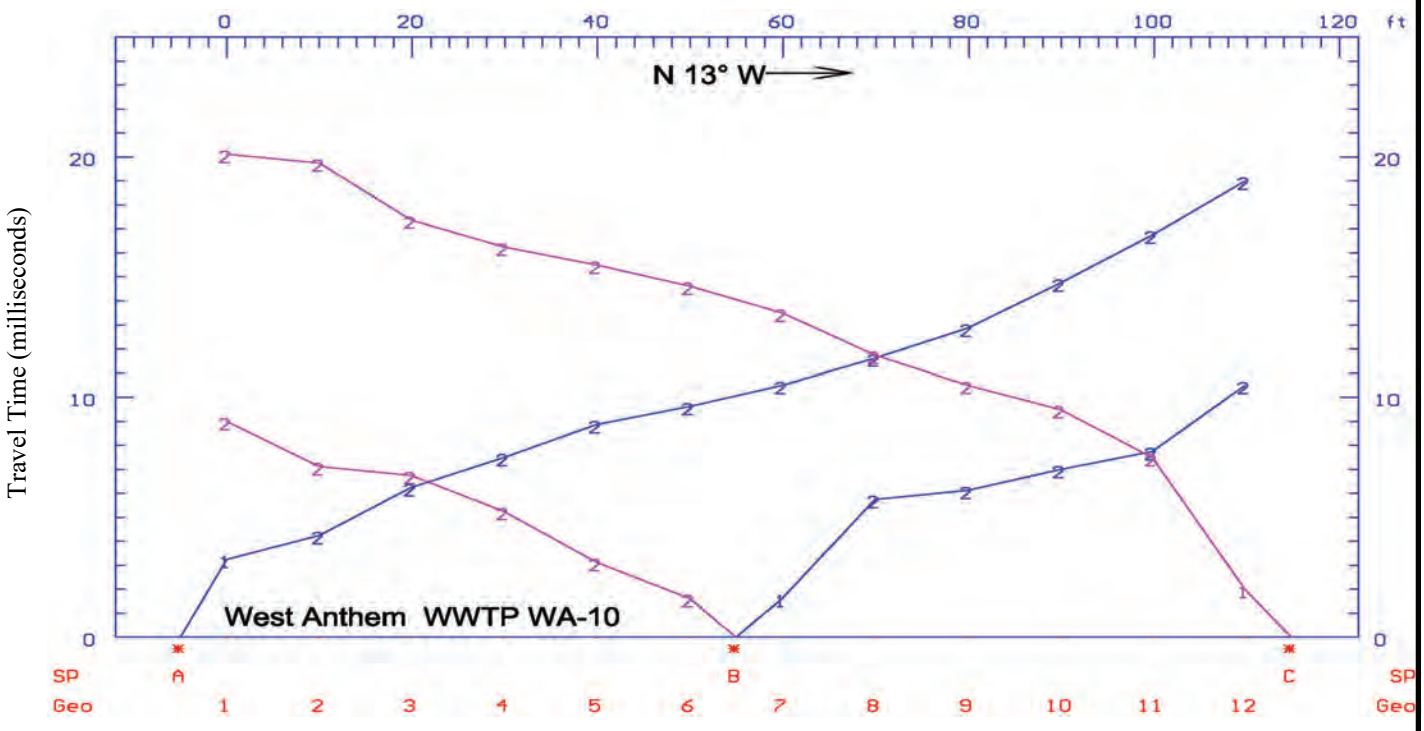

Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 20 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-10
Velocity Profile &Time-Distance Plot
Figure 19

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Figure 20; Photo 1: Seismic Survey Line WA-10 view looking toward the South-southeast from Shot Point A toward Shot Point C.

Figure 20; Photo 2: Seismic Survey Line WA-10 view looking toward the South-southeast from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-10 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 19 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-10
Seismic Survey Line Photographs
Figure 20

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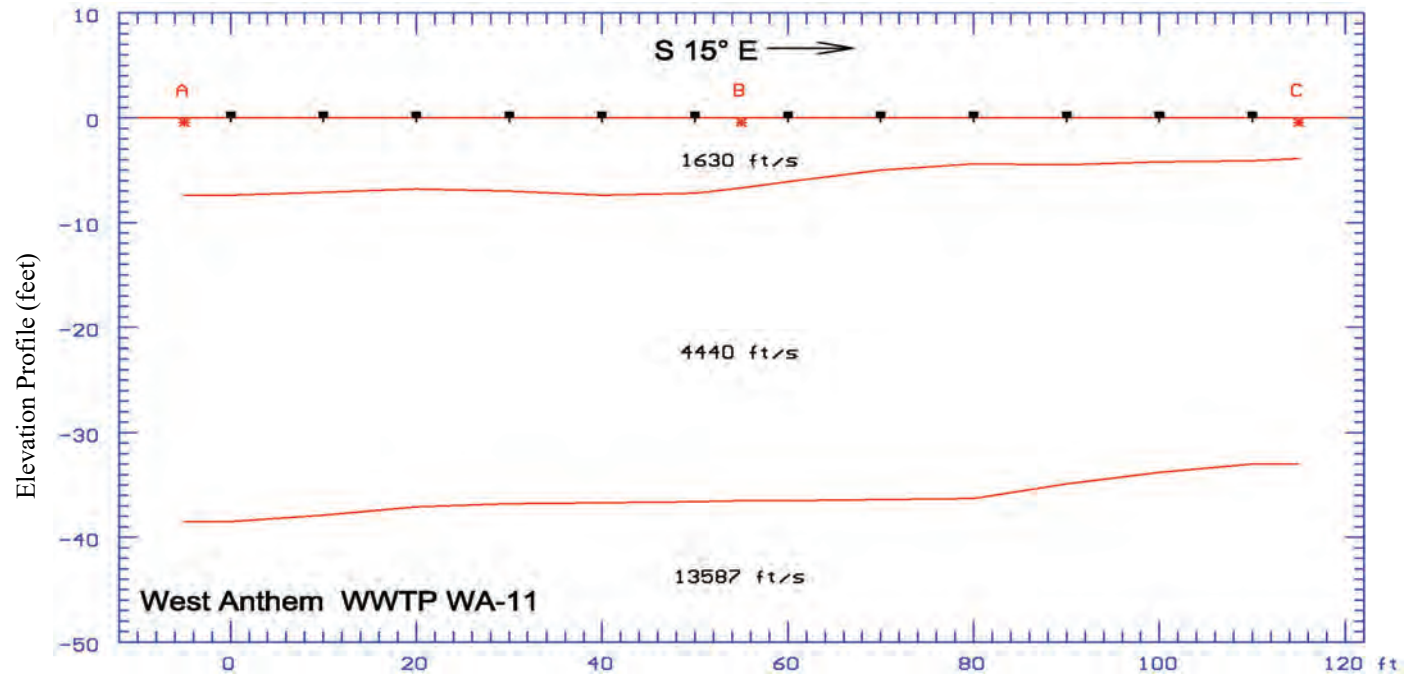

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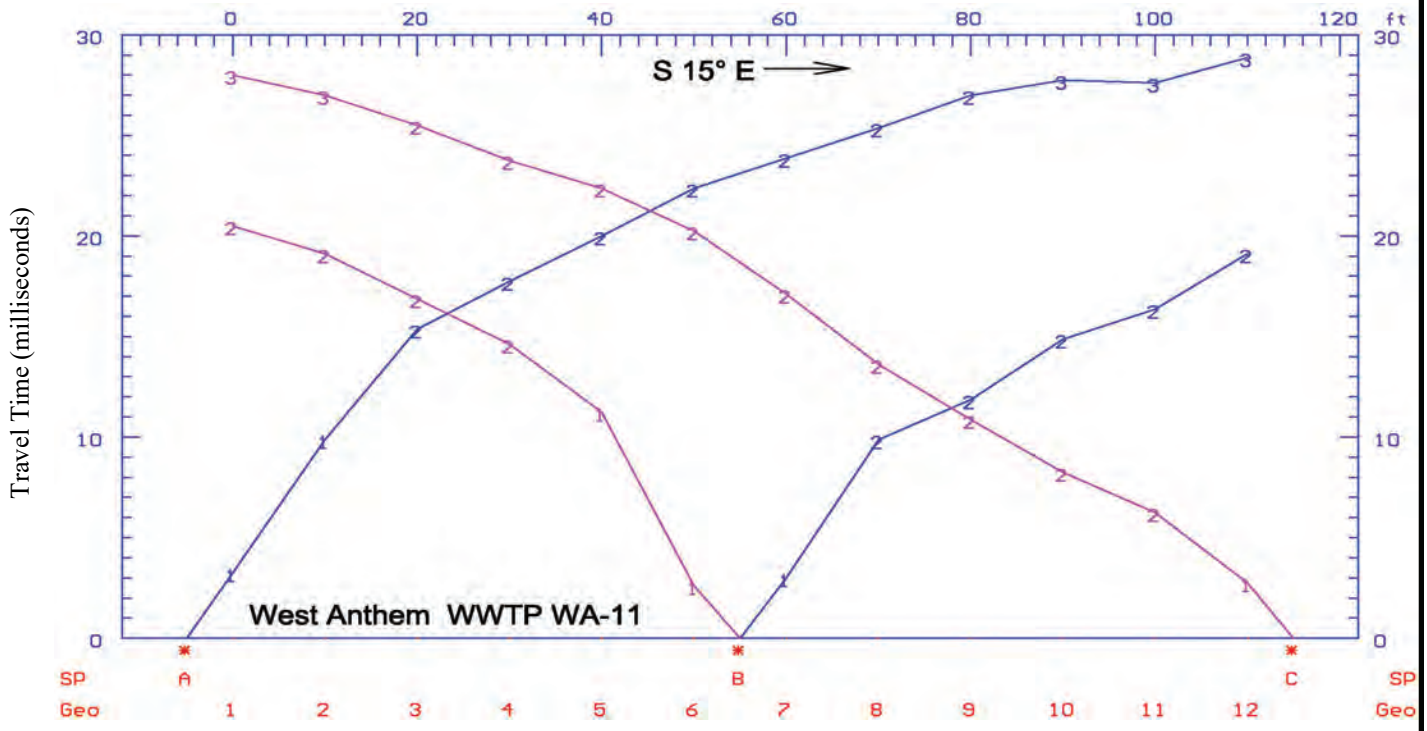

Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 22 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-11
Velocity Profile &Time-Distance Plot
Figure 21

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Fax 602-864-1899

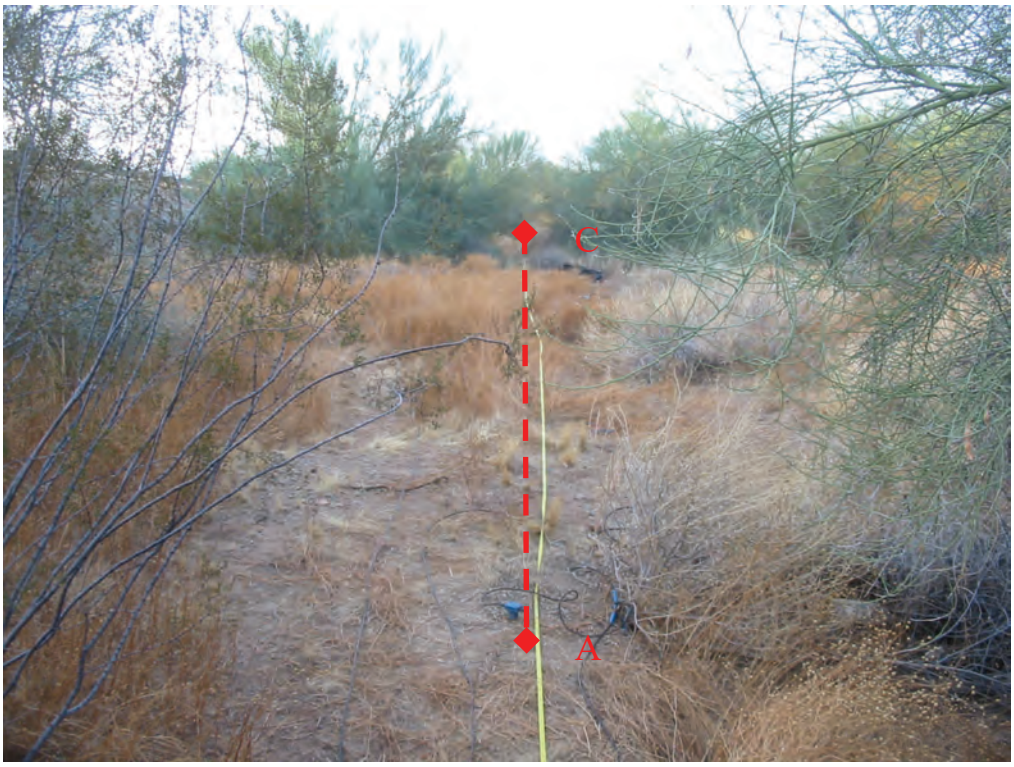

Figure 22; Photo 1: Seismic Survey Line WA-11 view looking toward the South-southeast from Shot Point A toward Shot Point C.

Figure 22; Photo 2: Seismic Survey Line WA-11 view looking toward the North-northwest from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-11 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Line WA-11

A **C**

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 21 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-11
Seismic Survey Line Photographs
Figure 22

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Phoenix, Arizona 85021
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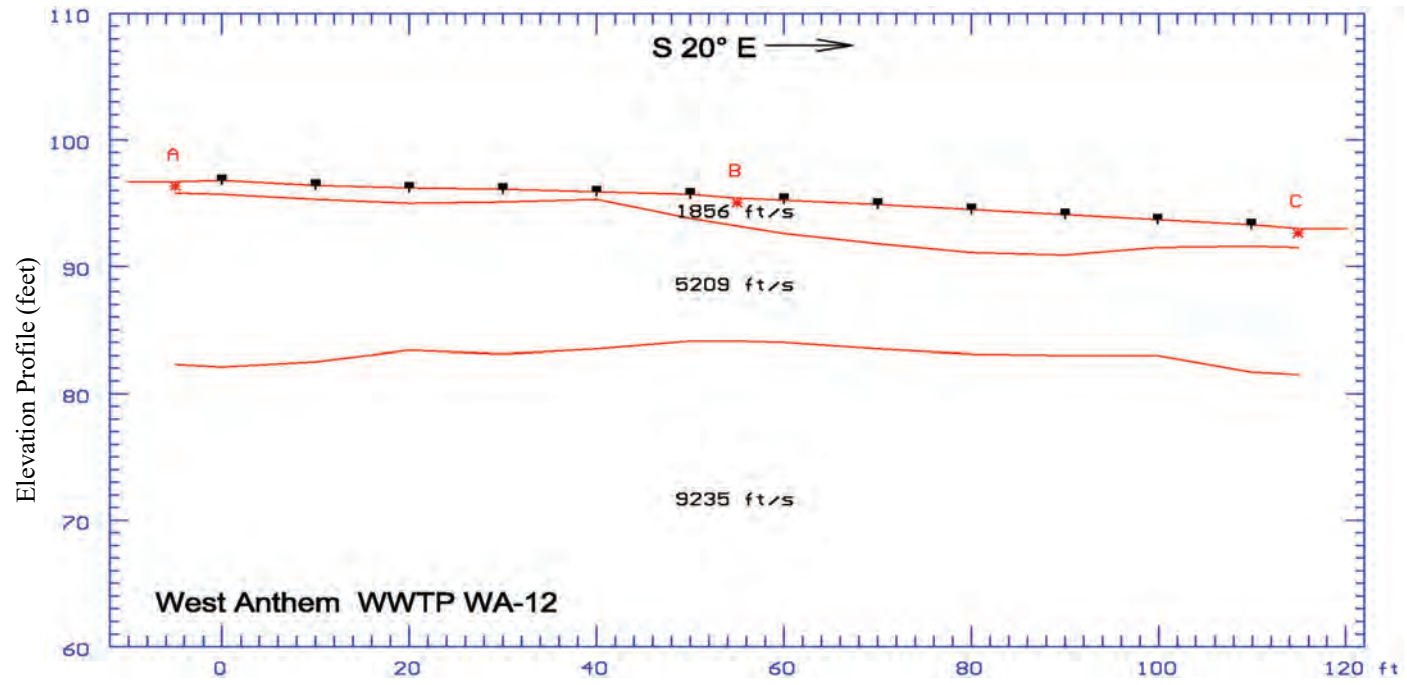

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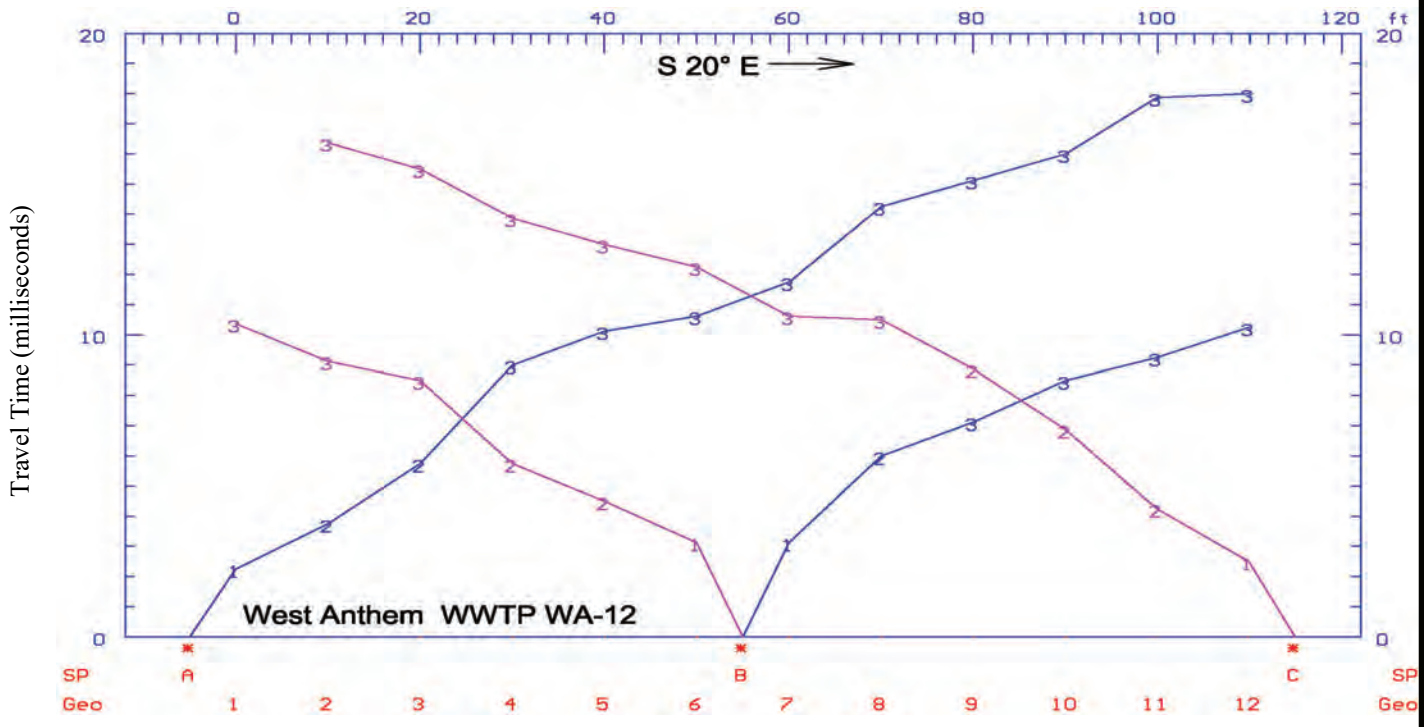

Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 24 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-12
Velocity Profile &Time-Distance Plot
Figure 23

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Figure 24; Photo 1: Seismic Survey Line WA-12 view looking toward the South-southeast from Shot Point A toward Shot Point C.

Figure 24; Photo 2: Seismic Survey Line WA-12 view looking toward the North-northwest from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-12 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Line WA-12

A — **C**

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 23 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-12
Seismic Survey Line Photographs
Figure 24

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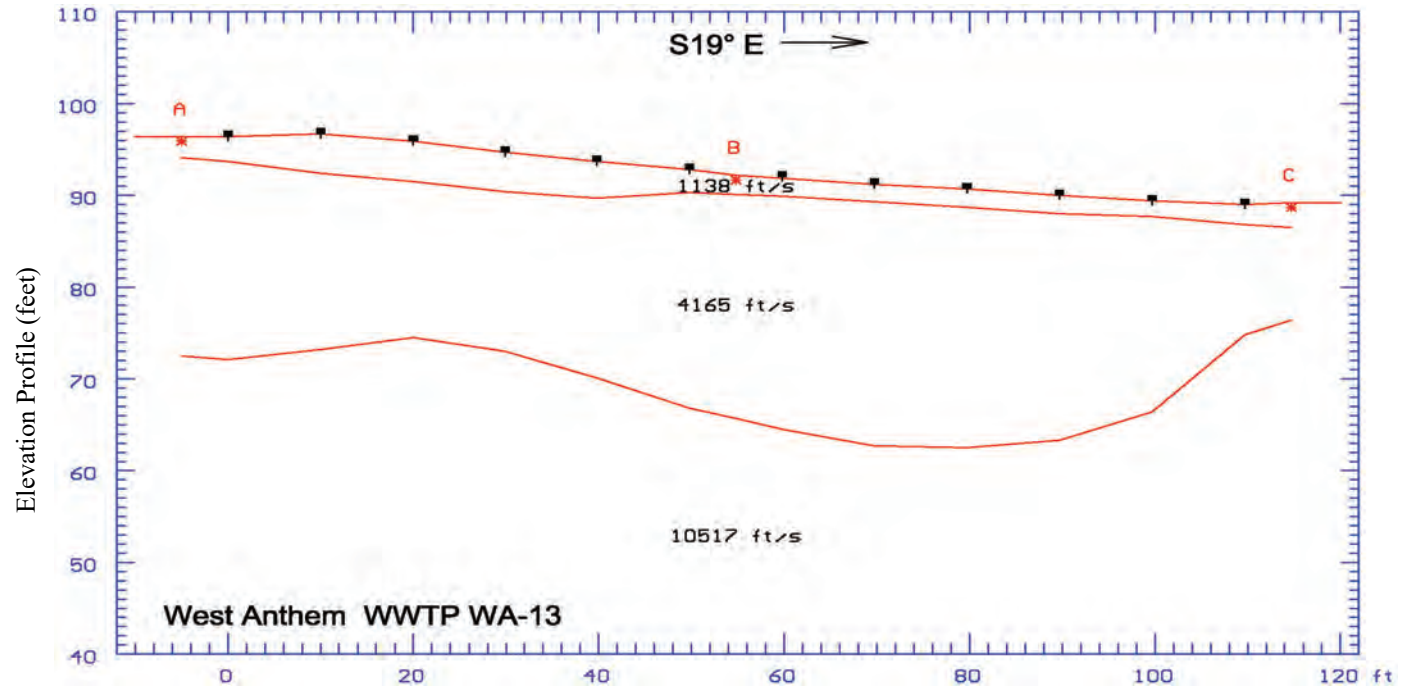
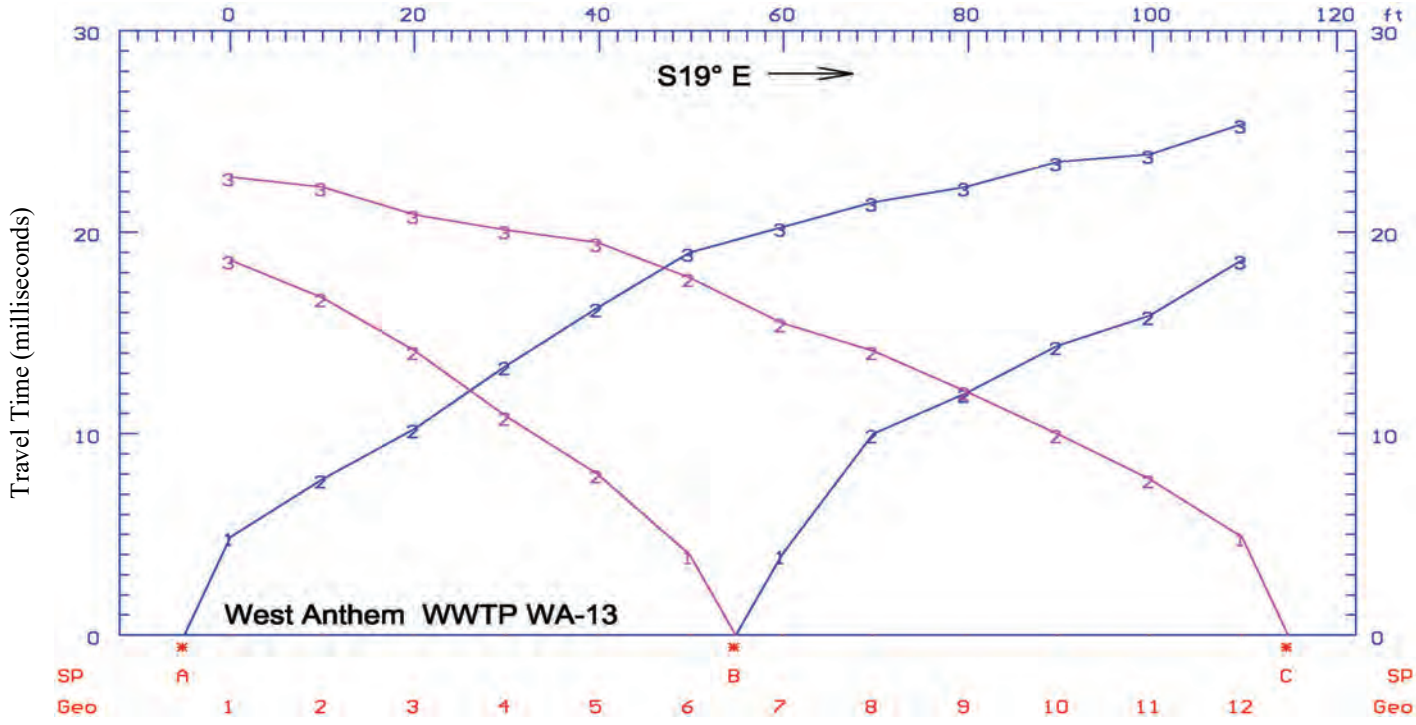


Interpreted Velocity Profile



Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 26 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-13
Velocity Profile &Time-Distance Plot
Figure 25

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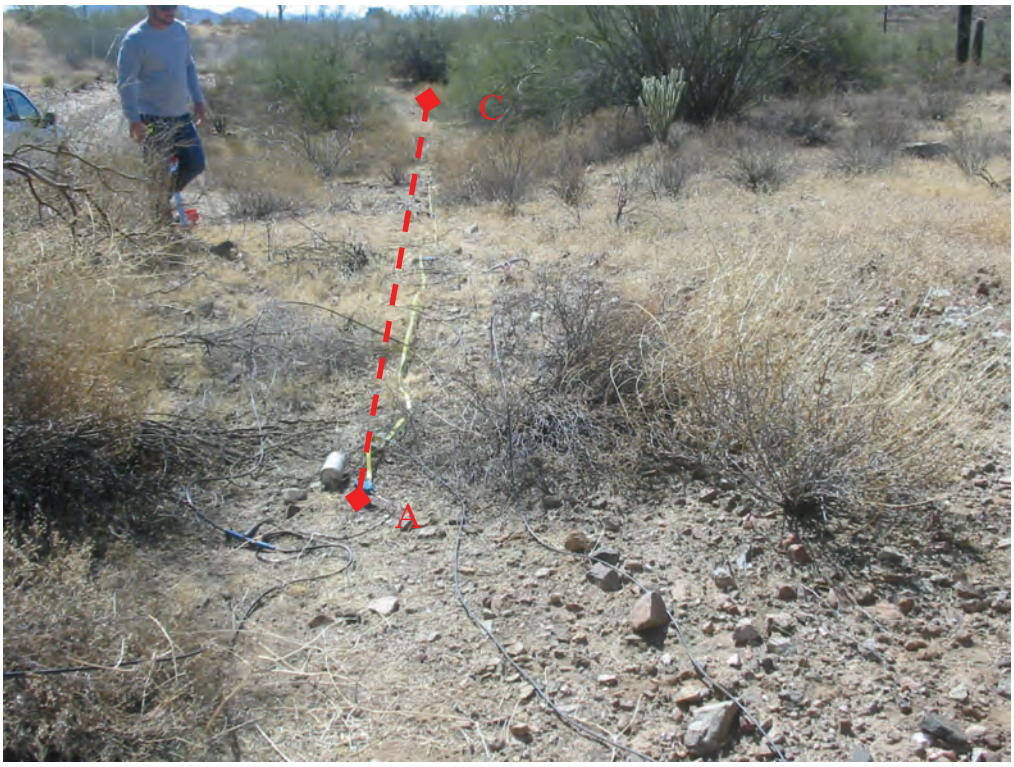

Figure 26; Photo 1: Seismic Survey Line WA-13 view looking toward the South-southeast from Shot Point A toward Shot Point C.

Figure 26; Photo 2: Seismic Survey Line WA-13 view looking toward the North-northwest from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-13 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 25 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-13
Seismic Survey Line Photographs
Figure 26

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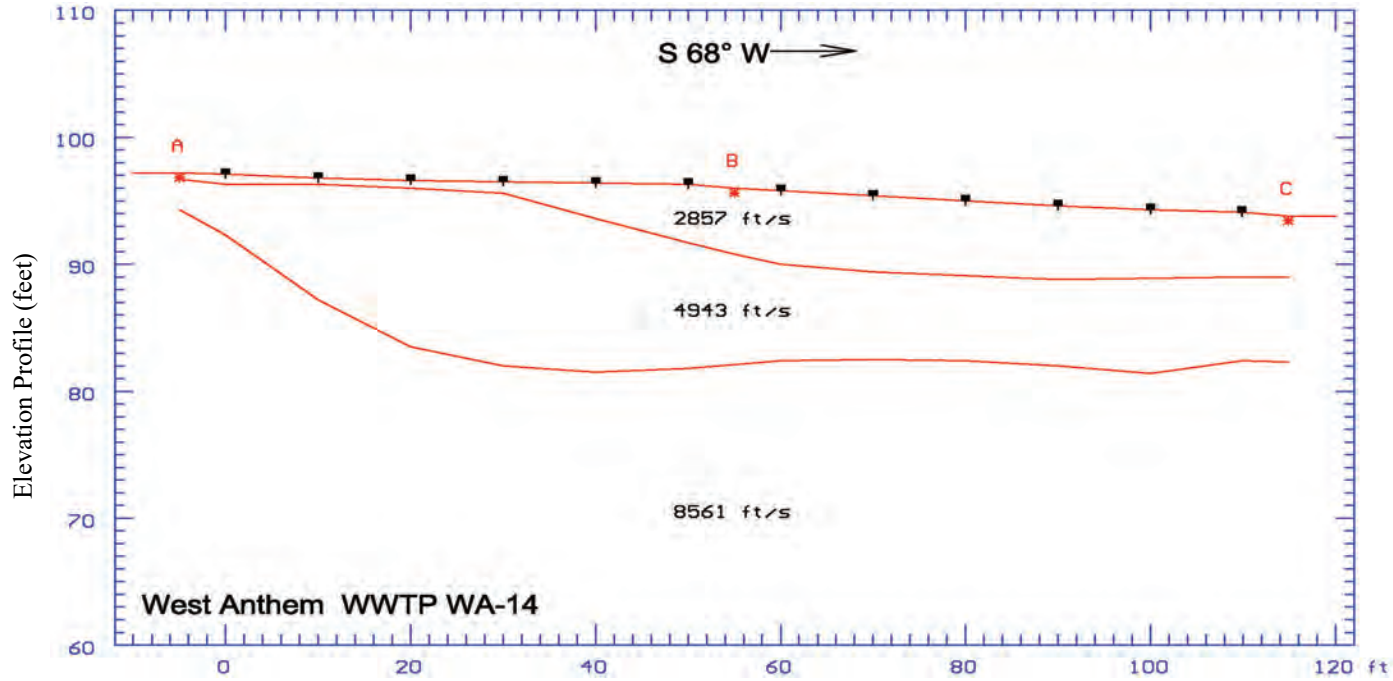
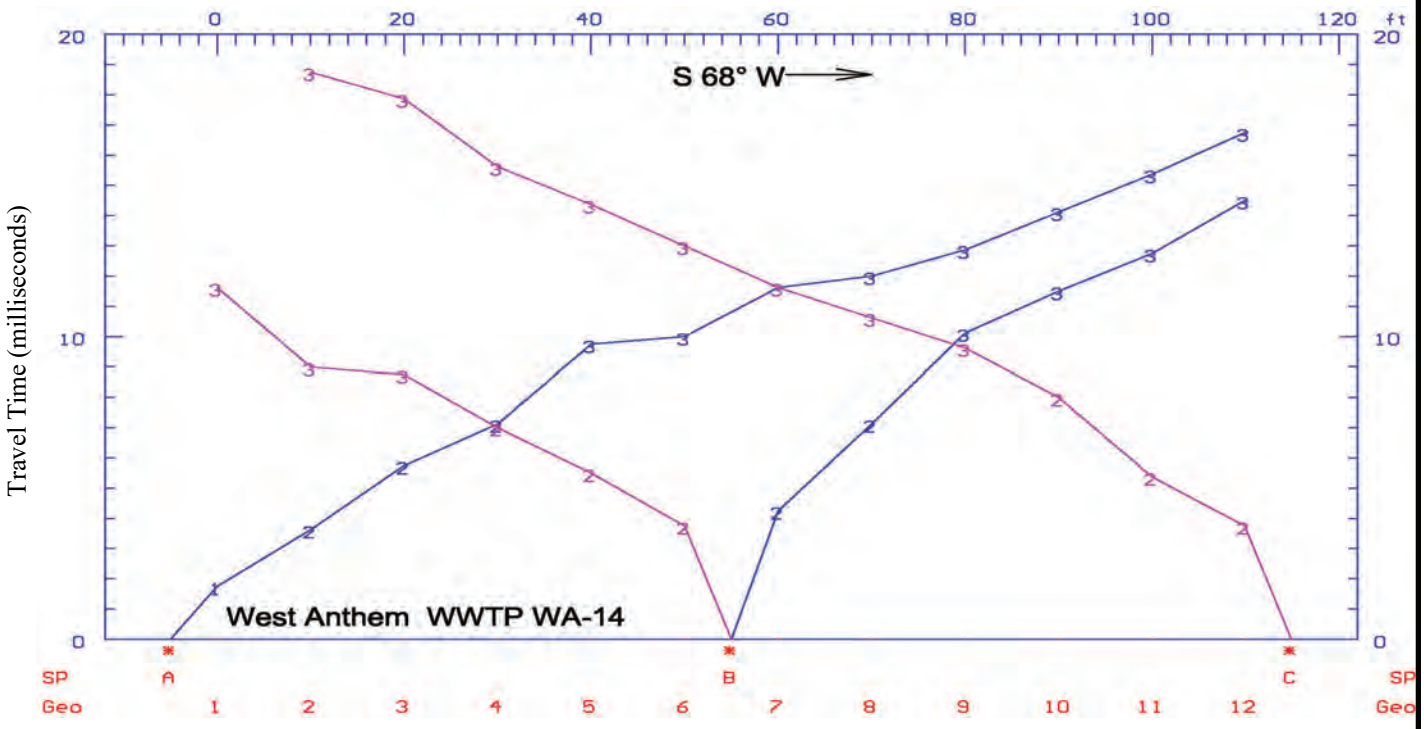


Interpreted Velocity Profile



Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 28 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-14
Velocity Profile &Time-Distance Plot
Figure 27

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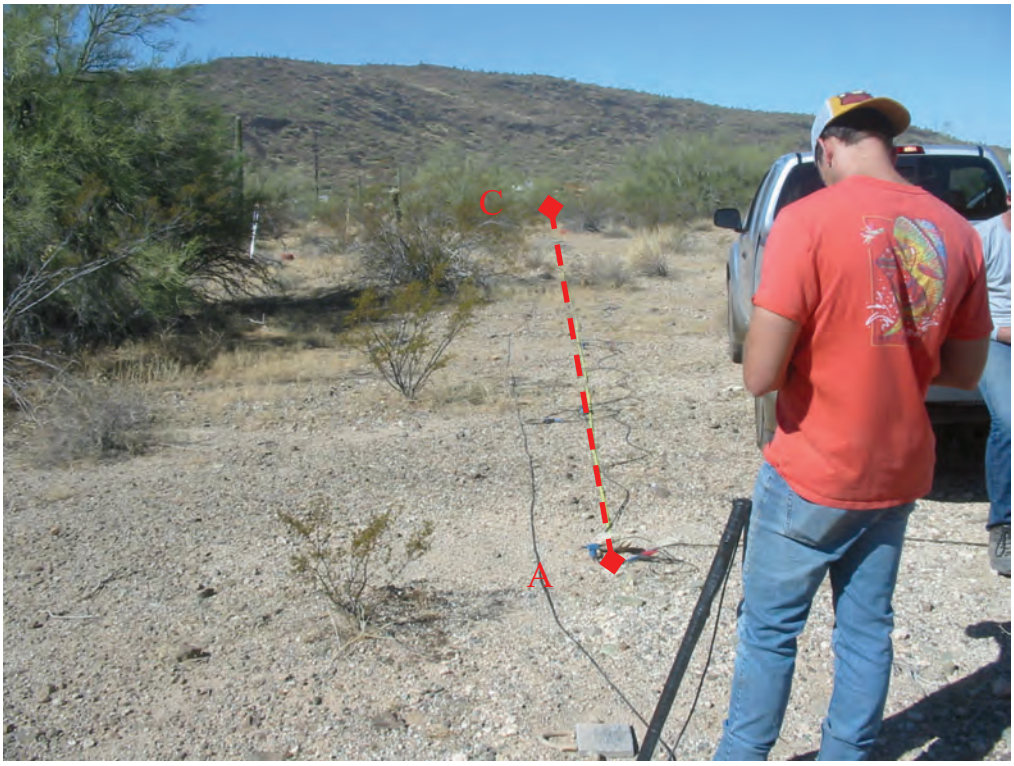

Figure 28; Photo 1: Seismic Survey Line WA-14 view looking toward the Southeast from Shot Point A toward Shot Point C.

Figure 28; Photo 2: Seismic Survey Line WA-14 view looking toward the North-west from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-14 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 27 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-14
Seismic Survey Line Photographs
Figure 28

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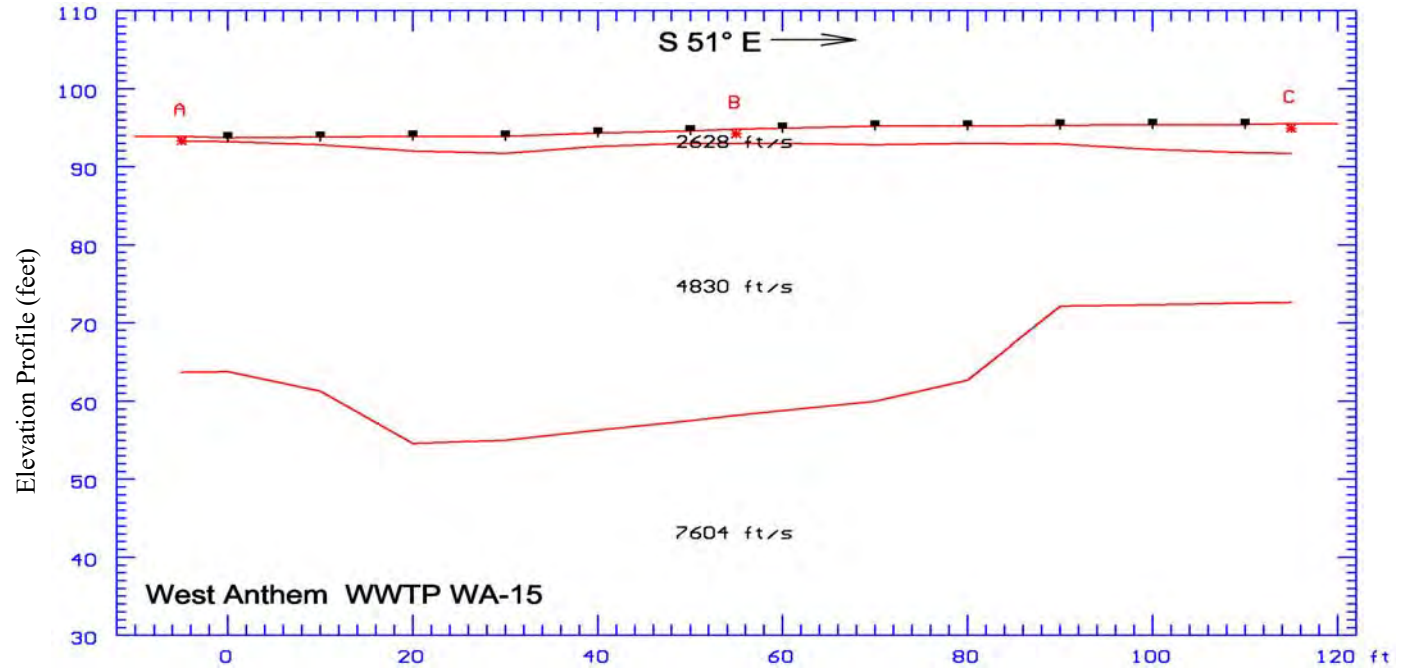
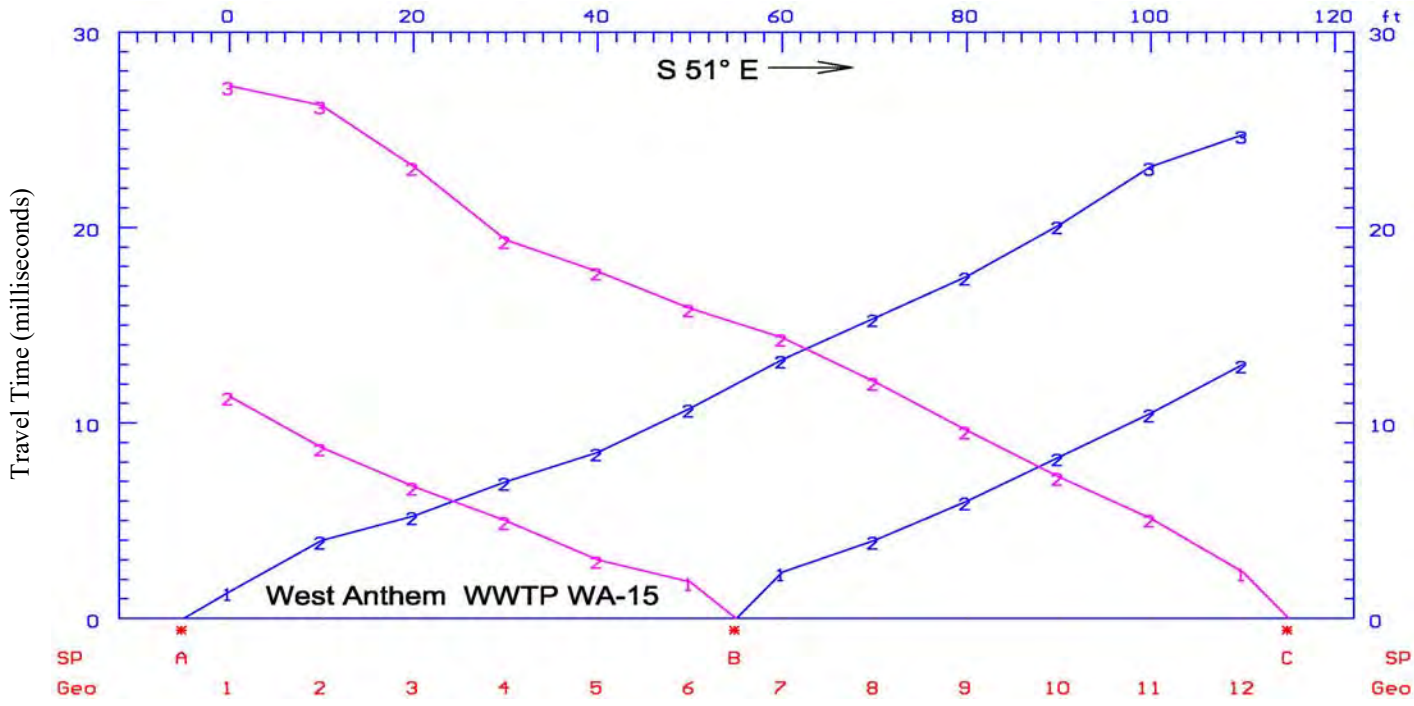


Interpreted Velocity Profile



Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 30 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-15
Velocity Profile &Time-Distance Plot
Figure 29

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Fax 602-864-1899

Figure 30; Photo 1: Seismic Survey Line WA-15 view looking toward the Southeast from Shot Point A toward Shot Point C.

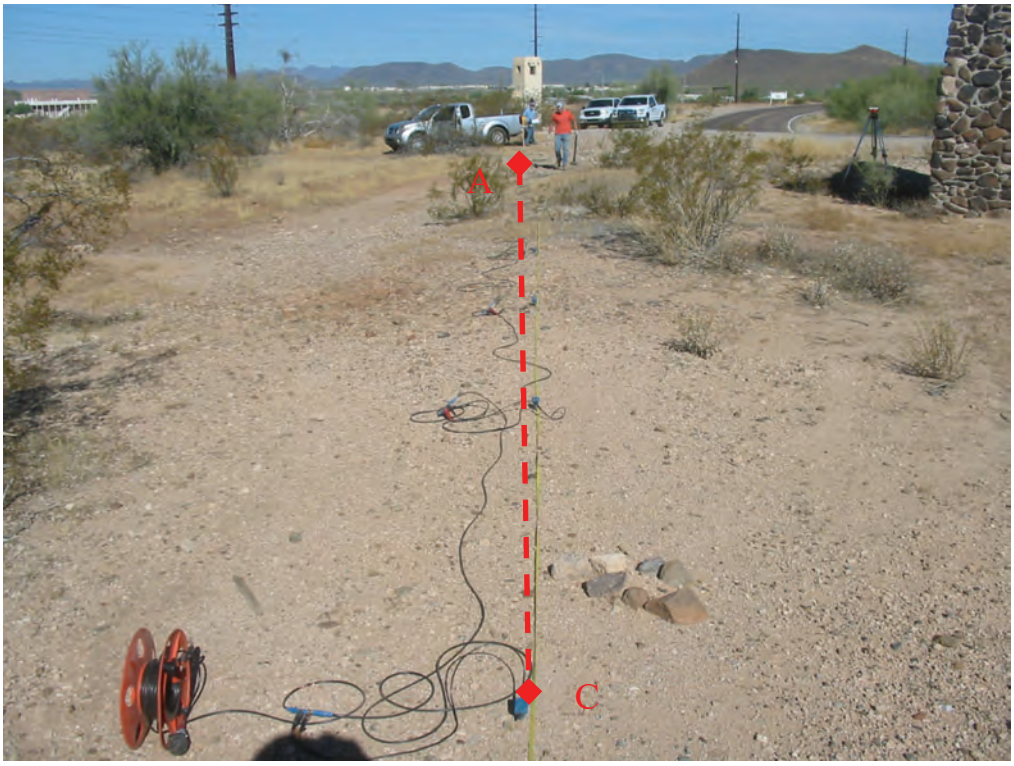

Figure 30; Photo 2: Seismic Survey Line WA-15 view looking toward the North-west from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-15 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Line WA-15

A **C**

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 29 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-15
Seismic Survey Line Photographs
Figure 30

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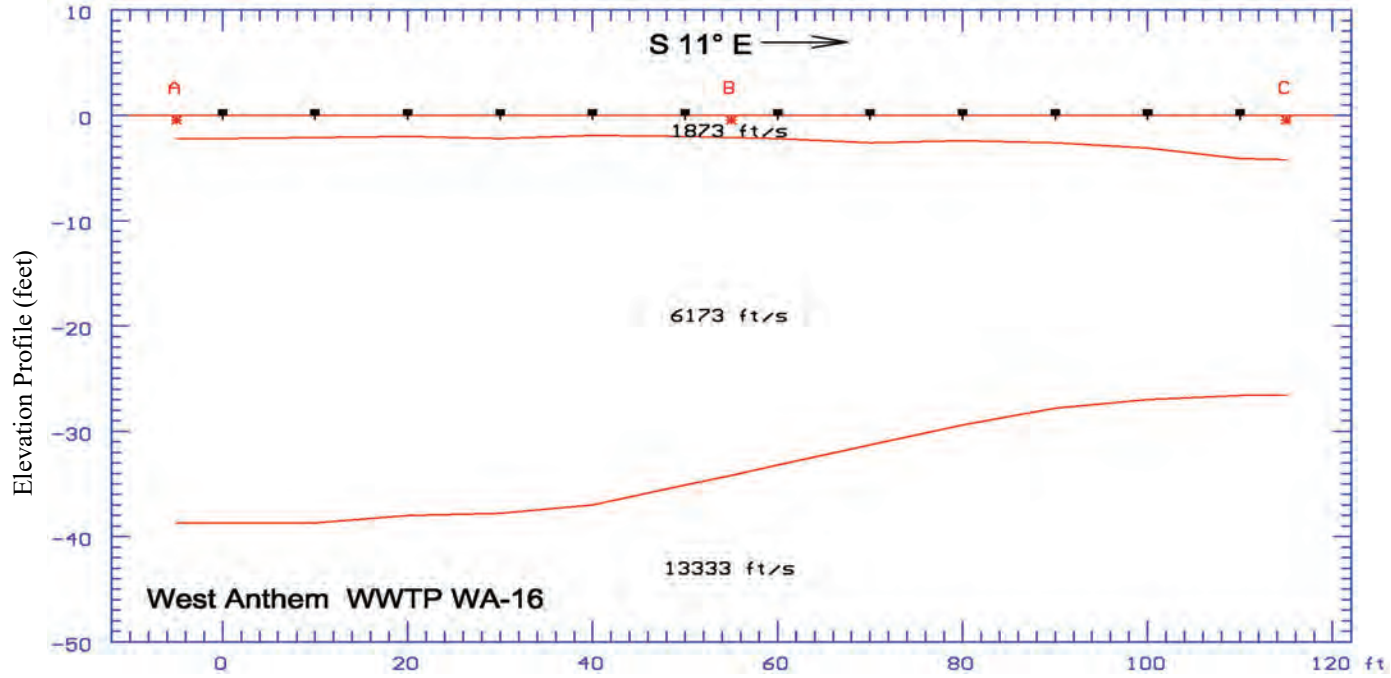
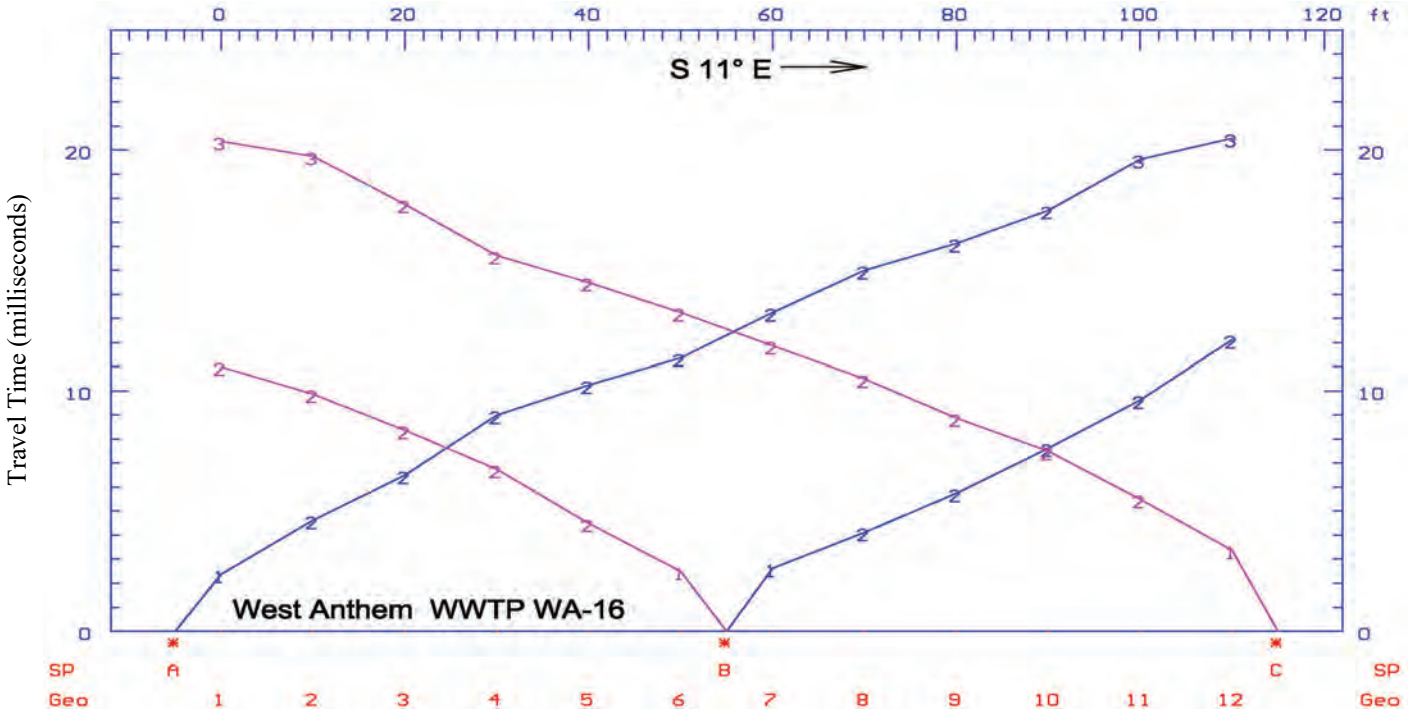


Interpreted Velocity Profile



Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 32 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-16
Velocity Profile &Time-Distance Plot
Figure 31

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Phone 602-864-1888
Fax 602-864-1899

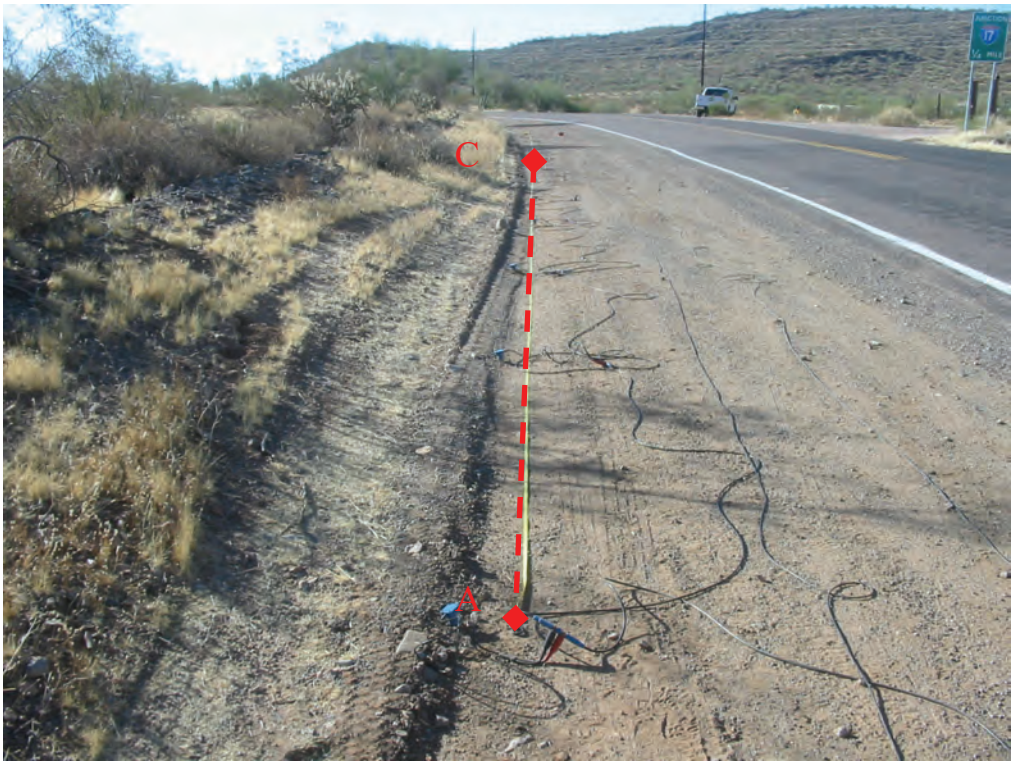

Figure 32; Photo 1: Seismic Survey Line WA-16 view looking toward the South-southeast from Shot Point A toward Shot Point C.

Figure 32; Photo 2: Seismic Survey Line WA-16 view looking toward the North-northwest from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-16 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Line WA-16

A **C**

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 31 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-16
Seismic Survey Line Photographs
Figure 32

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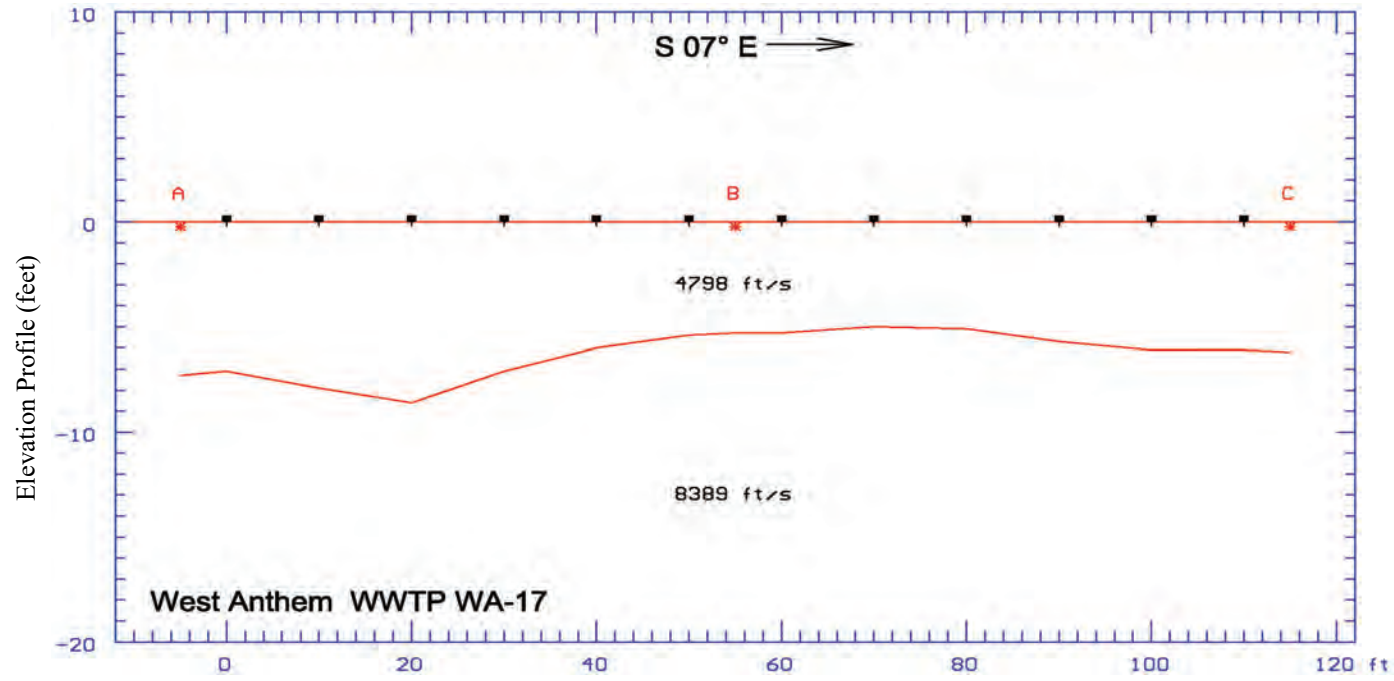
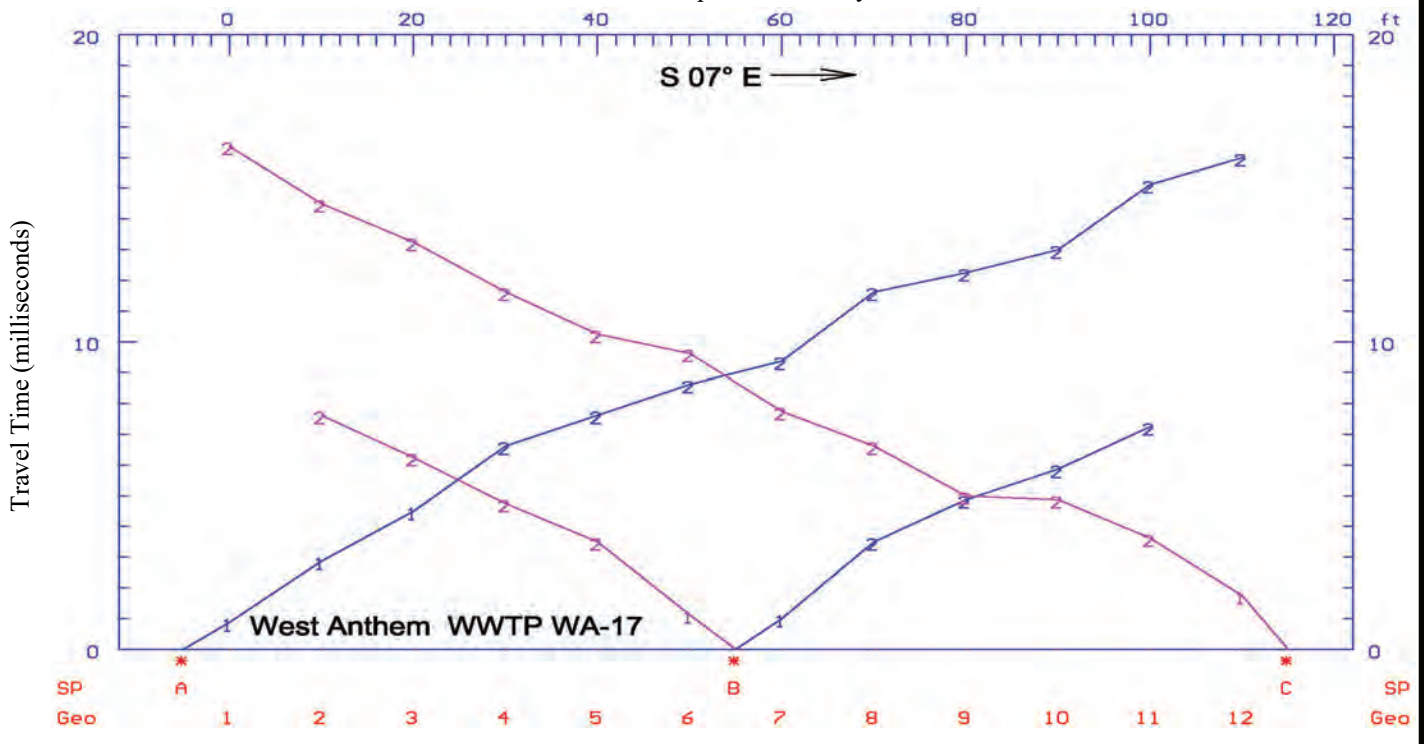


Interpreted Velocity Profile



Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 34 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-17
Velocity Profile &Time-Distance Plot
Figure 33

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Figure 34; Photo 1: Seismic Survey Line WA-17 view looking toward the South from Shot Point A toward Shot Point C.

Figure 34; Photo 2: Seismic Survey Line WA-17 view looking toward the North from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-17 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Line WA-17

A C

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 33 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-17
Seismic Survey Line Photographs
Figure 34

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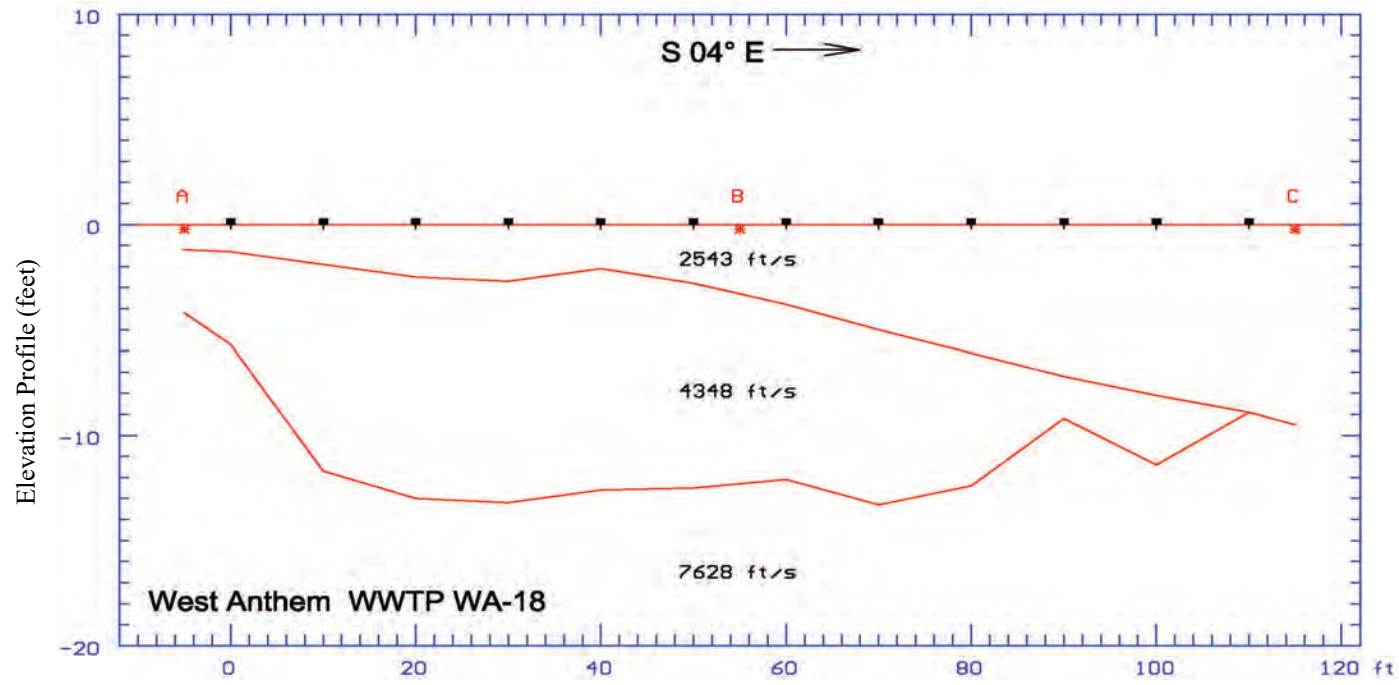
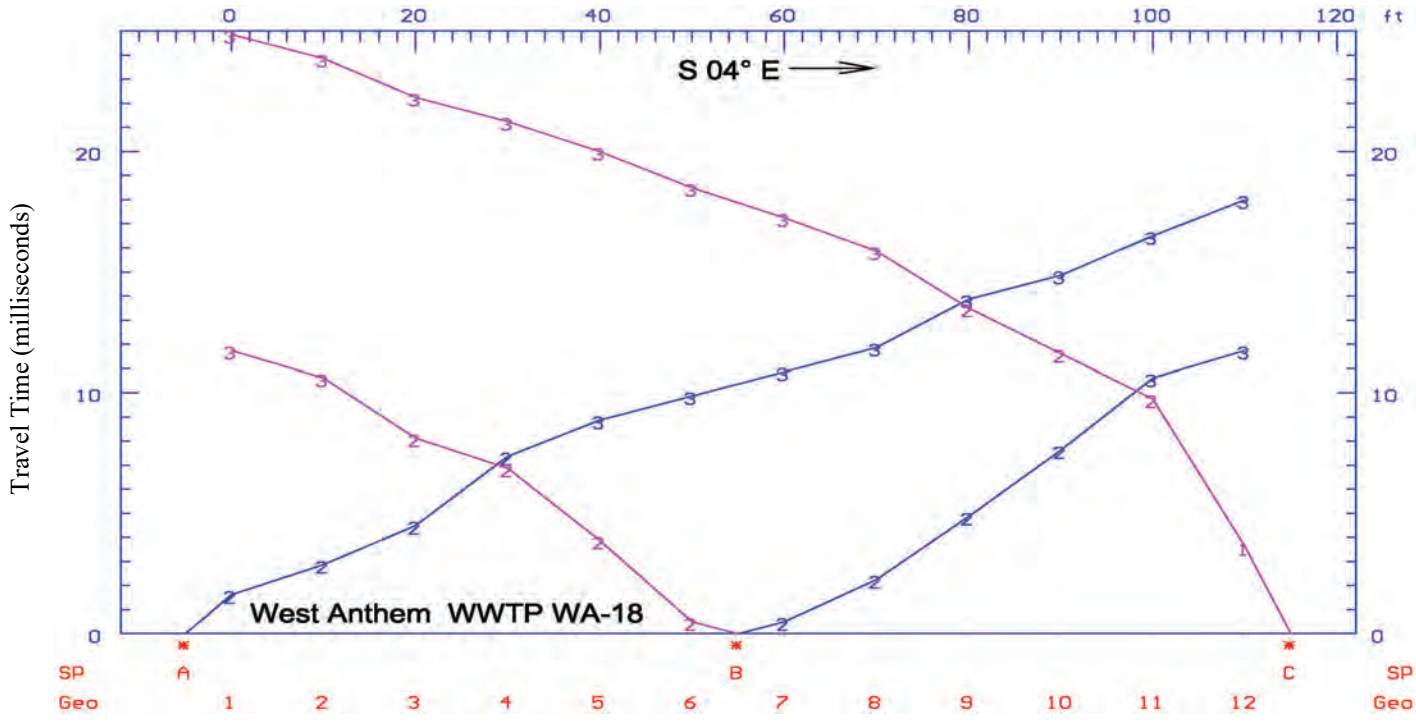


Interpreted Velocity Profile



Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 36 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-18
Velocity Profile &Time-Distance Plot
Figure 35

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Fax 602-864-1899

Figure 36; Photo 1: Seismic Survey Line WA-18 view looking toward the South from Shot Point A toward Shot Point C.

Figure 36; Photo 2: Seismic Survey Line WA-18 view looking toward the North from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-18 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Line WA-18

A **C**

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 35 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-18
Seismic Survey Line Photographs
Figure 36

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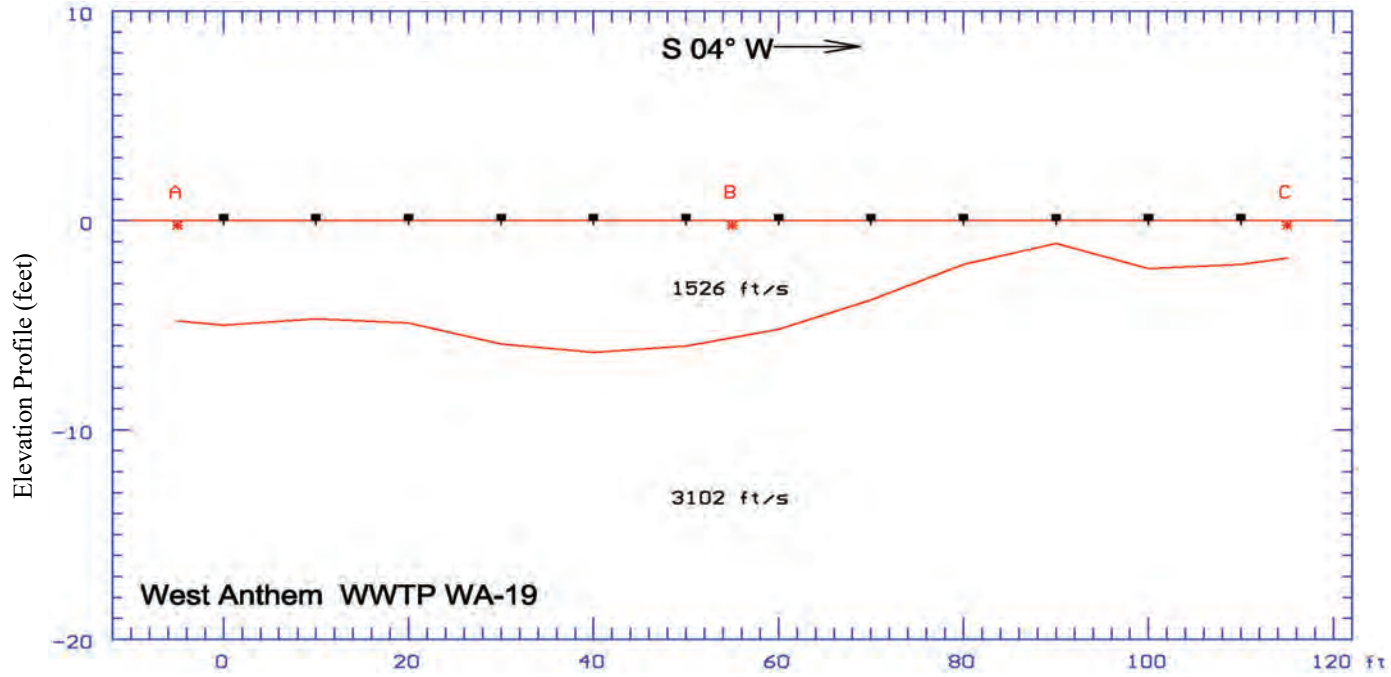
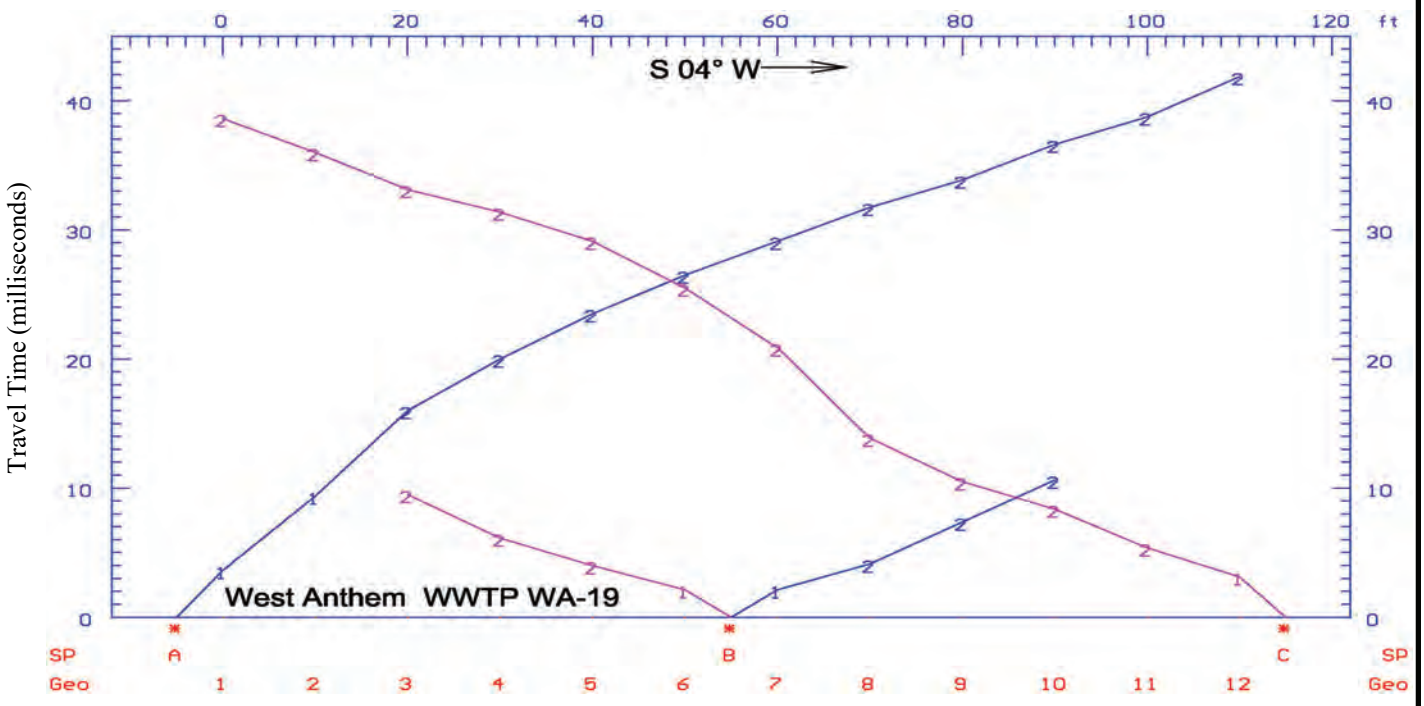


Interpreted Velocity Profile



Time/Distance Plot

Refer to Figure 2 for seismic survey line location and Figure 38 for photographs of the seismic survey line layout.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-19
Velocity Profile &Time-Distance Plot
Figure 37

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Figure 38; Photo 1: Seismic Survey Line WA-19 view looking toward the North from Shot Point A toward Shot Point C.

Figure 38; Photo 2: Seismic Survey Line WA-19 view looking toward the South from Shot Point C toward Shot Point A.

Photographs of seismic survey line WA-19 taken by K. Euge, R.G.; Geological Consultants Inc. Project No. 2017-136.

Explanation:

Line WA-19

A C

Seismic survey line location: A-shot point start; C-shot point end. Refer to Figure 37 for interpreted seismic line profiles and travel time-distance plot.

West Anthem WWTP Improvements
Seismic Refraction Survey WA-19
Seismic Survey Line Photographs
Figure 38

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APPENDIX A

SEISMIC REFRACTION SURVEY

APPENDIX A
SEISMIC REFRACTION SURVEY

A.1 GENERAL

In general, seismic wave velocities are related to the hardness, consolidation, and density of the materials through which seismic (shock) waves travel. Seismic velocities of subsurface soils and bedrock can be correlated to some of the physical properties of the material with reasonable levels of confidence. As with rock rippability (ease of excavation) for example, the Caterpillar tractor Company has correlated ranges of seismic velocities in different rock and soil materials to qualitative estimates of rippability for their D-9 tractor with a mounted hydraulic No.9 ripper.

The use of seismic velocities measured in various soils and rock types are considered reasonably conservative for evaluating soil and rock characteristics by "indirect" shallow geophysical seismic methods. Some general correlations are as follows:

- Soil, loose surface material, alluvium and strongly weathered and broken bedrock has velocities ranging from 500 feet per second (fps) to 1,200 fps;

- Moderately hard, slightly to moderately cemented, dense alluvial and colluvial sediments and moderately weathered and broken bedrock range from 1,200 fps to 3,000 fps;

- Very dense, hard, well-cemented soils and moderately competent bedrock range from 3,000 fps to 6,000 fps;

- Sound, relatively homogeneous or tightly jointed bedrock and uniformly, strongly cemented soils (silica hardpan, caliche, calcrete, etc.) have seismic velocities greater than 6,000 fps.

Soils and rock with velocities of less than 3,000 fps can usually be excavated with conventional earth moving equipment. Where materials with velocities in excess of 6,000 fps are found, blasting would normally be required for efficient fragmentation. However, if the rock is thinly bedded, jointed, or fractured, it may be possible to break the rock with heavy ripping using a single shank ripper or large ram-hoe. The resulting fragments will be of a size consistent with the fracture spacing and the progress of the excavation would be very slow. The intermediate material (velocities between 3,000 fps and 6,000 fps) would likely require heavy equipment and possibly the localized use of jack- hammers, ram-hoes, or selective blasting to provide cost-

effective excavation.

A.2 DATA COLLECTION

Refraction data were collected along seismic survey lines consisting of 12 geophones spaced 10 feet apart. This geometry provided coverage of about 110 feet along each survey line. Refer to Figure 2 for the seismic survey line locations. Seismic waves were generated at shot points located at line ends and the center to measure shallow materials (near-surface) seismic velocities. Data were recorded from both line ends so the effect of layer inclination, or dip on velocity boundaries, could be calculated. This geometry provided at least 40 feet, or more, of penetration at most line locations.

A.3 REFRACTION SEISMIC SURVEY LIMITATIONS

The seismic survey data presented in this report are derived from and interpreted from an indirect geophysical investigative technique (seismic refraction surveys) employed at the specific locations indicated and from observations made of the surface geologic conditions exposed at the site. The interpretations made at the specific seismic survey sites are believed to be reasonable based on the information available at the time of this study. The interpretations may not represent, nor are they intended to represent, the subsurface condition at other locations.

Geologic contacts between rock and soil units are approximate, may be either gradual or abrupt, and the calculated depths could vary from 10 to 20 percent or more. Geological and geotechnical information provided others and our experience on similar projects in similar geological terrain were considered in the interpretations of subsurface conditions.

A.4 REFRACTION DATA PROCESSING

Seismic Refraction Interpretation Programs (SIP) computer programs by RlMROCK GEOPHYSICS, were used to analyze seismic data obtained in the field. The programs calculate average velocities of any number of layers assuming the multilayered intervals do not include velocity inversions or "hidden" zones (i.e., high velocity zone over a low velocity zone). Thicknesses of each layer, except for the lowermost layer, are calculated along with the dip (inclination) angle of the layer boundary. The depth below the ground surface to each layer boundary is also provided.

Input data, velocity of each layer and seismic wave arrival times, obtained during the field work are checked by the computer program to assure that they satisfy reciprocity at least within 20 percent. These data are used to develop a meaningful geological model used to interpret subsurface stratigraphic conditions.

APPENDIX B

ROCK HARDNESS & EXCAVATION CHARACTERISTICS

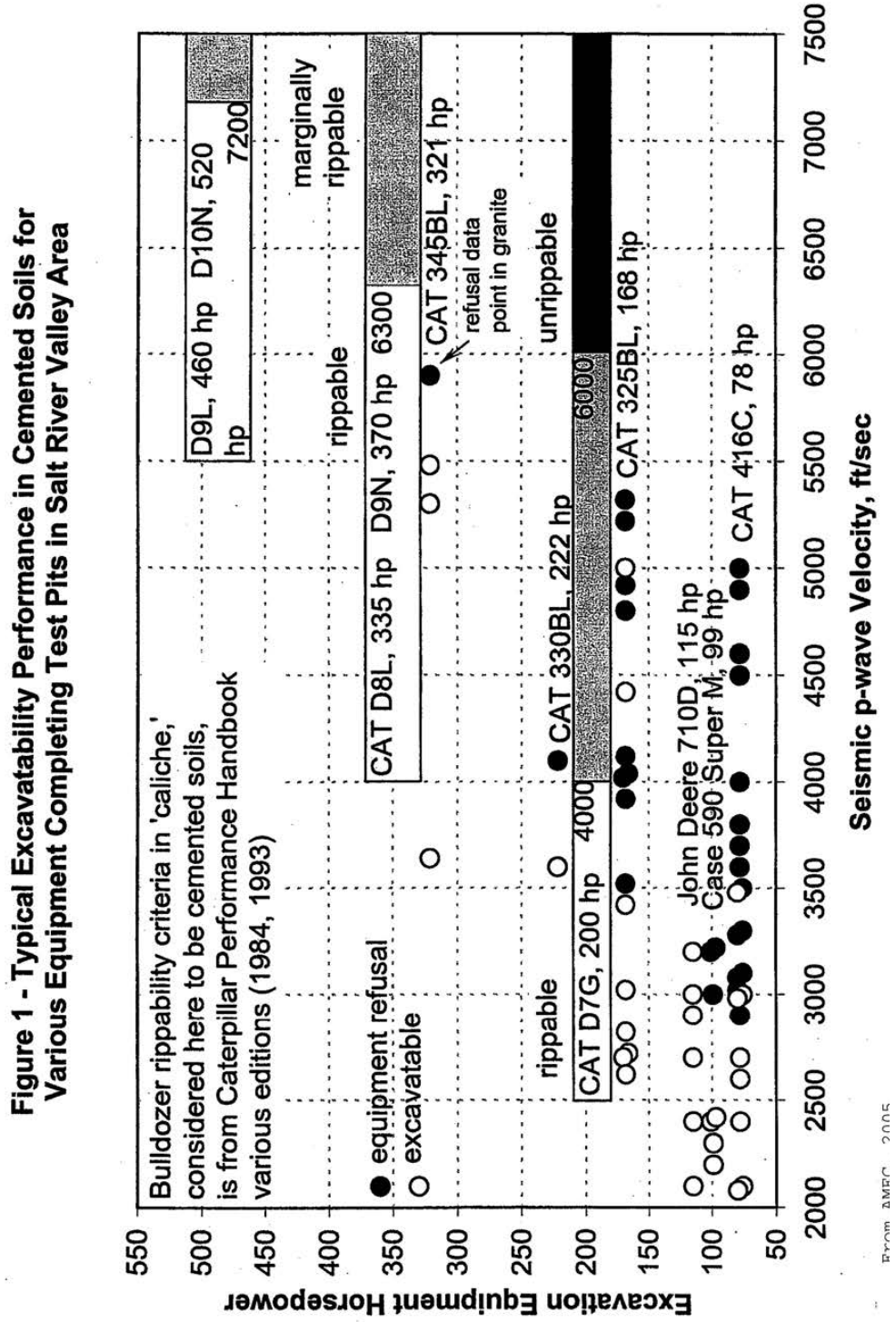
Tables B-1, B-2, and B-3

Table B-1
Rock Hardness & Excavation Characteristics(1)

Rock Hardness Description	Identification Criteria	Unconfined Compressive Strength		Seismic Compression (P-Wave) Velocity		Excavation Characteristics
		MPa	psi	m/s	f/s	
Very Soft Rock	Material crumbles under firm blows with sharp end of geological pick; can be peeled with a knife; too hard to cut a triaxial sample by hand. SPT will refuse. Pieces up to 3-cm thick can be broken by finger pressure.	1.7 - 3.0	246 - 435	450 - 1,200	1,475 - 3,935	Easy Ripping
Soft Rock	Can just be scraped with a knife; indentations 1-mm to 3-mm show in specimen with firm blows of the pick point; has dull sound under hammer.	3.0 - 10.0	435 - 1,450	1,200 - 1,500	3,935 - 4,920	Hard Ripping
Hard Rock	Cannot be scraped with a knife; hand specimen can be broken with a pick with a single firm blow; rock rings under hammer.	10.0 - 20.0	1,450 - 2,900	1,500 - 1,850	4,920 - 6,070	Very Hard Ripping
Very Hard Rock	Hand specimen breaks with a pick after more than one blow; rock rings under hammer	20.0 - 70.0	2,900 - 10,150	1,850 - 2,150	6,070 - 7,050	Extremely Hard Ripping or Blasting
Extremely Hard Rock	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.	> 70.0	> 10,150	> 2,150	> 7,050	Blasting

Note: (1) Table from Weaver, J.M.; 1975; Geological Factors Significant in the Assessment of Rippability; The Civil Engineer in South Africa (*Die siviele iIngenieur in Suid-Afrika*); Volume 17, Issue 12, December 1975; pp. 313-316.

Table B-2
Typical Excavatability Performance in Cemented Soils[(2)]



Note: (2) From Caterpillar, Inc.; 2013; Caterpillar Performance Handbook, Edition 43; Section 18, Rippers, Seismic Wave Velocity Charts; pp. 18-75 to 18-80.

Table B-3
Approximate Excavatability of Materials(3)
Using Various Ripping & Trenching Equipment

Material & Range of Marginal Rippability by Seismic Velocity (Cat, 1984; 1993)	Typical Bulldozer Used as Ripper (Cat, 1984; 1993)	Equivalent Backhoe (Kirsten, 1982; 1988)
"Caliche"		
4,000 – 6,000 fps	D7G, 200 HP	235
6,300 – 8,600 fps	D8L, 335 HP	245
6,300 – 8,700 fps	D9N, 370 HP	-
7,200 – 10,300 fps	D9L, 460 HP	RH 40
7,200 – 10,300 fps	D10N, 520 HP	-
7,400 – 10,600 fps	D10, 700 HP	-
7,600 – 11,000 fps	D11N, 770 HP	-
Conglomerate		
4,600 – 5,700 fps	D7G, 200 HP	235
7,600 – 9,300 fps	D8L, 335 HP	245
7,600 – 9,300 fps	D9N, 370 HP	-
8,400 – 10,600 fps	D9L, 460 HP	RH 40
8,400 – 10,600 fps	D10N, 520 HP	-
9,000 – 11,000 fps	D10, 700 HP	-
9,300 – 11,500 fps	D11N, 770 HP	-
Granite		
4,300 – 4,800 fps	D7G, 200 HP	235
6,800 – 8,000 fps	D8L, 335 HP	245
6,800 – 8,000 fps	D9N, 370 HP	-
7,300 – 8,400 fps	D9L, 460 HP	RH 40
7,300 – 8,400 fps	D10N, 520 HP	-
7,800 – 9,000 fps	D10, 700 HP	-
8,100 – 9,500 fps	D11N, 770 HP	-
Schist		
4,300 – 5,300 fps	D7G, 200 HP	235
7,200 – 9,000 fps	D8L, 335 HP	245
7,200 – 9,000 fps	D9N, 370 HP	-
7,700 – 9,500 fps	D9L, 460 HP	RH 40
7,700 – 9,500 fps	D10N, 520 HP	-
8,000 – 10,000 fps	D10, 700 HP	-
8,300 – 10,500 fps	D11N, 770 HP	-

Note: Bulldozer and backhoe power are presented by Kirsten (1982, 1988) as a measure of equivalent performance for excavation. The Caterpillar D6D bulldozer and 225 backhoe and D4E/D5B bulldozer and 215 backhoe are considered equivalent. Seismic velocities below marginal indicate that the material is rippable. Seismic velocities above marginal indicate that the material is non-rippable. All velocities are approximate and represent a typical range. See the Caterpillar Performance Handbook (Caterpillar, 1984, 1993 or current edition) for details on use of this information. Different model configurations include variations in weight and horsepower.

From AMEC, 2005

Note: (3) From AMEC; 2005; consultants report prepared for City of Phoenix entitled "Refraction Seismic Evaluation, Deer Valley Road-7th Street to Cave Creek Road"; COP Project No. ST85100044, AMEC Job No. 5-119-000199, Report No. 2; 2 September 2005.