DOCUMENT 00 91 13
ADDENDUM NO. 1

PART 1 - GENERAL

A. Receipt of this Addendum must be acknowledged by indicating acknowledgement on Document 00300 Bid.

1.1 DOCUMENT INCLUDES

A. Changes to Contract Drawings.

1.2 CONSTRUCTION CONTRACT

A. The Construction Contract is known as: **AQUIFER STORAGE AND RECOVER PILOT TESTING PHASE 1 SIB AND INFRASTRUCTURE**

B. Date of this Addendum: May 1, 2023.

1.3 PRE-BID QUESTIONS AND CLARIFICATIONS

A. The following are questions asked during the bidding process with answers:

Q: *The typical trench detail provided calls for a " 1" minus crushed rock" for the pipe zone. Specification 31 23 15 states that this material can be import or native as long as it is a 1" minus well graded material. Being that there is no geotechnical report provided is the assumption that the native will be suitable for this material or are we to assume import material for bidding purposes?*

A: *The use of native material for Select Pipe Zone Material is acceptable provided that it meets the requirements of the Section 31 23 15, Part 2.1.B. Native materials may need to be screened to meet the requirements. It is the Bidder's responsibility to become familiar with local conditions that may affect cost, progress, performance, or furnishing of the work. Refer Section 00100 Instructions to Bidders.*

Q: *During the prebid it was mentioned that there was not a geotechnical report for the project. Our driller is asking for any information on the drilling conditions that can be provided from the contractor currently performing the well drilling work. This will help with deciding the level of effort on the drilling and if the bore holes will stand on their own or if they will require a casing.*

A: *A well casing is not required.*
See attached for lithologic logs for the recently constructed Monitoring Wells 1, 2, and 3. Also included is an excerpt from the Project Completion Report For Aquifer Recharge Water Bank Project, prepared by Bowen, Collins & Associates, dated July 2008 that contains additional lithologic logs and geotechnical information.

Q: *Is there a specification for the 3/8" Rounded gravel called out for the drain holes on detail A sheet CD-101?*

A: *There is not a specification for this material. The material shall be clean/washed and 3/8" rounded gravel of uniform size.*

Q: *Will precast vaults be allowed for the ASR Vault and SIB Meter Vaults?*

A: Precast vaults is an acceptable alternative to cast-in-place. The ASR and SIB vaults have cast-in-place thrust rings in the walls. If precast vaults are utilized, thrust restraint will need to be addressed.

Q: *Specification section 40 10 00 is included for the Programming Contractor, but the "Instructions to Bidders" states that the Owner will provide programming/HMI/SCADA (page 00100-6). Please confirm that the owner provides programming/HMI/SCADA.*

A: OWNER will provide programming / HMI / SCADA. Refer to Section 00100, Instructions to Bidders, "OWNER PROVIDED SERVICES". Refer to Section 01 22 00, Measurement and Payment, Part 1.2.N and O, CONTRACTOR shall assist OWNER personnel in SCADA programming and integration.

Q: *Specification section 26 29 23 references both 6 pulse and 18 pulse VFDs. Is there a specific pulse rating required for the well pump motor, or is that for the contractor to decide?*

A: Refer to the attached revised Specification Section 26 29 23 Pulse Width Modulated Variable Frequency Drive. The document lists 4 acceptable methods to achieve the required harmonics mitigation. Any of those methods that guarantees meeting IEEE519 and guarantees that under no conditions will the VFD or filter introduce a leading power factor will be accepted.

Q: *Is there a specific kVA rating required for the medium voltage transformer, such as 750 kVA, or is that up to the contractor to calculate?*

A: 500kVA. Refer to revised Drawing Sheet E-61.

Q: *The drawings indicate a 12,470V-480/277V transformer needs to be provided. Is this to be a dry type transformer? That is the only transformer specification that is included in the bid documents. Typically these medium voltage transformers tend to be pad mount, fluid filled transformers, but there is no specification section for those type of transformers in the bid documents. Please clarify what type of transformer this is intended to be.*

A: This is to be a dry-type transformer.

1.4 PRE-BID CONFERENCE NOTE

A. The Pre-Bid Conference Notes and Attendance List are attached.

PART 2 – CHANGES

2.1 CHANGES TO PRIOR ADDENDA

A. NONE

2.2 CHANGES TO BIDDING DOCUMENTS

A. Replace 00020 Table of Contents with the attached.

2.3 CHANGES TO AGREEMENT AND OTHER CONTRACTUAL DOCUMENTS

A. NONE

2.4 CHANGES TO CONDITIONS OF THE CONTRACT

A. NONE

2.5 CHANGES TO TECHNICAL SPECIFICATIONS

A. Replace 01 22 00 Measurement and Payment with the attached. Basis of Payment for Bid Item A5 & A6 has been updated to include Water Risers. Basis of Payment for Bid Item A15 & A16 has been updated to include precast structures.
B. Replace 26 29 23 Pulse Width Modulated Variable Frequency Drive with the attached. Removed reference to 6-pulse and 18-pulse and replaced with 4 acceptable methods to achieve the required harmonics mitigation.
C. Add 33 05 13 Precast Concrete Manholes and Structures to the Technical Specifications.

2.6 CHANGES TO CONTRACT DRAWINGS

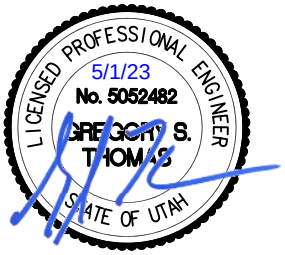
A. Replace Drawing Sheet G-002 with the attached. Drawing Sheet CD-107 and CD-108 has been added to the Index of Drawings.
B. Replace Drawing Sheet C-101 with the attached. Water Riser is now shown.
C. Replace Drawing Sheet C-102 with the attached. Water Riser is now shown.
D. Replace Drawing Sheet PP-300 with the attached. Water Riser has been added to the plan and profile.
E. Replace Drawing Sheet PP-302 with the attached. Water Riser has been added to the plan and profile.
F. Replace Drawing Sheet CD-101 with the attached. Drill Hole gravel note has been revised.
G. Replace Drawing Sheet CD-105 with the attached. Monitoring Well Pad dimensions have been revised.
H. Add Drawing Sheet CD-107 to the Contract Drawings.
I. Add Drawing Sheet CD-108 to the Contract Drawings.
J. Replace Drawing Sheet E-11 with the attached. Submersible level transmitters based off a 4-20 mA model and corresponding wiring.

K. Replace Drawing Sheet E-61 with the attached. 500 kVA transformer is now shown.

L. Replace Drawing Sheet I-61 with the attached. Submersible level transmitters based off a 4-20 mA model and corresponding wiring.

THIS ADDENDUM IS HEREBY ATTACHED TO AND MADE A PART OF THE CONTRACT DOCUMENTS, AND EACH BIDDER SHALL ACKNOWLEDGE RECEIPT OF THIS ADDENDUM WITH THE BID.

- END OF DOCUMENT -



MEETING NOTES

MEETING DATE: April 19, 2023, 1:30 PM – 3:00 PM

SUBJECT: Aquifer Storage and Recovery Pilot Testing – Phase 1
Pre-Bid Meeting

PROJECT NO.: 262.08.200

ATTENDEES: Ammon Allen, MWDSLS

David Hansen, HAL
Greg Thomas, HAL
Stephen Marginson, HAL

NOTES BY: Hansen, Allen & Luce, Inc.

The following meeting notes summarize items discussed related to the 4700 South Sewer Outfall Design – Phase 1 during the in-person Pre-Bid Meeting at the Kearns Improvement District.

1. Table 1 summarizes the contact information for all attendees.

Table 1: Pre-Bid Meeting Attendee Contact Information

Name	Affiliation	Phone	Email Address
Ammon Allen	MWDSLS	(801) 942-9687	allen@mwdsls.org
Mike Demice	Red Pine Construction	(385) 628-8176	miked@redpineconstruction.com
Paul Hunsaker	VanCon	(385) 495-5262	bid@wedigutah.com
Brandon Karnath	COP Construction	(406) 600-2167	utbid@copconstruction.com
David Hansen	HAL	(801) 566-5599	david@halengineers.com
Greg Thomas	HAL	(801) 918-0513	gthomas@halengineers.com
Stephen Marginson	HAL	(401) 451-1498	smarginson@halengineers.com

2. A project overview and description of work was given by Greg Thomas. Substantial completion is to be on or before February 12, 2024, in time for spring runoff.

3. All work will be conducted on MWDSLS property therefore no easements will be needed. MWDSLS conducted utility marking (BlueStakes) of existing utilities. Contractor will still need to contact BlueStakes prior to construction.

4. Contractor will need to coordinate with ongoing well drilling and development on MWDSLS property. Rocky Mountain Power (RMP) contractors may be on site during construction for unground power installation. Contractor to coordinate with RMP contractor, if necessary.

5. Contractor shall coordinate with MWDSLS for site access.

6. Bid items below were discussed in further detail.

    a. Bid Item 6 – Furnish Well House Prefabricated Building
        i. Contractor to coordinate with VersaTube Representative (contract information provided) during bidding period and provide Appendix 1 of the Project Manual, if necessary.
    b. Bid Item 9 -Furnish Well House Pump Equipment
        i. Specifications include an estimated pump size and motor size that cannot be finalized until test pumping occurs. Change order pending, if applicable.
    c. Bid Item 8 – Building Permit Fee Allowance
        i. Based on the cost of the prefabricated well house. Actual costs will be paid.
    d. Bid Item 23 – SWPPP Construction General Permit and Fugitive Dust Permit Fee Allowance
        i. Actual costs will be paid.

7. A site visit was conducted so Bidders could tour the MWDSLS facility and ask additional questions.

8. Excavation quantities are estimated. HAL will provide electronic CAD files to Bidders.

9. Clearing and grubbing limits of the area where excavated material is to be disposed of onsite is not necessary.

10. No other items were noted.

APPENDIX A –
PRE-BID MEETING AGENDA

METROPOLITAN WATER DISTRICT OF SALT LAKE & SANDY
LC063 AQUIFER STORAGE AND RECOVERY PILOT TESTING – PHASE 1
MANDATORY PRE-BID MEETING
APRIL 19, 2023 @ 1:30 PM

INTRODUCTION

Metropolitan Water District of Salt Lake & Sandy (MWDSLS):
Ammon Allen, P.E. – Engineering Supervisor

Hansen, Allen, & Luce (HAL) Design Team:
David Hanse, Ph.D, P.E. – Principal in Charge
Greg Thomas, P.E. – Project Manager
Stephen Marginson, E.I.T. – Project Engineer

BRIEF DESCRIPTION OF THE WORK

Work comprises of constructing two Surface Infiltration Basins (SIBs), the equipping of an Aquifer Storage and Recover (ASR) well, installation and furnishing of monitoring well level sensors, new HDPE piping and connection to existing piping infrastructure, the construction of flow control and valve vaults, associated electrical and controls equipment, and accompanying site improvements.

INSTRUCTION TO BIDDERS

A. Contract Time: As per Agreement Section 00 07 00-14.08 of the Project Manual – The Work will be substantially completed on or before **February 12, 2024**, and completed and ready for final payment in accordance with Paragraph 14.09 of the General Conditions on or before **45 calendar days** after the Notice of Completion.
B. Liquidated Damages: As per Agreement Section 00 80 00-14.07 of the Project Manual, the following Liquidated Damages shall apply:
   i. Late Completion: **$500.00** for each day or part thereof that expires after the Contract Time until the Work is Substantially Complete.
   ii. Late Punchlist Time Completion: **$500.00** for each day that expires after such time until the Work is completed and ready for final payment.
C. Interruption of Public Services: No interruption of public services shall be caused by Contractor, its agents, or employees without Engineer's prior written approval.
D. Regular Working Hours: 8:00 a.m. to 5:00 p.m., five days per week, Monday through Friday.
E. Utility Coordination: Contractor is responsible to notify MWDSLS for all utility locations.
F. Testing & Certification Requirement: Contractor is required to have their own quality control program, see Section 01 45 00 of the Project Manual.
G. Construction Staking: Contractor is responsible for own construction staking and layout.
H. Measurement & Documentation of Quantities: Coordinate with the MWDSLS inspector and field person on site.
I. Safety: Contractor is responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the work.
J. Instructions to Bidders: No contract award will be made to Bidder whose firm and subcontractors have not satisfactorily completed at least three similar projects in the past five years including mass grading, HDPE piping, well equipping, cast in place concrete vaults, and erection of prefabricated metal buildings.
K. Sealed bids will be received by the OWNER through the Utah Public Procurement Place (https://bids.sciquest.com/apps/Router/PublicEvent?CustomerOrg=StateOfUtah) on behalf of

MWDSLS, until **12:00 pm on Wednesday, May 10, 2023**. Any Bids received after the specified time will not be considered.

L. Bid Opening: Bids will be opened electronically. The names of the Bidders responding to the Request for Bids and their bid amounts will be available immediately thereafter.
M. Bid Bonds: The bond amount must equal at least 5% percent of the total amount of the bid.
N. The Bid shall contain an acknowledgement of receipt of all Addenda. The addenda numbers must be filled in on the Bid Form.
O. Questions: All questions related to this project prior to the opening of the Bids shall be directed to the OWNER for the project. See Section 00 03 00 in Project Manual.

Metropolitan Water District of Salt Lake & Sandy
3430 East Danish Road
Cottonwood Heights, Utah 84093
Contact: Ammon Allen, P.E., Engineering Supervisor
801-942-9687
allen@mwdsls.org

GENERAL DISCUSSION

A. CONTRACTOR Obtained Permits:
    i. SWPPP: Refer to Section 00 80 00-6.06
    ii. Cottonwood Heights Building Permit: Refer to Section 00 80 00-6.06
B. Prefabricated Metal Building (ASR Well House)
    i. VersaTube Building Solutions: Refer to Appendix 1 of Project Manual

QUESTIONS

APPENDIX B –
PRE-BID MEETING SIGN IN SHEET

METROPOLITAN WATER DISTRICT OF SALT LAKE & SANDY
MANDATORY PRE-BID MEETING
APRIL 19, 2023

ATTENDANCE

NAME	REPRESENTING	PHONE	EMAIL
MIKE DEMKE	RED PINE CONSTRUCTION	385-628-8176	MIKED@REDPINECONSTRUCTION.COM
PAUL Hunsaker	VanCon	3854955262	bid@wabigutah.com
Brandon Karnath	COP Construction	406-600-2167	utbid@copconstruction.com

TABLE OF CONTENTS

Section **Page**

BIDDING DOCUMENTS

00030 Notice Inviting Bids .....00030-1 – 00030-2
00100 Instructions to Bidders .....00100-1 – 00100-6
00300 Bid .....00300-1 – 00300-2
00310 Bid Schedule .....00310-1 – 00310-6
00320 Bid Bond .....00320-1 – 00320-2
00330 Information Required of Bidder .....00330-1 – 00330-4

CONTRACTUAL DOCUMENTS

00500 Agreement .....00500-1 – 00500-6
00610 Performance Bond .....00610-1 – 00610-2
00620 Payment Bond .....00620-1 – 00620-2
00630 Notice of Award .....00630-1 – 00630-2
00631 Notice to Proceed .....00631-1 – 00631-2
00632 Application for Payment .....00632-1 – 00632-2
00633 Change Order .....00633-1 – 00633-2
00634 Notice of Substantial Completion .....00634-1 – 00634-2
00635 Certificate of Final Completion .....00635-1 – 00635-2
00636 Consent of Surety for Final Payment .....00636-1 – 00636-2
00637 Affidavit of Payment .....00637-1 – 00637-2

CONDITIONS OF THE CONTRACT

00700 General Conditions .....00700-1 – 00700-46

Article 1 – Definitions .....00700-1 – 00700-3
Article 2 – Preliminary Matters .....00700-4 – 00700-4
Article 3 – Contract Documents: Intent, Amending, Reuse .....00700-5 – 00700-6
Article 4 – Availability of Land; Physical Conditions; Reference Points .....00700-6 – 00700-9
Article 5 – Bonds and Insurance .....00700-9 – 00700-11
Article 6 – Contractor's Responsibilities .....00700-12 – 00700-18
Article 7 – Other Work .....00700-18 – 00700-19
Article 8 – Owner's Responsibilities .....00700-19 – 00700-20
Article 9 – Engineer's Status During Construction .....00700-20 – 00700-23
Article 10 – Changes in the Work .....00700-23 – 00700-24
Article 11 – Change of Contract Price .....00700-24 – 00700-29
Article 12 – Change of Contract Time .....00700-30 – 00700-32
Article 13 – Warranty and Guarantee; Tests and Inspections; Correction, Removal, or Acceptance of Defective Work .....00700-32 – 00700-35
Article 14 – Payments to Contractor, Liquidated Damages and Completion .....00700-35 – 00700-41
Article 15 – Suspension of Work and Termination .....00700-42 – 00700-44
Article 16 – Notice .....00700-44 – 00700-45

Table of Contents
(continued)

Article 17 – Subcontract Limitations ..... 00700-45 – 00700-45
Article 18 – Patents and Copyrights ..... 00700-45 – 00700-45

00800 Supplemental General Conditions ..... 00800-1 – 00800-10
00 19 13 Addendum No. 1 ..... 00 19 13 - 1 to 4

TECHNICAL SPECIFICATIONS

DIVISION 1 - GENERAL REQUIREMENTS

01 11 00 Summary of Work ..... 01 11 00 - 1 to 2
01 14 00 Work Restrictions ..... 01 14 00 - 1 to 2
01 22 00 Measurement and Payment ..... 01 22 00 - 1 to 12
01 30 00 Administrative Requirements ..... 01 30 00 - 1 to 4
01 32 16 Construction Progress Schedule ..... 01 32 16 - 1 to 8
01 33 00 Submittal Procedures ..... 01 33 00 - 1 to 6
01 42 13 Abbreviations ..... 01 42 13 - 1 to 2
01 42 19 Reference Standards ..... 01 42 19 - 1 to 2
01 45 00 Quality Control and Materials Testing ..... 01 45 00 - 1 to 6
01 45 23 Testing Agency Services ..... 01 45 23 - 1 to 4
01 50 00 Temporary Construction Utilities and Environmental Controls ..... 01 50 00 - 1 to 6
01 50 30 Protection of Existing Facilities ..... 01 50 30 - 1 to 6
01 56 00 Dust Control ..... 01 56 00 - 1 to 2
01 60 00 Product Requirements ..... 01 60 00 - 1 to 4
01 71 13 Mobilization ..... 01 71 13 - 1 to 2
01 78 50 Project Closeout ..... 01 78 50 - 1 to 4

DIVISION 02 - EXISTING CONDITIONS (NOT USED)

DIVISION 03 - CONCRETE

03 10 00 Concrete Forming and Accessories ..... 03 10 00 - 1 to 4
03 20 00 Concrete Reinforcement ..... 03 20 00 - 1 to 4
03 25 00 Expansion Joints, Construction Joints, and Waterstops ..... 03 25 00 - 1 to 6
03 30 00 Cast-In-Place Concrete ..... 03 30 00 - 1 to 18
03 60 00 Grout ..... 03 60 00 - 1 to 12

DIVISION 04 - MASONRY (NOT USED)

DIVISION 05 – METALS

05 45 00 Mechanical Metal Supports (Pipe Supports) ..... 05 45 00 - 1 to 6
05 50 00 Miscellaneous Specialties ..... 05 50 00 - 1 to 8

DIVISION 06 and 07 (NOT USED)

Table of Contents
(continued)

DIVISION 08 - OPENINGS

08 10 00 Doors, Frames, and Hardware ..... 08 10 00 - 1 to 8
08 51 13 Aluminum Windows ..... 08 51 13 - 1 to 8
08 62 00 Skylights ..... 08 62 00 - 1 to 4

DIVISION 09 - FINISHES

09 90 00 Painting and Finishes ..... 09 90 00 - 1 to 16

DIVISIONS 10 through 25 (NOT USED)

DIVISION 26 – ELECTRICAL

26 05 00 Electrical General Requirements ..... 26 05 00 - 1 to 10
26 05 05 Operation and Maintenance Manuals ..... 26 05 05 - 1 to 4
26 05 07 Electrical Power System Studies ..... 26 05 07 - 1 to 16
26 05 08 Electrical Acceptance Tests ..... 26 05 08 - 1 to 18
26 05 09 Electrical Identification ..... 26 05 09 - 1 to 4
26 05 19 Conductors and Cables ..... 26 05 19 - 1 to 4
26 05 22 Wiring Devices ..... 26 05 22 - 1 to 4
26 05 24 Equipment Wiring ..... 26 05 24 - 1 to 4
26 05 26 Grounding and Bonding ..... 26 05 26 - 1 to 4
26 05 30 Conduits ..... 26 05 30 - 1 to 10
26 05 32 Conduit Ductbanks ..... 26 05 32 - 1 to 2
26 05 34 Electrical Boxes and Fittings ..... 26 05 34 - 1 to 2
26 05 74 Electrical Motors ..... 26 05 74 - 1 to 10
26 09 13 Control Devices ..... 26 09 13 - 1 to 14
26 16 00 Panels and Consoles ..... 26 16 00 - 1 to 10
26 20 00 Service and Distribution Systems ..... 26 20 00 - 1 to 4
26 22 00 Dry Type Transformers ..... 26 22 00 - 1 to 2
26 24 16 Branch Circuit Panelboards ..... 26 24 16 - 1 to 6
26 24 17 Distribution Panelboard ..... 26 24 17 - 1 to 6
26 28 13 Fuses ..... 26 28 13 - 1 to 2
26 28 19 Disconnect Switches ..... 26 28 19 - 1 to 2
26 29 23 Pulse Width Modulated Variable Frequency Drive ..... 26 29 23 - 1 to 10
26 35 53 Surge Protection Devices ..... 26 35 53 - 1 to 8
26 41 00 Lightning Protection Systems ..... 26 41 00 - 1 to 4
26 51 13 Interior Luminaires ..... 26 51 13 - 1 to 8
26 56 00 Area Lighting ..... 26 56 00 - 1 to 10
26 80 10 HVAC Systems Control ..... 26 80 10 - 1 to 2

DIVISIONS 27 through 30 (NOT USED)

Table of Contents
(continued)

DIVISION 31 - EARTH WORK

31 05 19 Geosynthetics ..... 31 05 19 - 1 to 6
31 11 00 Clearing, Grubbing and Stripping ..... 31 11 00 - 1 to 2
31 22 00 Site Grading ..... 31 22 00 - 1 to 4
31 23 15 Excavation and Backfill for Buried Pipelines ..... 31 23 15 - 1 to 10
31 23 19 Dewatering ..... 31 23 19 - 1 to 2
31 23 23 Excavation and Backfill for Structures ..... 31 23 23 - 1 to 6
31 37 00 Riprap ..... 31 37 00 - 1 to 4

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 11 23 Road Base - Untreated Base Course ..... 32 11 23 - 1 to 4
32 31 13 Galvanized Chain Link Fence and Gates ..... 32 31 13 - 1 to 6

DIVISION 33 - UTILITIES

33 05 05 Ductile Iron Pipe ..... 33 05 05 - 1 to 10
33 05 13 Precast Concrete Manholes and Structures ..... 33 05 13 - 1 to 6
33 05 11 High Density Polyethylene (HDPE) Pressure Pipe (AWWA C906) ..... 33 05 11 - 1 to 6
33 08 30 Gravity Pipeline Testing ..... 33 08 30 - 1 to 8
33 12 00 Mechanical Appurtenances ..... 31 12 00 - 1 to 6
33 12 30 Deep Well Pump and Pump Motor ..... 33 12 30 - 1 to 10
33 13 00 Pipeline Testing and Disinfection ..... 33 13 00 - 1 to 4

DIVISIONS 34 through 39 (NOT USED)

DIVISIONS 40 PROCESS INTEGRATION

40 10 00 Process Control and Instrumentation System ..... 40 10 00 - 1 to 12
40 12 50 Pressure Transmitter ..... 40 12 50 - 1 to 4
40 15 10 Process Control Strategies ..... 40 15 10 - 1 to 12
40 20 00 Instruments General ..... 40 20 00 - 1 to 8
40 21 20 Magnetic Flow Meters ..... 40 21 20 - 1 to 2
40 24 10 Level Detector ..... 40 24 10 - 1 to 2
40 27 60 Pressure Seals ..... 40 27 60 - 1 to 2
40 91 20 Pressure Gauges ..... 40 91 20 - 1 to 4
40 91 23 Miscellaneous Properties Measurement Devices ..... 40 91 23 - 1 to 6
40 92 57 Electric Motor Actuators ..... 40 92 57 - 1 to 10

DIVISIONS 41 through 50 (NOT USED)

APPENDIX
Appendix A – Prefabricated ASR Well House

DRAWINGS
Bound Separately

SECTION 01 22 00
MEASUREMENT AND PAYMENT

PART 1 GENERAL

A. All work completed under this contract shall be in accordance with the Contract Drawings and Specifications and will be measured by ENGINEER/OWNER. The quantities appearing on the Bid Schedule are approximate only, and are prepared for the comparison of bids. Payment to CONTRACTOR on bid items with unit prices other than "Lump Sum" will be made for actual quantities of work performed and accepted, or material furnished in accordance with the Contract. The scheduled quantities of work to be done and materials to be furnished may be increased or decreased in accordance with the General Conditions.

B. The term "Lump Sum" when used as an item of payment will mean complete payment for the work described in the contract. When a complete structure, portion of work, or unit is specified "Lump Sum" as the unit of measurement, the unit will include fittings, accessories, and all work necessary to complete the work as shown on the Contract Drawings and as specified.

C. When the accepted quantities of work vary from the quantities in the Bid Schedule, CONTRACTOR shall accept as payment in full, so far as contract items are concerned, payment at the original contract unit prices for the work done. OWNER reserves the right to add to or delete from quantities listed in the bid schedule in order to match the total bid with the budgeted money available.

1.2 BASE BID SCHEDULE

A. BID ITEM NO. A1 & B1- "MOBILIZATION"

1. **GENERAL** This bid item is provided to cover CONTRACTOR's cost for general and miscellaneous responsibilities and operations not normally attributed to any other single bid item within this schedule. This shall include, but is not limited to, work described or enumerated in Section 01 71 13 - Mobilization.

2. **METHOD OF MEASUREMENT** Mobilization shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as required in Section 01 71 13 - Mobilization.

3. **BASIS OF PAYMENT** Payment will be made at the contract lump sum bid price. Payments will be made in accordance with the following schedule:

    a. When 10% of the original contract amount is earned, 25% of the amount bid for mobilization will be paid.
    b. When 25% of the original contract amount is earned, an additional 25% for a total of 50% of the amount bid for mobilization will be paid.
    c. When 50% of the original contract amount is earned, an additional 25% for a total of 75% of the amount bid for mobilization will be paid.
    d. When 75% of the original contract amount is earned, an additional 25% for a total of 100% of the amount bid for mobilization will be paid.

B. **BID ITEM NO. A2 & B2 - "SITE PREPARATION AND SWPPP"**

1. **METHOD OF MEASUREMENT** Site Preparation and SWPPP shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as required in Sections 01 50 00 - Temporary Construction Utilities and Environmental Controls, 01 50 30 - Protection of Existing Facilities, and 01 56 00 - Dust Control.

2. **BASIS OF PAYMENT** Payment will be made at the contract lump sum bid price. Payments will be made in accordance with the following schedule:

   a. When 10% of the original contract amount is earned, 25% of the amount bid for site preparation and SWPPP will be paid.
   b. When 25% of the original contract amount is earned, an additional 25% for a total of 50% of the amount bid for site preparation and SWPPP will be paid.
   c. When 50% of the original contract amount is earned, an additional 25% for a total of 75% of the amount bid for site preparation and SWPPP will be paid.
   d. When 75% of the original contract amount is earned, an additional 25% for a total of 100% of the amount bid for site preparation and SWPPP will be paid.

C. **BID ITEM NO. A3 & B3 - "CONSTRUCTION SURVEYING AND STAKING"**

1. **GENERAL** This item is provided to cover the Contractor's cost for general and miscellaneous responsibilities and operations associated with Construction Surveying. Construction Surveying shall be performed by a registered professional land surveyor.

2. **METHOD OF MEASUREMENT** Construction Surveying shall be measured based on the percentage of work completed for the project according to the amount defined in the Bid Schedule.

3. **BASIS OF PAYMENT** Payment for Construction Surveying will be made at the contract lump sum bid price as shown and accepted by OWNER and ENGINEER in the Bid Schedule. Payments will be made in accordance with the following schedule:

   a. When 10% of the original contract amount is earned, 25% of the amount bid for construction surveying will be paid.
   b. When 25% of the original contract amount is earned, an additional 25% for a total of 50% of the amount bid for construction surveying will be paid.
   c. When 50% of the original contract amount is earned, an additional 25% for a total of 75% of the amount bid for construction surveying will be paid.
   d. When 75% of the original contract amount is earned, an additional 25% for a total of 100% of the amount bid for construction surveying will be paid.

D. **BID ITEM NO. A4 & B4 – "MATERIALS QUALITY CONTROL AND TESTING"**

1. **GENERAL** This item is provided to cover the Contractor's cost for general and miscellaneous responsibilities and operations associated with Materials Testing. This item shall include, but is not limited to, work described or enumerated in Section 01 45 00 - Quality Control and Materials Testing and Section 01 45 23 - Testing Agency Services.

2. **METHOD OF MEASUREMENT** The Materials Testing shall be measured based on the percentage of work completed for the project according to the amount defined in the Bid Schedule.

3. **BASIS OF PAYMENT** Payment for Material Testing will be made at the contract lump sum bid price as shown and accepted by Owner and Engineer in the Bid Schedule. Payments will be made in accordance with the following schedule:

   a. When 10% of the original contract amount is earned, 25% of the amount bid for material testing will be paid.
   b. When 25% of the original contract amount is earned, an additional 25% for a total of 50% of the amount bid for material testing will be paid.
   c. When 50% of the original contract amount is earned, an additional 25% for a total of 75% of the amount bid for material testing will be paid.
   d. When 75% of the original contract amount is earned, an additional 25% for a total of 100% of the amount bid for material testing will be paid.

E. **BID ITEM NO. A5 & A6 – "FURNISH AND INSTALL 16-INCH HDPE DR 32.5 WATERLINE" and "FURNISH AND INSTALL 24-INCH HDPE DR 32.5 WATERLINE"**

1. **METHOD OF MEASUREMENT** Measurement for 16- and 24-inch HDPE DR 32.5 waterlines shall be according to the lineal foot of pipe acceptably installed as shown on the Contract Drawings and specified herein. Measurement shall be along the horizontal centerline of the acceptably installed pipe. Measurement shall not include pipe which are paid elsewhere.

2. **BASIS OF PAYMENT** Payment for 16-inch and 24-inch HDPE DR 32.5 waterlines shall be paid for at the contract unit bid price per lineal foot listed in the bidder's proposal and shall be considered complete compensation for all labor, equipment, and materials necessary, including but not limited to furnishing the 16- and 24-inch HDPE DR 32.5 pipe to make a functional system, excavation, dewatering, fusion welding, select pipe zone material, backfilling with select trench backfill material, compaction, removal and disposal of excess excavated material, commissioning of pipeline (including pressure testing and disinfection where required); temporary bulkheads, temporary sample taps; water risers, valves, fittings and appurtenances where not paid for elsewhere; protection of buried utilities, potholing as needed; looping and re-routing of any affected utilities; and all other operations and materials required to complete this portion of the work as herein described and as shown on the Contract Drawings.

F. **BID ITEM NO. A7, A8, AND A9 – "SURFACE INFILTRATION BASIN (SIB) #1 EXCAVATION & MATERIAL DISPOSAL", "SURFACE INFILTRATION BASIN (SIB) #2 EXCAVATION & MATERIAL DISPOSAL", and "EXISTING CONSTRUCTION DEBRIS EXCAVATION & MATERIAL DISPOSAL"**

1. **METHOD OF MEASUREMENT** Measurement for SIB #1 Excavation & Material Disposal, SIB #2 Excavation & Material Disposal, and Existing Construction Debris Excavation & Material Disposal bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for SIB #1 Excavation & Material Disposal, SIB #2 Excavation & Material Disposal, and Existing Construction Debris Excavation & Material Disposal shall be made at the contract lump sum bid price listed in the bidder's proposal and shall be considered complete compensation for all labor, equipment, materials, including but not limited to: excavation to depths identified on the Contract Drawings, finished grading, disposal of excavated materials at designated location on site or to an offsite location, transportation, spreading and compaction of excavated materials at the designated location on site; and all other operations and materials required to complete this portion of the work as herein described and as shown on the Contract Drawings.

G. **BID ITEM NO. A10 – "DRAIN HOLES"**

1. **METHOD OF MEASUREMENT** Drain Holes shall be measured per each complete drain hole constructed as shown in the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for Drain Holes shall be made at the Contract unit bid price for each acceptable complete drain hole constructed. Payment shall be considered complete compensation for all labor, equipment, and materials, including but not limited to excavation (borehole); gravel, manhole section; removal and disposal of excess excavation materials; and all other operations and materials required to complete this portion of the work as herein described and as shown on the Contract Drawings.

H. **BID ITEM NO. A11 – "SIB OVERFLOW PIPING"**

1. **METHOD OF MEASUREMENT** SIB Overflow Piping bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for SIB Overflow Piping shall be made at the contract lump sum bid price for completion of the work as shown on the Contract Drawings and Specifications. Payment shall be considered complete compensation for all labor, equipment, materials, including but not limited to: excavation, removal and disposal of excavated materials; site grading, furnishing the 16-inch HDPE DR 32.5 pipe to make a functional system, dewatering, select pipe zone material, backfilling with select trench backfill material, compaction, commissioning of pipeline; and appurtenances where not paid for elsewhere; protection of buried utilities, potholing as needed; looping and re-routing of any affected utilities; geotextile fabric, loading, hauling, placing; and all other operations and materials required to complete this portion of the work as herein described and as shown on the Contract Drawings.

I. **BID ITEM NO. A12 – "DRAINAGE BERM (3'-0" HIGH)"**

1. **METHOD OF MEASUREMENT** Measurement of Drainage Berm bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for Drainage Berm shall be made at the contract lump sum bid price for completion of the work as shown on the Contract Drawings and Specifications. Payment shall be considered complete compensation for all

labor, equipment, materials, including but not limited to: installation of berm to depths identified on the Contract Drawings, finished grading, disposal of excess materials at designated location on site or to an offsite location, transportation, spreading and compaction of excavated materials at the designated location on site; and all other operations and materials required to complete this portion of the work as herein described and as shown on the Contract Drawings.

J. **BID ITEM NO. A13 – "SIB RIP RAP APRON"**

1. **METHOD OF MEASUREMENT** Measurement for SIB Rip Rap Apron bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for SIB Rip Rap Apron shall be made at the lump sum bid price for completion of the work as shown on the Contract Drawings and Specifications. Payment shall be considered complete compensation for all labor, equipment, and materials necessary, including but not limited to excavation, removal and disposal of excavated materials, site grading, geotextile fabric, furnishing, loading, hauling, placing; and all other operations and materials required to complete this portion of the work as herein described and as shown on the Contract Drawings.

K. **BID ITEM NO. A14 – "UBC ACCESS ROAD (12'-0" WIDE X 6" THICK)"**

1. **METHOD OF MEASUREMENT** Measurement for UBC Access Road bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for UBC Access Road shall be made at the contract lump sum bid price for completion of the work as shown on the drawings and specified herein. Payment shall be considered complete compensation for all labor, equipment, materials, appurtenances, including but not limited to: 6-inches of compacted road base approximately 12-feet in width; including excavation, preparation of subgrade, import materials, compaction, testing, protection of existing facilities, removal and disposal of excess material, and all other operations and materials required to complete this portion of the work as herein described and as shown on the Contract Drawings.

L. **BID ITEM NO. A15 – "FURNISH AND INSTALL ASR VALVE VAULT STRUCTURE"**

1. **METHOD OF MEASUREMENT** ASR Valve Vault Structure bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for ASR Valve Vault Structure shall be made at the contract lump sum bid price for completion of the work as shown on the Contract Drawings and Specifications. Payment shall be considered complete compensation for all labor, equipment, materials, including but not limited to: cast in place concrete vault, concrete forming, concrete curing, reinforcement, grouting, manhole frame and cover, ladder, ladder extension; excavation regardless of depth of structure, dewatering, shoring, removal and disposal of excavated materials, foundation gravel, geotextile fabric, bedding, backfill, compaction; ductile iron pipe, tee, reducing tee, gate valve, fittings, thrust collar, pipe support(s), appurtenances, floor stand with 18"

handwheel, grating, rebate, connection to HDPE pipe, cleaning, testing, disinfection; any incidental work which are not paid elsewhere with individual items; and all other incidentals and materials as herein described and as shown on the Contract Drawings, required to complete this item.

ASR Valve Vault Structure shall be cast-in-place concrete or precast concrete as per Specification Section 33 05 13.

M. **BID ITEM NO. A16 – "FURNISH AND INSTALL SIB VALVE VAULT STRUCTURES"**

1. **METHOD OF MEASUREMENT** SIB Valve Vault Structures bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for SIB Valve Vault Structures shall be made at the contract lump sum bid price for completion of the work as shown on the Contract Drawings and Specifications. Payment shall be considered complete compensation for all labor, equipment, materials, including but not limited to: cast in place concrete vault, concrete forming, concrete curing, reinforcement, grouting, access hatch, ladder, ladder extension; excavation regardless of depth of structure, dewatering, shoring, removal and disposal of excavated materials, foundation gravel, geotextile fabric, bedding, backfill, compaction; ductile iron pipe, flow meter, ball valve, fittings, thrust collar, pipe support(s), appurtenances, grating, rebate, connection to HDPE pipe, cleaning, testing; any incidental work which are not paid elsewhere with individual items; and all other incidentals and materials as herein described and as shown on the Contract Drawings, required to complete this item.

SIB Valve Vault Structures shall be cast-in-place concrete or precast concrete as per Specification Section 33 05 13.

N. **BID ITEM NO. A17 – "FURNISH AND INSTALL SIB VALVE VAULTS ELECTRICAL AND CONTROLS"**

1. **METHOD OF MEASUREMENT** SIB Valve Vaults Electrical and Controls bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for SIB Valve Vaults Electrical and Controls shall be made at the contract lump sum bid price for completion of the work as shown on the Contract Drawings and Specifications. Payment shall be considered complete compensation for all labor, equipment, materials, including but not limited to: valve actuator, flood alarm, furnish and install conduit and wiring with all preparations required for trenching, coring, drilling, excavating, supporting conduit, pulling wire, and completing wiring terminations; all coordination and protection with existing utilities, excavation, dewatering, shoring, applying sand backfill, laying out conduits, completing sand pipe zone material, backfilling with approved backfill material, compaction, installation of detectable marker, backfilling and compaction as required to achieve level finish grade, removal and disposal of excess excavated material, furnish and install all handholes and pull-boxes as required in the Contract Drawings and Specifications and as needed to provide wire pulls that prevent wire damage, provide support for conduits as outlined in the Contract Drawings, Specifications and

by code, debur conduit and apply protection as required to prevent wire damage, and usage of conduit materials consistent with the environments in which it is installed and as outlined in the Contract Drawings and Specifications and by code; install electrical wiring of the correct size per the amperage of load by code and as outlined in the Contract Drawings and Specifications, ensure wiring if of the correct insulation rating and material consistent with the environments and voltage and as outlined in the Contract Drawings and Specifications, and terminate all wiring per required procedures, torques, terminations, finishes, environments and as outlined in the Contract Drawings and Specifications, and assisting OWNER personnel in SCADA programming and integration, and all other operations and materials required to complete this portion of the work as herein described and as shown on the Contract Drawings.

O. **BID ITEM NO. A18 – "FURNISH AND INSTALL CONTROL PANEL, SCADA PROGRAMMING, AND INTEGRATION"**

1. **METHOD OF MEASUREMENT** Furnish and Install Control Panel, SCADA Programming, and Integration bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for Furnish and Install Control Panel, SCADA Programming, and Integration shall be made at the contract lump sum bid price for completion of the work as shown on the Contract Drawings and specified herein. Payment shall be considered complete compensation for all labor, equipment, materials, appurtenances, including but not limited to: wire and assembly, instrumentation, cabinet(s), supports, components, electrician support during loop checks, assisting OWNER personnel in SCADA programing and integration, and all other related items as shown on the Contract Drawings not paid elsewhere.

P. **BID ITEM NO. A19 – "FURNISH AND INSTALL SIB AND MONITORING WELL LEVEL SENSORS"**

1. **METHOD OF MEASUREMENT** Furnish and Install SIB and Monitoring Well Level Sensors bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for Furnish and Install SIB and Monitoring Well Level Sensors shall be made at the contract lump sum bid price for completion of the work as shown on the Contract Drawings and specified herein. Payment shall be considered complete compensation for all labor, equipment, materials, appurtenances, including but not limited to: instrumentation (level sensors), perforated PVC pipe, furnish and install conduit and wiring with all preparations required for trenching, coring, drilling, excavating, supporting conduit, pulling wire, and completing wiring terminations; all coordination and protection with existing utilities, excavation, dewatering, shoring, applying sand backfill, laying out conduits, completing sand pipe zone material, backfilling with approved backfill material, compaction, installation of detectable marker, backfilling and compaction as required to achieve level finish grade, removal and disposal of excess excavated material, furnish and install all handholes and pull-boxes as required in the Contract Drawings

and Specifications and as needed to provide wire pulls that prevent wire damage, provide support for conduits as outlined in the Contract Drawings, Specifications and by code, debur conduit and apply protection as required to prevent wire damage, and usage of conduit materials consistent with the environments in which it is installed and as outlined in the Contract Drawings and Specifications and by code; install electrical wiring of the correct size per the amperage of load by code and as outlined in the Contract Drawings and Specifications, ensure wiring if of the correct insulation rating and material consistent with the environments and voltage and as outlined in the Contract Drawings and Specifications, and terminate all wiring per required procedures, torques, terminations, finishes, environments, and assisting OWNER personnel in SCADA programing and integration, and all other related items as shown on the Contract Drawings not paid elsewhere.

Q. **BID ITEM NO. A20 – "FURNISH AND INSTALL 16-INCH HDPE DR 32.5 ASR WASTE LINE"**

1. **METHOD OF MEASUREMENT** Measurement for 16-inch HDPE DR 32.5 ASR Waste Line shall be according to the lineal foot of pipe acceptably installed as shown on the Contract Drawings and specified herein. Measurement shall be along the horizontal centerline of the acceptably installed pipe. Measurement shall not include pipe which are paid elsewhere.

2. **BASIS OF PAYMENT** Payment for 16-inch HDPE DR 32.5 pipeline shall be paid for at the contract unit bid price per lineal foot listed and shall be considered complete compensation for all labor, equipment, and materials necessary, including but not limited to furnishing the 16-inch HDPE DR 32.5 pipe to make a functional system, excavation, dewatering, shoring, geotextile, select pipe zone material, backfilling with select trench backfill material, compaction, removal and disposal of excess excavated material, commissioning of pipeline (including testing and video inspection); protection of buried utilities, potholing as needed; looping and re-routing of any affected utilities; and all other operations and materials required to complete this portion of the work as herein described and as shown on the Contract Drawings.

R. **BID ITEM NO. A21 – "3X3 PRECAST ASR WASTE LINE CATCH BASIN"**

1. **METHOD OF MEASUREMENT** 3x3 Precast ASR Waste Line Catch Basin bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for 3x3 Precast ASR Waste Line Catch Basin shall be made at the contract lump sum bid price for completion of the work as shown on the Contract Drawings and specified herein. Payment shall be considered complete compensation for all labor, equipment, materials, appurtenances necessary, including but not limited to: precast concrete catch basin including trough formation, excavation regardless of depth of catch basin, dewatering, shoring, removal and disposal of excavated materials, foundation gravel, geotextile fabric, bedding backfill, compaction, pip jointing, cleaning, grouting, testing and all other operations and materials required to complete this portion of work as herein described and as shown on the Contract Drawings.

S. **BID ITEM NO. A22 – "SITE RESTORATION"**

1. **METHOD OF MEASUREMENT** Site Restoration bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for Surface Restoration shall be made at the contract lump sum bid price for completion of the work as shown on the Contract Drawings and specified herein. Payment shall be considered complete compensation for all labor, equipment, materials, appurtenances, including but not limited to: existing access road(s), landscaping, irrigation systems, fences, signs, bollards, concrete pads, slab on grades, and all other surface improvements damaged or removed during construction of the project; including excavation, preparation of subgrade, import materials, compaction, protection of existing facilities, restoration of underground irrigation systems, removal and disposal of excess material, all other site restoration or improvements not included in other items, and all other operations and materials required to complete this portion of the work as herein described and as shown on the Contract Drawings.

T. **BID ITEM NO. A23 – "SWPPP CONSTRUCTION GENERAL PERMIT AND FUGITIVE DUST PERMIT FEE ALLOWANCE"**

1. **METHOD OF MEASUREMENT** SWPPP Construction General Permit and Fugitive Dust Permit Fee Allowance bid item shall not be measured, but shall be paid for on a lump sum basis for the actual cost of the SWPPP Construction General Permit and Fugitive Dust Permit obtained from Utah Department of Environmental Quality. Refer to Supplementary General Conditions, Part 6.06.

2. **BASIS OF PAYMENT** SWPPP Construction General Permit and Fugitive Dust Permit Fee Allowance shall be made at the contract lump sum bid price and any adjustment, if required, for the actual fee for the SWPPP Construction General Permit and Fugitive Dust Permit obtained from Utah Department of Environmental Quality. Payment shall only be for SWPPP Construction General Permit and Fugitive Dust Permit and shall not include preparation of permit application package or other incidental costs, those costs shall be included in Item A1 Mobilization.

U. **BID ITEM NO. B5 – "WELL HOUSE PAD"**

1. **METHOD OF MEASUREMENT** Well House Pad bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for Well House Pad shall be made at the contract lump sum bid price for completion of the work as shown on the Contract Drawings and Specifications. Payment shall be considered complete compensation for all labor, equipment, materials, including but not limited to: excavation, removal and disposal of excavated materials; site grading, concrete flat work, steel reinforcement, forming, concrete curing, subgrade preparation, untreated base course; and all other operations and materials required to complete this portion of the work as herein described and as shown on the Contract Drawings.

V. **BID ITEM NO. B6 – "FURNISH WELL HOUSE PREFABRICATED BUILDING"**

1. **METHOD OF MEASUREMENT** Furnish Well House Prefabricated Building bid item shall not be measured, but shall be paid for on a lump sum basis for furnishing complete Well House Prefabricated Building as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for Furnish Well House Prefabricated Building shall be made at the contract lump sum bid price for furnishing complete Well House Prefabricated Building as shown on the Contract Drawings and Specifications. Payment shall be considered complete compensation to supply all components of the prefabricated building including shipping as herein described and as shown on the Contract Drawings.

W. **BID ITEM NO. B7 – "INSTALL WELL HOUSE PREFABRICATED BUILDING"**

1. **METHOD OF MEASUREMENT** Install Well House Prefabricated Building bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for Install Well House Prefabricated Building shall be made at the contract lump sum bid price for completion of the work as shown on the Contract Drawings and Specifications. Payment shall be considered complete compensation for all labor, equipment, materials, including but not limited to: erection of prefabricated building, miscellaneous hardware, temporary bracing, doors, window, skylights, insulation; and all other operations and materials required to complete this portion of the work as herein described and as shown on the Contract Drawings.

X. **BID ITEM NO. B8 – "BUILDING PERMIT FEE ALLOWANCE"**

1. **METHOD OF MEASUREMENT** Building Permit Fee Allowance bid item shall not be measured, but shall be paid for on a lump sum basis for the actual cost of the Building Permit obtained from Cottonwood Heights City.

2. **BASIS OF PAYMENT** Payment for Building Permit Fee Allowance shall be made at the contract lump sum bid price and any adjustment, if required, for the actual fee for the Building Permit obtained from Cottonwood Heights City. Payment shall only be for Building Permit and shall not include preparation of permit application package or other incidental costs, those costs shall be included in Item B1 Mobilization.

Y. **BID ITEM NO. B9 – "FURNISH WELL HOUSE PUMPING EQUIPMENT"**

1. **METHOD OF MEASUREMENT** Furnish Well House Pumping Equipment bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for Furnish Well House Pumping Equipment shall be made at the contract lump sum bid price for completion of the work as shown on the Contract Drawings and Specifications. Payment shall be considered complete compensation to supply pump discharge head, isolation sleeves and washers; pump bowl assembly, shafting, columns, motor, and all other pump related items not paid elsewhere for a complete and operable well pump and motor.

Z. **BID ITEM NO. B10 – "INSTALL WELL HOUSE PUMPING EQUIPMENT"**

1. **METHOD OF MEASUREMENT** Install Well House Pumping Equipment bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for Install Well House Pumping Equipment shall be made at the contract lump sum bid price for completion of the work as shown on the Contract Drawings and Specifications. Payment shall be considered complete compensation for all labor, equipment, materials, including but not limited to: installing pump discharge head, extending existing well casing, installing isolation sleeves and washers; installing pump bowl assembly, installing shafting, installing columns, installing motor, PVC sounder tubes, Baski Flow Control Valve, startup and testing, and all other pump related items not paid elsewhere for a complete and operable well pump and motor.

AA. **BID ITEM NO. B11 – "FURNISH AND INSTALL WELL HOUSE ELECTRICAL AND HVAC EQUIPMENT"**

1. **METHOD OF MEASUREMENT** Well House Electrical and HVAC Equipment bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for Well House Electrical and HVAC Equipment shall be made at the contract lump sum bid price for completion of the work as shown on the Contract Drawings and Specifications. Payment shall be considered complete compensation for all labor, equipment, materials, including but not limited to: all electrical equipment at the well pump house, one (1) variable frequency drive with control wiring, panelboards, transformer, grounding system, lighting, service outlets, pressure switches, pressure transducers, intrusion switches, buried conduits including spares, electrical service connection, heat trace, wiring for equipment controls, instruments and signals including the control panel, pump motor terminations, lightning protection system, HVAC, and all other items as shown on the Contract Drawings required for a complete and operable electrical and control system.

BB. **BID ITEM NO. B12 – "FURNISH AND INSTALL WELL HOUSE PIPING"**

1. **METHOD OF MEASUREMENT** Well House Piping bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for Well House Piping shall be made at the contract lump sum bid price for completion of the work as shown on the Contract Drawings and Specifications. Payment shall be considered complete compensation for all labor, equipment, materials, including but not limited to: piping, valves, flow meter, pressure relief valve, pump control valve, fittings and appurtenances, pipe supports, excavation, polyethylene wrap, concrete encasement, air valves, pressure gauge and pressure switch piping and fittings, pipe coating, flange isolation kits, joint restraints, disinfection and testing, ASR waste line and catch basin, and all other

appurtenances and related items not paid elsewhere for a complete and operable piping system.

CC. **BID ITEM NO. B13 – "FURNISH AND INSTALL WELL HOUSE CONTROLS"**

1. **METHOD OF MEASUREMENT** Well House Controls bid item shall not be measured, but shall be paid for on a lump sum basis for the completion of the work as shown on the Contract Drawings and Specifications.

2. **BASIS OF PAYMENT** Payment for Well House Controls shall be made at the contract lump sum bid price for completion of the work as shown on the Contract Drawings and Specifications. Payment shall be considered complete compensation for all labor, equipment, materials, including but not limited to: furnishing and installing the station control panel (listed on the Contract Drawings as the PLC), including wire and assembly per Division 26, instrumentation, cabinet(s), supports, and all other and all other items as shown on the Contract Drawings required for a complete and operable electrical and control system.

PART 2 PRODUCTS (Not Used)

PART 3 EXECUTION (Not Used)

- END OF SECTION -

SECTION 26 29 23
PULSE WIDTH MODULATED VARIABLE FREQUENCY DRIVE

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Provide all labor, materials, equipment and incidentals required and install, place in operation and field test a variable frequency drive.

B. The adjustable frequency controller shall be a flux vector sine-wave, pulse width modulated (PWM) design. A modulation method which incorporates “gear changing” is not acceptable. The final responsibility of the completed drive system is that of the manufacturer. Qualified system integration will be by manufacturers approved and should use methods and procedures approval in writing by the VFD manufacturer prior to shipping the drive system to customer site. One manufacturer shall provide all drives systems under this contract. The drive systems shall be manufactured within the United State of America to alleviate concerns of future spare part availability and technical support. All drive systems shall be purchased and furnished by the CONTRACTOR.

C. Drives for motors shall be supplied with harmonic mitigation.

1.2 QUALITY ASSURANCE STANDARDS

A. The entire VFD system as described herein shall be assembled and factory tested to assure a properly coordinated system.

B. Codes: Provide equipment is full accordance with the latest applicable rules, regulations, and standards of:

1. Local Laws and Ordinances.
2. State and Federal Laws.
3. National Electrical Code (NEC).
4. Underwriters Laboratories (UL).
5. American National Standards Institute (ANSI).
6. National Electrical Manufactures Association (NEMA).
7. Institute of Electrical and Electronic Engineers (IEEE).

C. The complete drive system shall be UL listed.

D. The manufacturer will have a minimum of 12 years experience in Integrated Bi-polar Transistor technology.

1.3 ACCEPTABLE EQUIPMENT MANUFACTURERS

A. Toshiba International Corporation

B. Robicon Corporation.
C. Cutler-Hammer
D. Allen Bradley
E. Danfoss
F. ABB
G. Square D
H. General Electric
I. Benshaw
J. Mitsubishi

1.4 SUBMITTALS

A. Submittals shall conform in all respect to this section.

B. Submittals shall be prepared specifically for this project by the VFD manufacturer. For this specific application submittal package will be due three weeks upon request.

C. Submittal information shall include, but not be limited to:

1. Equipment dimensions, including stub-up locations, shipping split and shipping weights.
2. Approval electrical drawings, termination drawings and component location diagrams.
3. Manufactures equipment specification.
4. Catalog cut sheets of major components.
5. Spare parts list, per Paragraph 3.03.
6. Certifications, including:
    a. Warranty, per section 1.04
    b. Efficiencies, per section 2.02. A.1.
    c. Harmonic distortion analysis study, per section 2.01E.

1.5 WARRANTY

A. All equipment furnished under this section shall be warranted for all parts and labor by the CONTRACTOR and the original equipment manufacturer for a period of not less than one (1) year from the date of startup.

B. The manufacturer shall meet the quality and program requirements of ISO 9001.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Any modification to the standard product required to meet this specification shall be performed by the VFD manufacturer or approved systems integrator only. Distributors and panel manufactures changes to the VFD products are specifically disallowed.

B. The VFD system shall consist of any harmonics equipment needed to meet the harmonics mitigation requirements, converter section, output inverter and control logic. All components shall be wired and tested together as a complete system. The labor and materials for field interconnection of the system are to be provided by the VFD manufacturer. Each drive shall be designed for stand alone operation. Multiple drive units shall not utilize shared components. The drive shall be housed in a free standing, front accessible, general purpose indoor enclosure rated NEMA 12, gasketed, with fans and filters. Cabinets shall be single or multi-bay, sheet steel with hinged doors. Doors will have concealed hinges with lockable through-the-door handle operator mechanism. Provisions shall be made for top or bottom entry/exit of incoming line power cables, outgoing load cables and control wiring. All VFD's shall include DC link reactors.

C. Each VFD shall have a molded case, circuit breaker type main power disconnect switch, with an external operating handle. The circuit breaker and the drive unit shall have a minimum short circuit rating of the available fault current at the equipment entry interrupting capacity and shall be labeled in accordance with UL Standard 489.

D. The following safety features shall be standard on all drives:

1. Provisions to padlock main disconnect handle in the "OFF" position.
2. Mechanical interlock to prevent opening cabinet door with disconnects in the "ON" position, or moving disconnect to the "ON" position while the unit door is open.
3. Auxiliary contact on main disconnects to isolate control when fed from external source.
4. Barriers and warning signs on terminals that are energized with the power disconnect "OFF".

E. Any VFD over 60 horsepower shall meet all requirements as outlined in the most recently adopted edition of IEEE 519 for each individual and total harmonic voltage and current distortion and as indicated in this specification. As per Table 10.2 of IEEE 519, individual or simultaneous operation of the VFD's shall not add more than 3% total voltage harmonic distortion while operating at full load and speed from the utility source, or more than 5% while operating from a standby generator (if applicable).

1. The VFD manufacturer cannot predict or be responsible for pre-existing voltage distortion on the line or distribution from sources supplied by others. Maximum input voltage unbalance shall be .5% as defined in NEMA MG1 section 14.35.2.
2. As per Table 10.3 of IEEE 519, maximum allowable total harmonic current demand distortion limits for each VFD operation at full load and speed shall not exceed 5% as calculated and measured at the point of common coupling Isc/Il>20).
3. The point of common coupling for all harmonic calculation and field measurement for both voltage and current distortion **shall be defined as** the main bus feeding each drive.

4. The short circuit current used for harmonic calculations shall be defined as the total full load current with all VFD's operating multiplied by twenty. Example (5) 100 HP VFD's Full load current = 5 x 126 amps = 630 amps. Short circuit current = 20x 630 amps = 12600 amps.
5. If harmonic filters are required to meet these requirements, the VFD manufacturer must provide as a minimum 5th, 7th, and 11th harmonics filters and is responsible for the design and manufacturing of the filters. The vendor must supply cabling and installation for the filters. The filters are to be provided with a separate contactor such that the VFD can operate in the event of a filter failure. Failure of a filter shall not cause the entire drive system to shutdown.

F. Harmonic compliance shall be verified with onsite field measurement of both the voltage and current harmonic distortion on the main bus of the VFD termination without the VFD in operation. A recording of harmonic analysis displaying individual and total harmonic currents and voltage must be utilized.

G. In order to achieve the IEEE519 results, in no condition or situation will the VFD and its harmonics mitigation ever introduce a leading power factor. Provided the result can be guaranteed, the following methods are acceptable.
1. Provide an active-front end VFD
2. Provide an active harmonic filter (separate or integral)
3. Provide an 18-pulse transformer
4. Provide a passive harmonic filter

H. VFD system shall maintain a 95 minimum true power factor throughout the entire speed range.

I. Displacement power factor shall be .95 percent or higher throughout the entire operating speed range, measured at drive input terminals.

J. For motors over 250hp, the drive shall include an RTD monitoring module which shall monitor 8 – 100 ohm platinum RTD's in the motor. The RTD module shall provide a trip and an alarm contact. The RTD alarm contact shall cause an alarm light to illuminate on the VFD front panel. The RTD Trip contact shall cause the VFD to trip, and send the trip status to the PLC. The alarm and trip contacts shall be settable and adjustable to variable trip and alarm settings.

K. For Motors equal to or under 250hp, the drive shall monitor overtemperature using temperature monitoring equipment to cause a trip and alarm.

L. Variable Frequency Drive Ratings:
1. The minimum drive efficiency for NEMA 12 enclosed drive shall be 95.0 percent or better at motor base speed and rated torque. Losses shall include all control power and cooling system losses associated with the drive as well as the input phase shifting transformer.
2. Input Power rating shall be 400-460VAC, plus 10 percent, minus 10 percent, 3 phase, 60 Hz, plus 2, minus 2 Hertz.

3. The voltage ride through of the VFD shall be capable of sustaining continued operation with a 40% dip in normal line voltage. Output speed may decline only if current limit rating of VFD is exceeded.
4. Power loss ride through of the VFD shall be capable of a minimum of 3 cycles loss.
5. The output power shall be HP, 460 Volt, 3 Phase, 60 Hertz, per motor nameplate FLA at installed altitude plus service factor of 25%.
6. The operating ambient Temperature -10 to 40°C (14 to 104°F).
7. The storage temperature shall be -20 to 60°C (4 to 140°F).
8. The relative operating humidity shall be 0 to 95% Non-Condensing.
9. The site operating vibration condition shall be acceleration at 0.6 G maximum (10-55 Hz). Amplitude at 0.1mm maximum (50-100 Hz).
10. Drives shall be sized/de-rated to operate at full load at an elevation of 4700 ft.
11. Power unit rating bases shall be 100% rated current continuous and 120% for one minute at rated temperature.

2.2 CONSTRUCTION

A. The controller shall produce an adjustable AC voltage / frequency output. It shall have an output voltage regulation to maintain correct output V/Hz ratio despite incoming voltage variations.

B. The controller shall have a continuous output current rating of 100% of the motor nameplate rating as a minimum.

C. The converter section will incorporate three distinct diode bridges configured in a series connection. The series connection will provide continued balance of the bridges to insure the harmonic litigation remains consistent throughout the life of the drive. The input to the diode bridges will be a full phase shifting isolation transformer with multiple secondaries. The variable frequency drive system shall also include a filter network and a transistorized inverter section. The drive manufacturer will also manufacture the Transistors used in the inverter section of the drive to reduce harmonics to flow back to the incoming power source.

D. The inverter output shall be generated by to be Insulated Gate Bipolar Transistors (IGBT's) with a PIV rating of 1200 volts minimum. The VFD shall not induce excessive power losses in the motor. The worst case RMS motor lines current measured at rated speed, torque and voltage shall not exceed 1.05 times the rated RMS motor current for a pure sin wave operation.

E. The controller (s) shall be suitable for operating standard NEMA Design-B induction squirrel-cage motor having a 1.15 service factor. The drive can be located up to 300 feet from the motor without requiring special cabling or a separate motor protection devices. Motor nameplate information shall be provided by the CONTRACTOR, prior to contract award to the VFD manufacture to properly size the inverter. In the future, is shall be possible to substitute any standard inverter rate motor (equivalent house power, voltage and RPM) in the field. Output filters shall be installed for motors over 300 foot from VFD.

F. The control logic section shall be fully digital and not require analog adjustment pots or fixed selector resistors. A power failure will not necessitate a reload of any drive parameter or configuration.

2.3 BASIC FEATURES

A. The door of each adjustable speed drive system shall include an operator interface station (OIT/HMI) and key pad with a manual speed device. Each drive shall have operator interface devices at a minimum as called out in the drawings.

B. For safety the drive will require manual restart for customer programmable faults. The fault displays shall include over current, over voltage, heat sink overheat, load side short circuit, load-side ground fault, inverter overload, stator over-current during start-up, load-side over current during start-up, EEPROM error, RAM error, ROM error, communication error, (Dynamic braking resistor over current), Under voltage, low current, over torque, lose of phase, and motor overload.

C. The door mounted operator interface shall be capable of controlling the VFD and setting the drive parameters. The key pad shall have the following programming features:

1. The digital display must present all diagnostic messages and parameters values in English engineering units when accessed.
2. The digital interface keypad shall allow the operator to enter exact numerical settings in engineering units. A plain English user menu (rather than codes) shall be provided in software in nonvolatile memory as a guide to parameter setting and reset table in the field through the key pad. The drive set up parameters must be able to be transferred to new boards to reprogram spare boards.
3. The VFD shall have the capabilities of communicating via network to the PLC. All status shall be communication to the PLC including 3 phase voltage, 3 phase current, speed, status alarms, errors, etc.
4. Programmable output relay contacts and inputs shall be rated for 250 VAC, 2 Amps. A separate 24 VDC power supply (50 mA) shall be available to control exterior control devices. Programmable analog output signals shall be available to meet system requirements. Programmable analog input speed signals shall be available to accept a speed command.
5. The principle output frequency shall be programmable from 0-400 Hz and acceleration / deceleration from .1 to 6000 seconds. The PWM carrier frequency shall be adjustable from .5 to 15 kHz and shall be self adjusting.
6. The VFD shall have internal to the drive a proportional gain; integral gain anti-hunting gain, lag time constant and PID error limit adjustments. This shall be programmable through the key pad.

2.4 ENCLOSURE

A. All VFD components shall be factory mounted and wired on a dead front, grounded indoor NEMA Type 12, gasketed enclosure. It shall be suitable for mounting on a concrete house keeping pad. The steel enclosure shall have a minimum of two-layer of primer and one-layer of industrial finished Sherwin Williams Precision enamel paint or equal.

B. A forced air cooling system will automatically start and stop as necessary to extend the life of the fan.

C. VFD systems shall be stand alone system with an integral through the door mounted disconnect switch operator.

D. The dimensions of the VFD enclosure shall be maximum 36” wide, 24” + 8” depth, 90” height.

2.5 PROTECTIVE FEATURES AND CIRCUITS

A. The VFD shall have the following additional protective features that will protect against damage to the motor, load conductor, contactors or solid state soft starts and the VFD internal devices and electronics.

B. Three phase short circuit on the VFD output terminals.

C. Losses of input power due to opening VFD input disconnect device or loss of utility power during VFD operation.

D. A loss of one (1) phase of the input power shall cause the drive to trip off protecting the drive systems electronics.

E. The VFD will run without connection to the motor load.

F. The VFD shall sense an output short circuit that may occur during operation.

G. The key pad display shall provide a minimum of the last 50 system faults.

H. There shall be stall protection on an overload condition with inverse time overcurrent trip. Current limits shall be adjustable from 10 to 215% of the drive current.

2.6 PARAMETER SETTINGS

A. The following system configuring setting shall be provided and field adjustable, without exception, through the keypad/display unit. Except for motor nameplate data, all parameters must be adjustable while the processor is on-line and the drive is running.

1. Motor Nameplate Data.
2. Motor Full Load Amps.
3. Motor Frequency.
4. Number of poles.
5. Full Load RPM’s.

6. Motor Voltage.
7. Operating current limits. – Min/Max.
8. VFD Configuration Parameters.
9. Independent accel/decel rates.
10. Min./Max. speed (Frequency
11. Forward or Reverse operation.
12. Catch a spinning load selection.
13. Preset Speed capabilities.
14. Volts per Hertz ratio.
15. No load / Full Load boost.
16. Over current trip selection.
17. Frequency jump selection.
18. Programmable meter output signals (Hz. Speed, RPM, Voltage, Torque, PID feed back, input/output power, and DC bus voltage.

B. Automatic Control
   1. 4-20 mA input control signal.
   2. PID internal or external set point capabilities.
   3. Programmable preset speed operational run conditions.
   4. Automatic load reduction during overload condition or soft stall.
   5. Programmable loss of signal control: Stop, maintain speed or default to preset speed or set point.

C. All drive setting adjustable and operation parameters shall be restored in a parameter log which allows minimum and maximum points as well as the present set values. This parameter log shall be accessible via a RS-232 or RS485 serial port or other communications method as well as on the keypad or internal to the drive.

D. The drive shall have the following inputs/output features that will provide control and monitoring of the VFD. The analog outputs shall be isolated as required by this specification.
   1. Three programmable analog outputs.
   2. Two programmable analog inputs. The 4-20mA analog input speed reference signal will be galvanically isolated. Calibration adjustments shall be provided by the keypad.
   3. 4-groups of 8 pattern runs or 32 pattern runs shall be available.
   4. Three programmable digital output (form C, dry contact relays)
   5. One potential pot input (three wire control) +10 V, wiper and common, if specified in drawing.

6. System control program providing built–in drive control or application specific configuration capabilities.
7. Input / output function shall match those indicated in the drawings.
8. Minimum / maximum dry contact output.

2.7 DIAGNOSTIC FEATURES AND FAULT HANDLING

A. The VFD shall include a comprehensive microprocessor based digital diagnostic system that monitors its own control functions and displays faults and operating conditions.

B. A “Fault Log” shall be accessible through the keypad digital illustrations in English. The display shall be capable of illustrating 50 past faults. Optional output shall be through the serial port link. All drive possible fault conditions will be accessible through the fault log.

2.8 DRIVE OPTIONS

A. For drives located more then 300 feet from motor, the drive shall be modified to include a factory or SI wired output line reactor.

B. Information included elsewhere:
1. Drive feed location – See Drawings.
2. Drive overall dimensions allowed – See Drawings.
3. Additional control information – See Drawings.

PART 3 - EXECUTION

3.1 FACTORY TESTING

A. The drives will be completely assembled, wired, and tested in the United States of America. The following tests will be performed:
1. The manufacturer shall use the ISO-9001 standards in the purchase, engineering, manufacturing and testing of the VFD system.
2. Upon completion of manufacture and assembly, the drives shall be subjected to a complete factory test to demonstrate compliance with specified features and characteristics of the specification. The purchaser at his option shall be able to witness factory testing of his unit, with factory coordination.
3. The testing procedure shall be the manufacturer’s standard procedure (except for loss of phase) to assure maintenance free service. The buyer shall be given a 5 day notice prior to the start of factory testing for the buyer's representative to witness the testing.

4. All equipment, devices, instrumentation, and personnel required to perform the factory tests shall be supplied by the manufacturer. Upon satisfactory completion of the test, the seller shall upon request submit two (2) certified copies of the test report to the buyer. Component failure during testing will require repeating any test associated with the failure or modified components to demonstrate proper operation.
5. A loss of each phase testing shall be conducted at the factory to guaranty the safe and orderly shutdown of the drive under load. These tests shall conclude that the drive will not fail its electronic circuits or causes sever over heating of the bridges. These tests shall not limit the life of the drive system. There are no exceptions to this test. This test shall be performed and test reports provided to the ENGINEER prior to installation of the drive system package.

3.2 STARTUP AND FIELD TESTING

A. The VFD manufacturer shall provide the services of a factory trained technician for startup assistance, programming and testing. Verification of the VFD input harmonics voltage and current distortion limits specified must be verified as part of the start-up and acceptance. If harmonics distortion requirements are not met, it is the responsibility of the VFD supplier to meet these specifications at the manufacturer's expense. Meg-ohm testing will be done to the load conductors and motor to verify condition of the equipment prior to startup. The VFD manufactures shall certify the VFD and motor system as compatible. UL508 technicians shall not be allowed to perform startup procedures.

B. A 10% payment retention will be released upon factory field test verification of harmonic specifications requirements and final test report and acceptance.

C. Spare Parts
   1. The following spare parts shall be furnished. The net price per item shall be provided with the request for proposal. Each spare part shall be package and identified by part number and type for long term customer storage.
      a. Three of each type of fuse rated 480 Volts or less.
      b. Two of each type of converter power semi-conductor.
      c. Two of each type of inverter power semi-conductor.
      d. One of each type of control board, gate firing board and communication board.
      e. One key pad assembly.
      f. OR Replacement VFD for items b. through e.
      g. Five of each type of panel lamp.
      h. Three of each size MOV's.

END OF SECTION

SECTION 33 05 13
PRECAST CONCRETE MANHOLES AND STRUCTURES

PART 1 GENERAL

1.1 SUMMARY

A. CONTRACTOR shall provide precast concrete manholes and vaults, complete and in place, in accordance with the Contract Documents.

1.2 RELATED WORK

A. Related Work specified in other Sections includes, but is not limited to:

1. Section 01 33 00 Submittals
2. Section 01 45 00 Quality Control and Materials Testing
3. Section 01 60 00 Product Requirements
4. Section 01 60 00 Product Requirements
5. Section 31 23 15 Excavation and Backfill for Buried Pipelines
6. Section 31 23 23 Excavation and Backfill for Structures
7. Section 33 05 05 Ductile Iron Pipe

1.3 REFERENCES

A. The latest edition of the following publications form a part of this specification to the extent referenced. The publications are referred to in the text by basic designation only.

B. AMERICAN SOCIETY FOR TESTING MATERIALS (ASTM)

1. ASTM A 48 Standard Specification for Gray Iron Castings
2. ASTM A 536 Standard Specification for Ductile Iron Castings
3. ASTM A 615 Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
4. ASTM C 150 Standard Specification for Portland Cement
5. ASTM C 478 Standard Specification for Precast Reinforced Concrete Manhole Sections
6. ASTM C 497 Standard Test Methods for Concrete Pipe, Manhole Sections, or Tile
7. ASTM C 857 Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
8. ASTM C 858 Standard Specification for Underground Precast Concrete Utility Structures
9. ASTM C 913 Standard Specification for Precast Concrete Water and Wastewater Structures
10. ASTM C 923 Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes and Laterals.
11. ASTM C 990 Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

1.4 SUBMITTALS

A. CONTRACTOR shall provide Submittals in accordance with Section 01 33 00 - Submittal Procedures.

B. Shop Drawings: Indicate manhole and concrete structure locations, elevations, and piping sizes, material, and elevations of penetrations.

C. Product Data: Submit cover and frame construction, features, configuration, and dimensions. Submit pipe connector materials and dimensions. Submit manhole step materials and dimensions. Submit manhole and structure joint sealant materials.

1.5 QUALITY ASSURANCE

A. CONTRACTOR shall demonstrate that manholes and structures have been properly installed, level, with tight joints, at correct elevations and orientations, and have been backfilled and compacted in accordance with the specifications.

1.6 DELIVERY, STORAGE AND HANDLING

A. Section 01 60 00 - Product Requirements: Product storage and handling requirements.

B. Comply with precast concrete manufacturer's instructions for unloading, storing and moving precast manholes and structures.

C. Store precast concrete manholes and structures to prevent damage to OWNER's property or other public or private property. Repair property damaged from materials storage.

D. Mark each precast structure by indentation or waterproof paint showing date of manufacture, manufacturer, and identifying symbols and numbers shown on Contract Drawings to indicate its intended use.

PART 2 PRODUCTS

2.1 MANHOLES

A. Reinforced precast concrete manholes in accordance with ASTM C 478 with HS-20 loading. Axial length of barrel sections shall be selected to provide the correct total height with the fewest joints. Conical sections shall be designed to support cast iron frames and covers under H-20 loading, unless noted otherwise. Design criteria shall be as shown on the Contract Drawings. Manholes shall be manufactured by **Oldcastle Precast, Geneva Pipe and Precast**, or approved equal.

B. Joints shall be sealed with butyl-rubber sealants, **ConSeal CS-102, Ram-Nek RN101**, or approved equal, conformation to ASTM C 990. Wrap exterior section joints with membrane waterproofing and exterior joint wrap meeting the requirements of ASTM C877, Type III, **Marmac, Conseal CS212, or Press-Seal Corp EA-Wrap**, or approved equal.

C. Barrel section to pipe connections shall be sealed with resilient connectors, **Kor-N-Seal by Trelleborg**, or approved equal, complying with ASTM C 923. Mechanical devices shall be stainless steel.

2.2 STRUCTURES

A. Provide reinforced concrete structures and vaults designed for the applications and sizes as shown on the drawings. Structures shall conform to the requirements of ASTM C 857, ASTM C 858, or ASTM C 913 as required. Minimum wall thickness shall be 5-inches. Cement shall be Type V Portland cement conforming to the requirements of ASTM C 150. The minimum 28-day concrete compressive strength shall be 4,000 psi. Reinforcing steel shall be embedded in the concrete with a minimum rebar clear cover as recommended by ACI 318. Structure and vaults shall be manufactured by **Oldcastle Precast, Geneva Pipe and Precast**, or approved equal

B. Structures in areas subject to traffic shall be designed for H-20 traffic loading. Vaults in other areas shall be designed for a vertical live load of 300 psf.

C. Where joints are required, joints shall be interlocking to secure proper alignment between members and shall prevent migration of soil through the joint. Joints shall be sealed with butyl-rubber sealants, **ConSeal CS-102, Ram-Nek RN101**, or approved equal, conformation to ASTM C 990. Wrap exterior section joints with membrane waterproofing and exterior joint wrap meeting the requirements of ASTM C877, Type III, **Marmac, Conseal CS212, or Press-Seal Corp EA-Wrap,** or approved equal.

D. Openings, where required, shall be of the size and location indicated on the Contract Drawings and shall be provided without obstructions from brackets and supports. Unless noted otherwise, frames and covers shall be fabricated from steel and galvanized after fabrication. Frames shall be integrally cast into the structure concrete sections. Covers shall be tight fitting to prevent dirt and debris entering the structure.

E. Where penetrations are required for piping, conduits, or ducts, such penetrations shall be through precast openings or core drilled through unreinforced thin-wall knock-out sections. Penetrations shall be smooth and exposed reinforcing steel will not be allowed. Unless noted otherwise, structures do not need to be designed to resist thrust from piping passing through the structure.

2.3 COMPONENTS

A. Manhole and Structure Steps shall have a 1/2-inch ASTM A 615 grade 60 steel reinforcement rod encased in polypropylene copolymer plastic. Steps shall have a tread width of 14-inches nominal. Steps shall be manufactured by **American Step Company, Inc., M.A. Industries**, or approved equal.

2.4 CONFIGURATION

A. Shaft Construction: Square or rectangular with flat lid top section; lipped male/female joints; shaped to receive pipe sections.

B. Clear Inside Dimensions: As indicated on the Contract Drawings.

C. Design Depth: As indicated on the Contract Drawings.

D. Clear Cover Opening: As indicated on the Contract Drawings.

2.5 BEDDING AND COVER MATERIALS

A. Bedding: 3/4" Washed Rock as specified in Section 31 23 23.

B. Soil Backfill to Finish Grade: Trench Backfill Material as specified in Section 31 23 15.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify items provided by other sections of Work are properly sized and located.

B. Verify built-in items are in proper location, and ready for roughing into Work.

C. Verify correct size of manhole and structure excavation.

3.2 PREPARATION

A. Do not install structures where site conditions induce loads exceeding structural capacity of structures.

B. Inspect precast concrete structures immediately prior to placement in excavation to verify structures are internally clean and free from damage. Remove and replace damaged units.

3.3 PRECAST CONCRETE MANHOLE AND STRUCTURE INSTALLATION

A. Lift precast components at lifting points designated by manufacturer.

B. When lowering manholes and structures into excavations and joining pipe to units, take precautions to ensure interior of pipeline and structure remains clean.

C. Set precast structures bearing firmly and fully on crushed stone bedding, compacted in accordance with provisions of Section 31 23 23.

D. Assemble multi-section structures by lowering each section into excavation. Lower, set level, and firmly position base section before placing additional sections.

E. Remove foreign materials from joint surfaces and verify sealing materials are placed properly. Maintain alignment between sections by using guide devices affixed to lower section.

F. Joint sealing materials may be installed on site or at manufacturer’s plant.

G. Verify manholes and structures installed satisfy required alignment and grade.

H. Remove knockouts or cut structure to receive piping without creating openings larger than required to receive pipe.

I. Steps shall be installed 12-inches on centers vertically not more than 1/2-inch out of plumb. The top step shall not be more than 12-inches below the manhole cover.

J. Prior to backfilling, fill all cracks and voids in the manholes or vaults with non-shrink grout, polyurethane sealant, or both.

3.4 FIELD QUALITY CONTROL

A. Section 01 45 00 - Quality Requirements: Field inspecting, testing, adjusting, and balancing.

B. Vertical Adjustment of Existing Manholes and Structures

1. Where required, adjust top elevation of manholes and structures to finished grades shown on Contract Drawings.
2. Reset existing frames, grates and covers, carefully removed, cleaned of mortar fragments, to required elevation in accordance with requirements specified for installation of castings.

- END OF SECTION –

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INDEX OF DRAWINGS

SHEET NO.	TITLE
	GENERAL
G–001	COVER SHEET
G–002	INDEX OF DRAWINGS
G–003	ABBREVIATIONS
G–004	LEGEND AND SYMBOLS
G–005	GENERAL NOTES & TEST HOLE DATA
G–006	SPECIAL INSPECTIONS
	CIVIL
C–100	SITE PLAN OVERVIEW & SURVEY CONTROL
C–101	AREA 1 SITE PLAN
C–102	AREA 2 SITE PLAN
C–103	AREA 3 SITE PLAN
C–200	SIB #1 GRADING PLAN
C–201	SIB #2 GRADING PLAN
C–202	SIB #1 CROSS SECTIONS
C–203	SIB #2 CROSS SECTIONS
C–300	ASR VALVE VAULT PLAN
C–300A	ASR VALVE VAULT SECTIONS
C–301	SIB METER VAULT PLAN AND SECTION
C–302	ASR WELL HEAD EQUIPMENT PLAN
C–303	ASR WELL HEAD EQUIPMENT SECTION I
C–304	ASR WELL HEAD EQUIPMENT SECTION II
C–305	ASR WELL HEAD EQUIPMENT DETAILS
C–306	ASR WELL HEAD PUMP BASE DETAILS
	ASR PIPING PLAN AND PROFILES
PP–100	STA 10+00 TO STA 15+00
PP–101	STA 15+00 TO STA 19+00
PP–102	STA 19+00 TO STA 21+80.62
	ASR WASTE LINE PLAN AND PROFILES
PP–200	STA 10+00 TO STA 10+27.41
	SIB PIPING PLAN AND PROFILES
PP–300	STA 10+00 TO STA 15+00
PP–301	STA 15+00 TO STA 20+00
PP–302	STA 20+00 TO STA 23+25
PP–303	STA 23+25 TO STA 25+17.75
PP–304	STA 10+00 TO STA 14+23.90
	SIB OVERFLOW PIPING PLAN AND PROFILES
PP–400	STA 10+00 TO STA 10+45.56
	ACCESS ROAD PLAN AND PROFILE
RD–100	STA 10+00 TO STA 15+00
RD–101	STA 15+00 TO STA 18+66.16
RD–102	STA 10+00 TO STA 14+16.74
RD–103	STA 10+00 TO STA 10+44.88
	CIVIL DETAILS
CD–100	DETAIL SHEET I
CD–101	DETAIL SHEET II
CD–102	DETAIL SHEET III
CD–103	DETAIL SHEET IV
CD–104	DETAIL SHEET V
CD–105	DETAIL SHEET VI
CD–106	BASKET FLOW CONTROL VALVE DETAILS
CD–107	MISCELLANEOUS DETAILS
CD–108	MONITORING WELL COMMUNICATION DETAIL

SHEET NO.	TITLE
	STRUCTURAL
S–100	ASR VALVE VAULT PLAN AND SECTION
S–100A	ASR VALVE VAULT SECTION
S–101	SIB #1 METER VAULT PLANS AND SECTION
S–101A	SIB #2 METER VAULT PLANS AND SECTION
S–102	ASR WELL PAD PLAN AND SECTION
S–103	MISCELLANEOUS DETAILS
	ELECTRICAL
E–01	SYMBOL LEGEND
E–02	SCHEDULES
E–10	SITE PLAN
E–11	SITE PLAN
E–12	SITE PLAN
E–13	ASR WELL HOUSE POWER PLAN
E–14	ASR WELL HOUSE CONTROL PLAN
E–15	ELECTRICAL ASR WELL HOUSE GROUNDING / LIGHTNING PROTECTION PLAN
E–16	ASR WELL HOUSE LIGHTING PLAN
E–51	DETAILS
E–52	DETAILS
E–53	DETAILS
E–54	DETAILS
E–61	SCHEDULES
E–62	SCHEDULES
I–01	P&ID SYMBOL LEGEND
I–02	P&ID SYMBOL LEGEND
I–61	P&ID DIAGRAM
	HVAC
H–01	SYMBOL LEGEND, SCHEDULES, DIAGRAMS
H–11	ASR WELL PLAN
H–51	DETAILS

1

LICENSED PROFESSIONAL ENGINEER
5/1/23
No. 5052482
GREGORY S. THOMAS
STATE OF UTAH

HANSEN ALLEN & LUCE, Inc. ENGINEERS

DESIGNED	SWM	3				
DRAFTED	SWM	2				
CHECKED	GST	1	5/23	ADDENDUM 1	SWM	GST
DATE	MAY 2023	NO.	DATE	REVISIONS	BY	APVD.

SCALE: NONE

METROPOLITAN WATER DISTRICT OF SALT LAKE & SANDY
3430 EAST DANISH ROAD
COTTONWOOD HEIGHTS, UT 84093

LC063 ASR PILOT TESTING – PHASE 1
GENERAL
INDEX OF DRAWINGS

SHEET G–002
262.08.200

FILE NAME: PROJECTS\262 – METROPOLITAN WATER DISTRICT\08.200 – PHASE 1 MAR\CAD\G–002 INDEX – ADDENDUM 1.DWG
FILE DATE: 5.1.2023 16:05:00 (SWM)

SEE SHEET C-102 FOR CONTINUATION

EXISTING DRYING BED NO 1

EXISTING MAINTENANCE BUILDING

SEE SHEET C-102 FOR CONTINUATION

16" HDPE DR 32.5 ASR WELL PIPING SEE SHEET PP-100

ASR VALVE VAULT A C-300

KEY MAP

0 40 80 SCALE IN FEET

EXISTING FENCING PROTECT IN PLACE, TYP

EXISTING ACCESS ROAD PROTECT IN PLACE, TYP

EXISTING 30" RCP PIG WASTE DISCHARGE PROTECT IN PLACE

EXISTING THICKENER

EXISTING THICKENER

EXISTING CONNECTION STRUCTURE

EXISTING GRAVITY FLOW CONTROL VAULT

EXISTING SLA FW PUMP STATION

24" HDPE DR 32.5 SIB INLET PIPING SEE PP-300

EXISTING 69" WELDED STEEL RAW WATER/SLA

EXISTING 54" RCP OVERFLOW

EXISTING FINISHED WATER RESERVOIR

EXISTING 36" WELDED STEEL SANDY CITY FINISHED WATER

EXISTING 60" WELDED STEEL POMA-3 FINISHED WATER

EXISTING 8" DUCTILE IRON FINISHED WATER

EXISTING 10" PVC C900

SURVEY CONTROL POINT 1

METROPOLITAN WATER DISTRICT OF SALT LAKE & SANDY

FILE NAME:PROJECTS\262 - METROPOLITAN WATER DISTRICT\08.200 - PHASE 1 MAR\CAD\C-100 SITE PLAN - ADDENDUM 1.DWG
FILE DATE: 4.28.2023 12:14:48 (SWM)

LICENSED PROFESSIONAL ENGINEER
5/1/23
No. 5052482
GREGORY S. THOMAS
STATE OF UTAH

HANSEN ALLEN & LUCE inc ENGINEERS

DESIGNED	SWM	3				
DRAFTED	SWM	2				
CHECKED	GST	1	5/23	ADDENDUM 1	SWM	GST
DATE	APRIL 2023	NO.	DATE	REVISIONS	BY	APVD.

SCALE: AS SHOWN

METROPOLITAN WATER DISTRICT OF SALT LAKE & SANDY
3430 EAST DANISH ROAD
COTTONWOOD HEIGHTS, UT 84093

LC063 ASR PILOT TESTING – PHASE 1
CIVIL
AREA 1 SITE PLAN

SHEET C-101

262.08.200

SEE SHEET C-103 FOR CONTINUATION

12'-0" WIDE UBC ACCESS ROAD SEE SHEET RD-100

200'-0"

100'-0"

24" HDPE DR 32.5 SIB INLET PIPING SEE SHEET PP-302

STAGING AREA

FUTURE DRYING BED NO 6

FUTURE DRYING BED OVERFLOW

SEE SHEET C-103 FOR CONTINUATION

LIMITS OF EXCESS EXCAVATED MATERIAL STOCKPILE AREA APPROX 4.14 ACRES X 3'-0" THICK

EXISTING FENCING PROTECT IN PLACE, TYP

EXISTING DRYING BED NO 5

16" HDPE DR 32.5 ASR WELL PIPING SEE SHEET PP-101

EXISTING MATERIALS STOCKPILE TO BE RELOCATED BY MWDSLS PERSONNEL

ELECTRICAL AND CONTROLS CONDUITS SEE SHEET E-10

EXISTING ACCESS ROAD PROTECT IN PLACE, TYP

MONITORING WELL BY OTHERS

EXISTING DRYING BED NO 4

EXISTING ACCESS ROAD PROTECT IN PLACE, TYP

MONITORING WELL CONCRETE PAD
D
CD-105

EXISTING DRYING BED NO 3

EXISTING DRYING BED NO 2

EXISTING 30" RCP PIG WASTE DISCHARGE PROTECT IN PLACE

SEE SHEET C-101 FOR CONTINUATION

EXISTING DRYING BED NO 1

SEE SHEET C-101 FOR CONTINUATION

KEY MAP

0 40 80
SCALE IN FEET

FILE NAME:PROJECTS\262 - METROPOLITAN WATER DISTRICT\08.200 - PHASE I MAR\CAD\C-100 SITE PLAN - ADDENDUM 1.DWG
FILE DATE: 4.28.2023 12:14:48 (SWM)

LICENSED PROFESSIONAL ENGINEER
5/1/23
No. 5052482
GREGORY S. THOMAS
STATE OF UTAH

HANSEN ALLEN & LUCE, INC. ENGINEERS

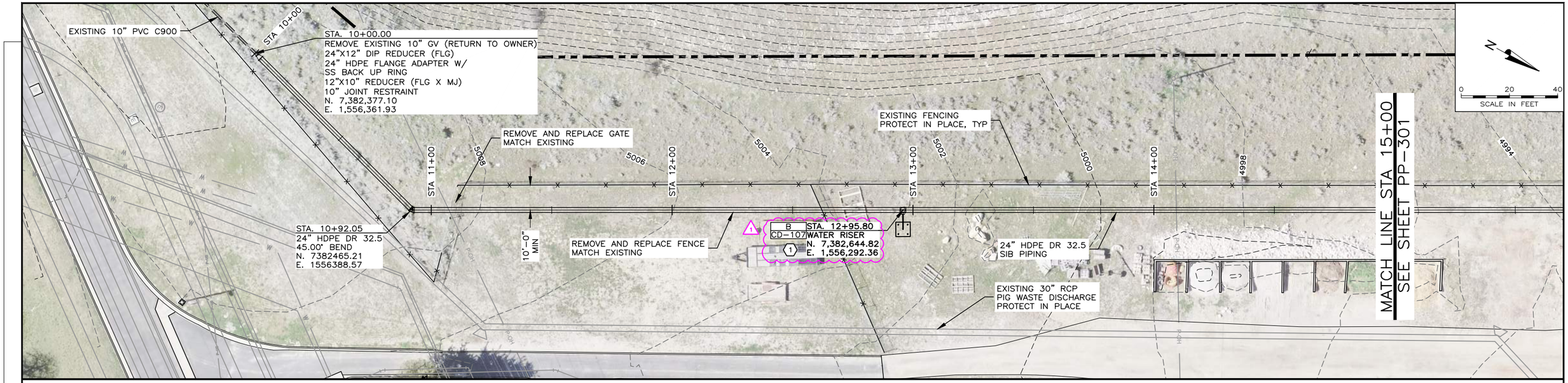
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DRAFTED	SWM	2				
CHECKED	GST	1	5/23	ADDENDUM 1	SWM	GST
DATE	APRIL 2023	NO.	DATE	REVISIONS	BY	APVD.

SCALE: AS SHOWN

METROPOLITAN WATER DISTRICT OF SALT LAKE & SANDY
3430 EAST DANISH ROAD
COTTONWOOD HEIGHTS, UT 84093

LC063 ASR PILOT TESTING – PHASE 1
CIVIL
AREA 2 SITE PLAN

SHEET C-102
262.08.200

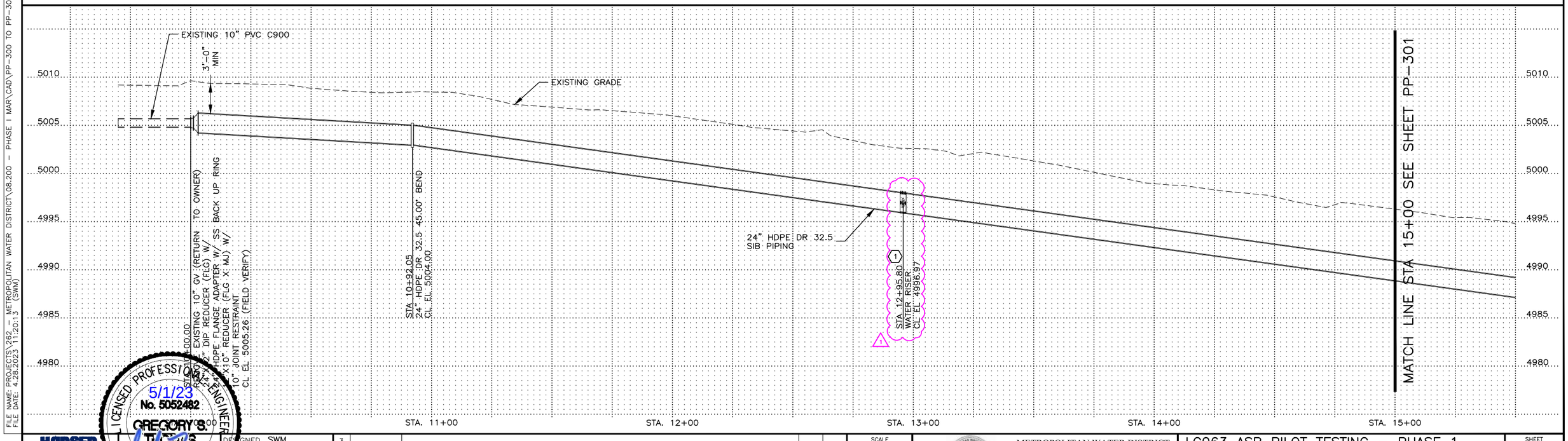


GENERAL NOTES:

1. CONTRACTOR SHALL PROTECT IN PLACE AND MAINTAIN IN SERVICE ALL EXISTING UTILITIES. REFER TO GENERAL NOTE 4 ON SHEET G-005.
2. PIPELINE SHALL BE PRESSURED TESTED IN ACCORDANCE WITH SECTION 33 05 11 HDPE PRESSURE PIPE. CONTRACTOR SHALL PROVIDE TEMPORARY BULKHEADS AND TEMPORARY TAPS AS NEEDED TO FACILITATE PRESSURE TESTING.
3. THE MINIMUM PIPE SLOPE SHALL BE 0.3% WITH NO LOCAL HIGH POINT EXCEPT AS INDICATED ON THE DRAWINGS.
4. TRENCH SECTION PER DETAIL A ON SHEET CD-105.

KEY NOTES:

1 (1) WATER RISER LOCATION APPROXIMATE. COORDINATE W/ MWDSLS PERSONNEL FOR FINAL LOCATION OF WATER RISER.



LICENSED PROFESSIONAL ENGINEER
5/1/23
No. 5052482
GREGORY S. TUCKER
STATE OF UTAH

DESIGNED	SWM	3				
DRAFTED	SWM	2				
CHECKED	GST	1	5/23	ADDENDUM 1	SWM	GST
DATE	APRIL 2023	NO.	DATE	REVISIONS	BY	APVD.

HANSEN ALLEN & LUCE, INC. ENGINEERS

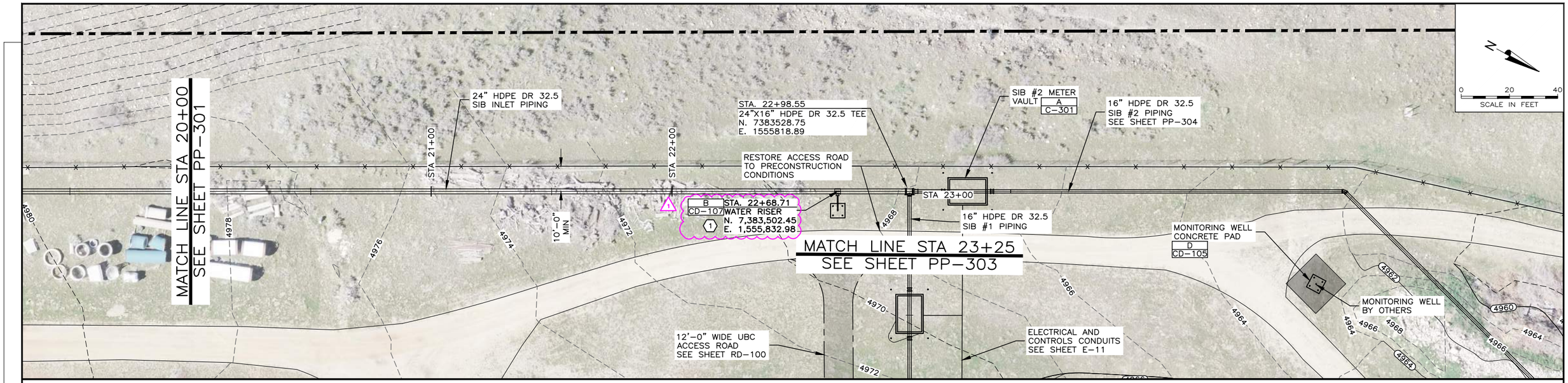
SCALE: AS SHOWN

METROPOLITAN WATER DISTRICT OF SALT LAKE & SANDY
3430 EAST DANISH ROAD
COTTONWOOD HEIGHTS, UT 84093

LC063 ASR PILOT TESTING – PHASE 1
SIB PIPING PLAN AND PROFILE
STA 10+00 TO STA 15+00

SHEET PP-300
262.08.200

FILE NAME: PROJECTS\262 - METROPOLITAN WATER DISTRICT\08.200 - PHASE I MAR\CAD\PP-300 TO PP-304 - ADDENDUM 1.DWG
FILE DATE: 4.28.2023 11:20:13 (SWM)

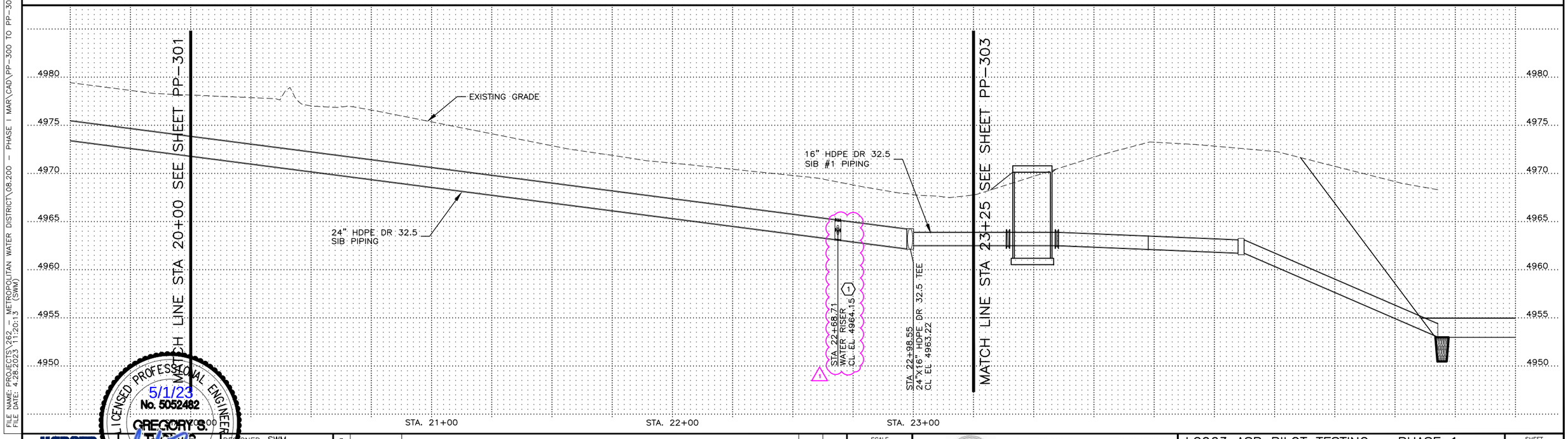


GENERAL NOTES:

1. CONTRACTOR SHALL PROTECT IN PLACE AND MAINTAIN IN SERVICE ALL EXISTING UTILITIES. REFER TO GENERAL NOTE 4 ON SHEET G–005.
2. PIPELINE SHALL BE PRESSURED TESTED IN ACCORDANCE WITH SECTION 33 05 11 HDPE PRESSURE PIPE. CONTRACTOR SHALL PROVIDE TEMPORARY BULKHEADS AND TEMPORARY TAPS AS NEEDED TO FACILITATE PRESSURE TESTING.
3. THE MINIMUM PIPE SLOPE SHALL BE 0.3% WITH NO LOCAL HIGH POINT EXCEPT AS INDICATED ON THE DRAWINGS.
4. TRENCH SECTION PER DETAIL A ON SHEET CD–105.

KEY NOTES:

(1) WATER RISER LOCATION APPROXIMATE. COORDINATE W/ MWDSLS PERSONNEL FOR FINAL LOCATION OF WATER RISER.



LICENSED PROFESSIONAL ENGINEER
5/1/23
No. 5052482
GREGORY S. THOMAS
STATE OF UTAH

HANSEN ALLEN & LUCE, Inc. ENGINEERS

DESIGNED	SWM	3				
DRAFTED	SWM	2				
CHECKED	GST	1	5/23	ADDENDUM 1	SWM	GST
DATE	APRIL 2023	NO.	DATE	REVISIONS	BY	APVD.

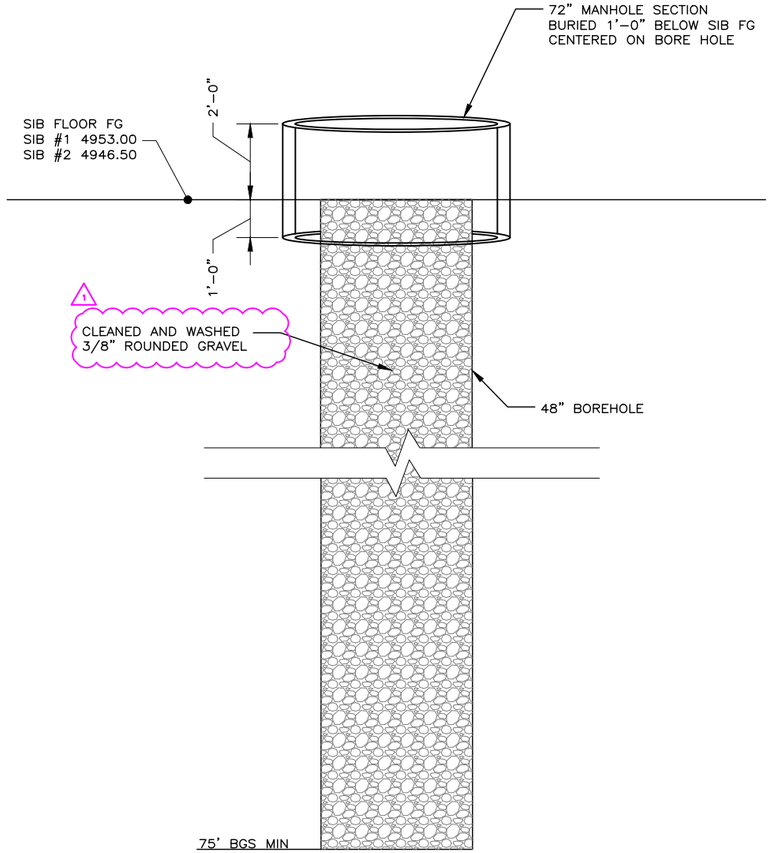
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METROPOLITAN WATER DISTRICT OF SALT LAKE & SANDY
3430 EAST DANISH ROAD
COTTONWOOD HEIGHTS, UT 84093

LC063 ASR PILOT TESTING – PHASE 1
SIB PIPING PLAN AND PROFILE
STA 20+00 TO STA 23+25

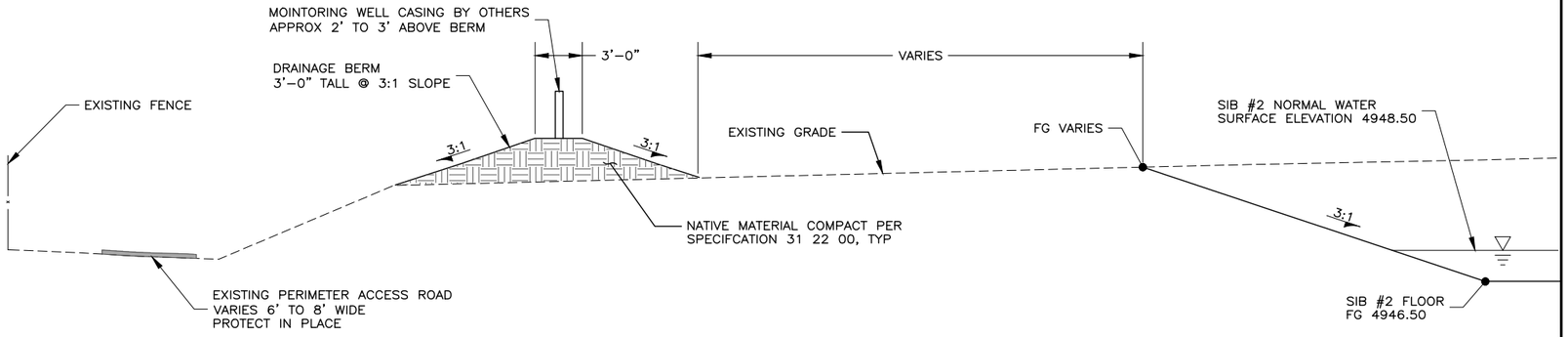
SHEET PP–302
262.08.200

FILE NAME: PROJECTS\262 – METROPOLITAN WATER DISTRICT\08.200 – PHASE I MARY\CAD\PP-300 TO PP-304 – ADDENDUM 1.DWG
FILE DATE: 4.28.2023 11:20:13 (SWM)



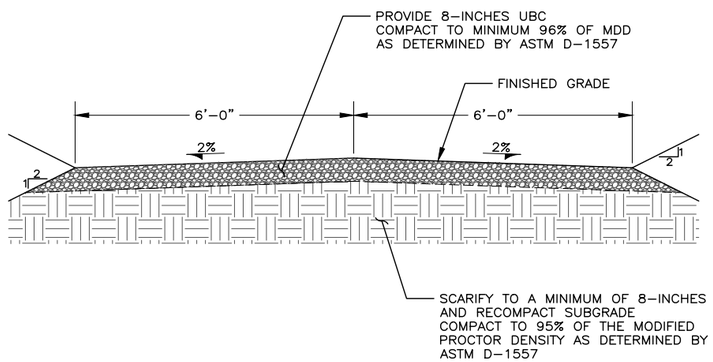
DRAIN HOLE SECTION
NTS

A	A
C-200	C-201



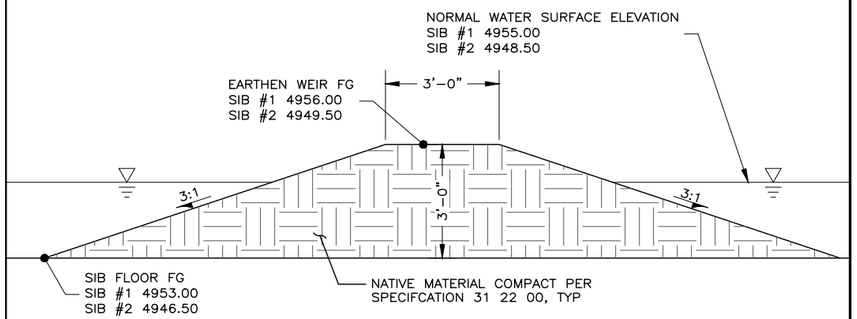
DRAINAGE BERM TYPICAL CROSS SECTION
NTS

B	B	B
C-103	C-201	RD-103



UBC ACCESS ROAD
NTS

C	C	C
RD-100	RD-101	RD-102
C	C	
RD-103	RD-104	



SIB EARTHEN WEIR
NTS

D	D	D	D
C-200	C-201	C-202	C-203

FILE NAME: PROJECTS\262 - METROPOLITAN WATER DISTRICT\08.200 - PHASE I MAR\CAD\CD-101 DETAIL SHEET II - ADDENDUM 1.DWG
FILE DATE: 4.28.2023 12:11:25 (SWM)

LICENSED PROFESSIONAL ENGINEER
5/1/23
No. 5052482
GREGORY S. THOMAS
STATE OF UTAH

HANSEN ALLEN & LUCE INC. ENGINEERS

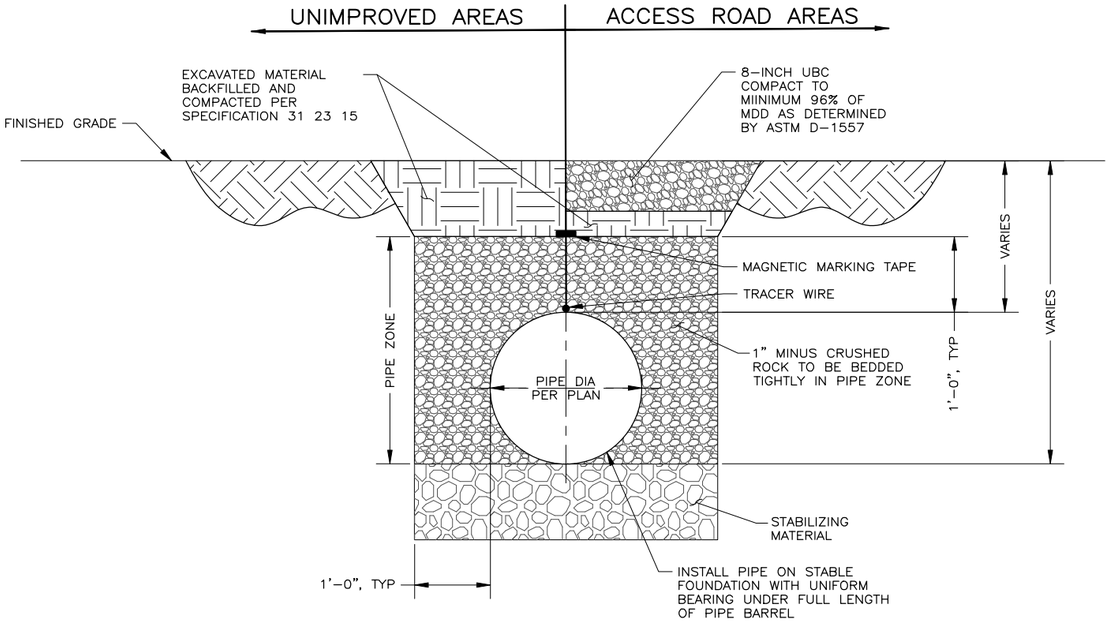
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DRAFTED	SWM	2				
CHECKED	GST	1	5/23	ADDENDUM 1	SWM	GST
DATE	APRIL 2023	NO.	DATE	REVISIONS	BY	APVD.

SCALE
AS SHOWN

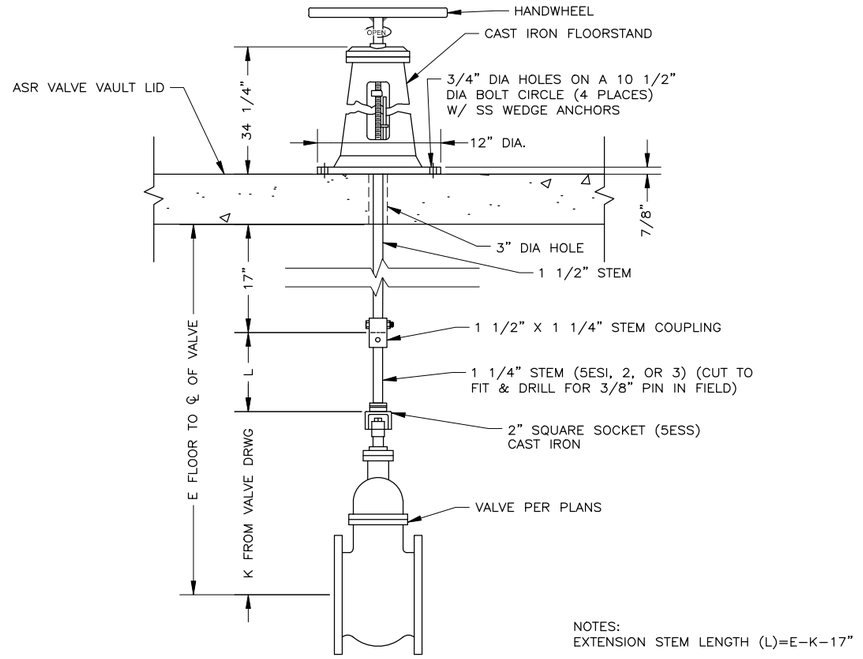
METROPOLITAN WATER DISTRICT
OF SALT LAKE & SANDY
3430 EAST DANISH ROAD
COTTONWOOD HEIGHTS, UT 84093

LC063 ASR PILOT TESTING - PHASE 1
CIVIL DETAILS
DETAIL SHEET II

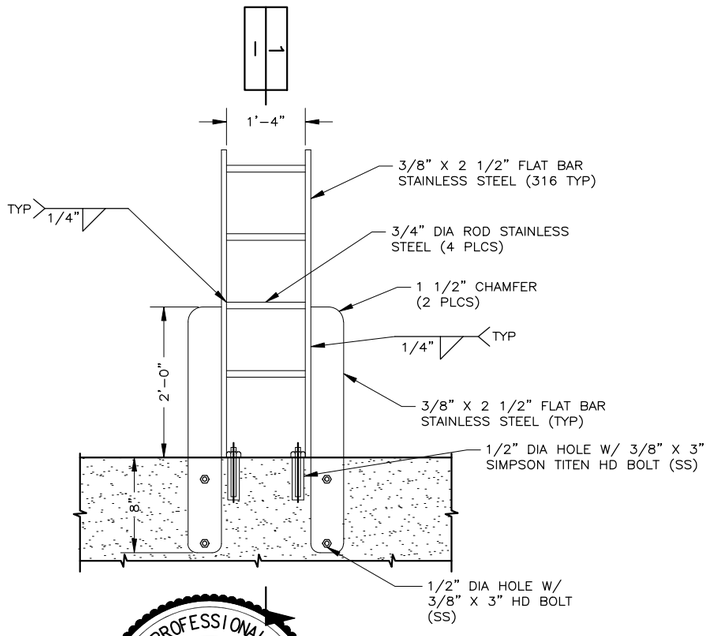
SHEET
CD-101
262.08.200



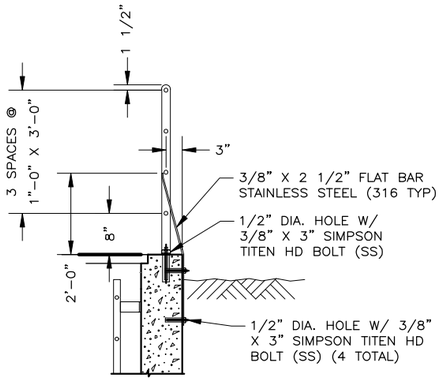
TYPICAL TRENCH DETAIL — NTS — A / —



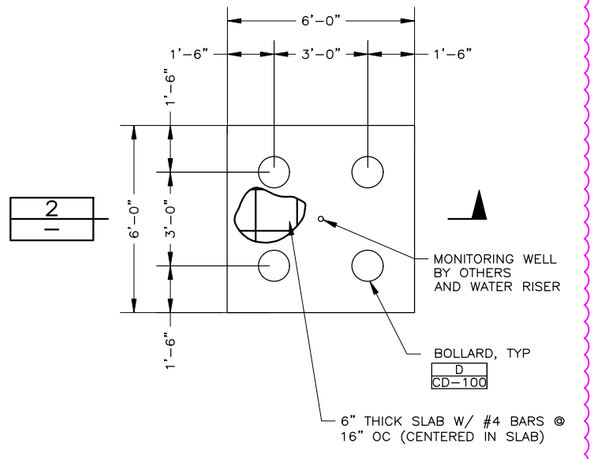
HANDWHEEL FLOORSTAND — NTS — B / C-300A



LADDER EXTENSION DETAIL — NTS — C / C-300 | C / C-300A | C / C-301

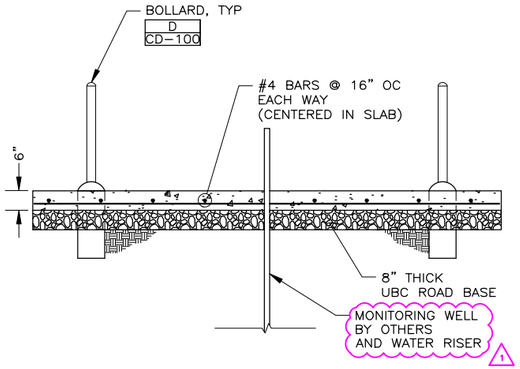


SECTION — NTS — 1 / —



MONITORING WELL PAD — NTS

D	D	
C-102	C-103	
D	D	B
PP-302	PP-304	CD-107



SECTION — NTS — 2 / —

LICENSED PROFESSIONAL ENGINEER
No. 5052462
GREGORY S. THOMAS
STATE OF UTAH
5/4/23

DESIGNED	SWM	3					
DRAFTED	SWM	2					
CHECKED	GST	1	5/23	ADDENDUM 1	SWM	GST	
DATE	APRIL 2023	NO.	DATE	REVISIONS	BY	APVD.	

HANSEN ALLEN & LUCE, INC. ENGINEERS

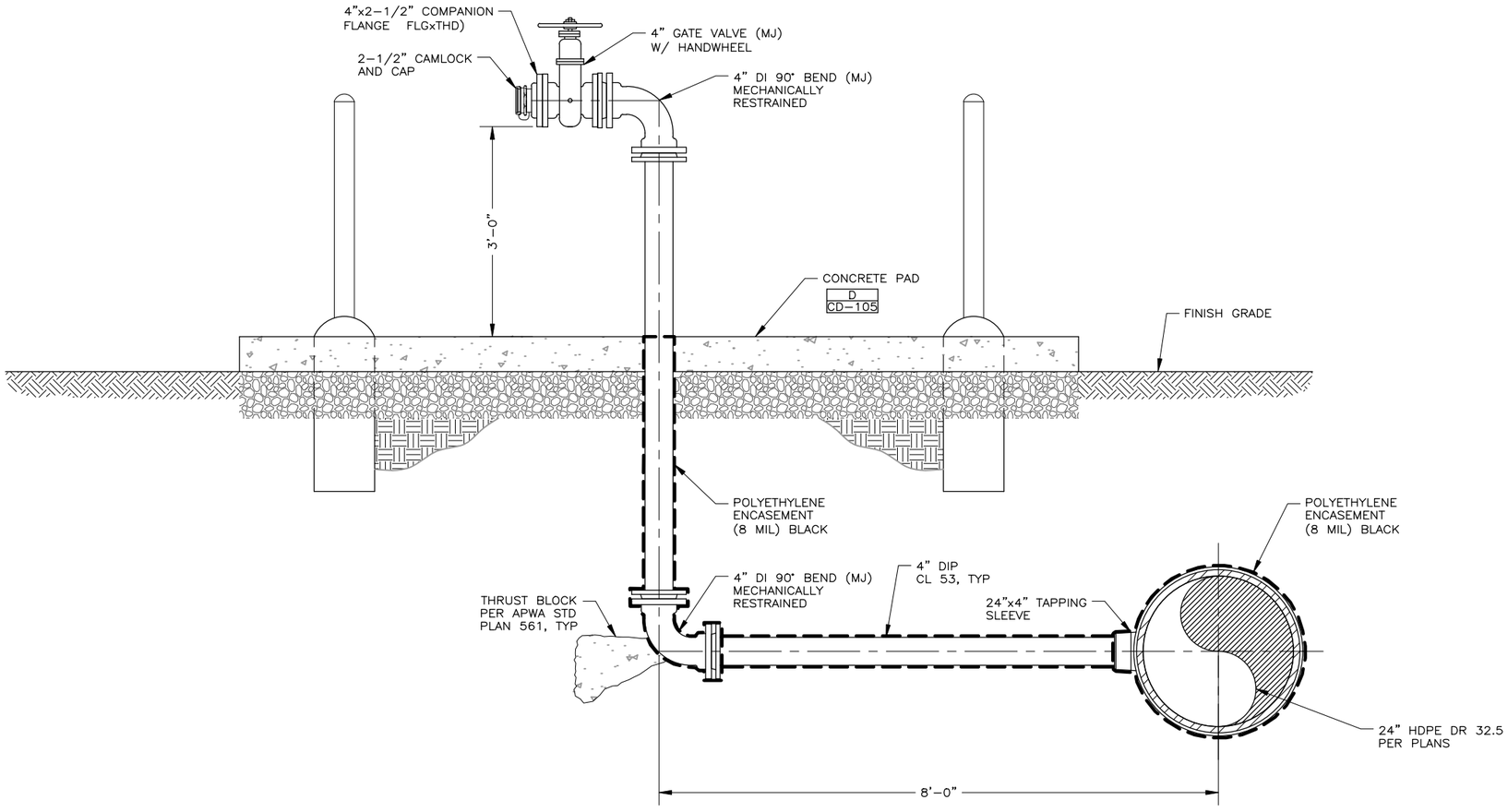
SCALE: AS SHOWN

METROPOLITAN WATER DISTRICT OF SALT LAKE & SANDY
3430 EAST DANISH ROAD
COTTONWOOD HEIGHTS, UT 84093

LC063 ASR PILOT TESTING – PHASE 1
CIVIL DETAILS
DETAIL SHEET VI

SHEET: CD-105
262.08.200

FILE NAME: PROJECTS\262 - METROPOLITAN WATER DISTRICT\08.200 - PHASE 1 MAR\CAD\CD-105 DETAIL SHEET VI.DWG
FILE DATE: 4.24.2023 11:54:56 (SWM)



WATER RISER DETAIL
NTS

B	B
PP-300	PP-302

FILE NAME: PROJECTS\262 - METROPOLITAN WATER DISTRICT\08.200 - PHASE 1 MAR\CAD\CD-107 MISCELLANEOUS DETAILS - ADDENDUM 1.DWG
FILE DATE: 4.28.2023 11:25:48 (SWM)

LICENSED PROFESSIONAL ENGINEER
5/1/23
No. 5052482
GREGORY S. THOMAS
STATE OF UTAH

HANSEN ALLEN & LUCE, Inc. ENGINEERS

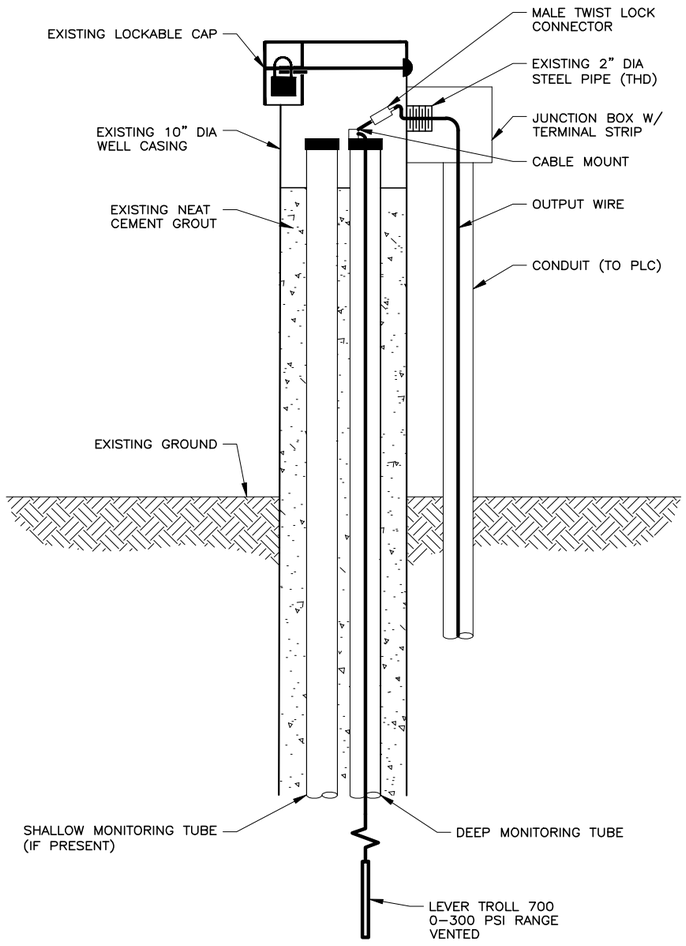
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DRAFTED	MAJ	2				
CHECKED	GST	1	5/23	ADDENDUM 1	SWM	GST
DATE	APRIL 2023	NO.	DATE	REVISIONS	BY	APVD.

SCALE: AS SHOWN

METROPOLITAN WATER DISTRICT OF SALT LAKE & SANDY
3430 EAST DANISH ROAD
COTTONWOOD HEIGHTS, UT 84093

LC063 ASR PILOT TESTING - PHASE 1
CIVIL DETAILS
MISCELLANEOUS DETAILS

SHEET: CD-107
262.08.200



NOTES:
SEE DRAWING NOTE 2, SHEET E–11.

MONITORING WELL COMMUNICATION DETAIL
NTS

FILE NAME: PROJECTS\262 – METROPOLITAN WATER DISTRICT\08.200 – PHASE I MAR\CAD\CD–108 MISCELLANEOUS DETAILS – ADDENDUM 1.DWG
FILE DATE: 5.1.2023 16:00:27 (MAJ)

May 1, 2023
PROFESSIONAL ENGINEER
BENJAMIN D. MINER
No. 318761-2202
STATE OF UTAH

HANSEN ALLEN & LUCE INC. ENGINEERS

DESIGNED	BDM	3					
DRAFTED	MAJ	2					
CHECKED	BDM	1	5/23	ADDENDUM 1	MAJ	BDM
DATE	MAY 2023	NO.	DATE	REVISIONS	BY	APVD.

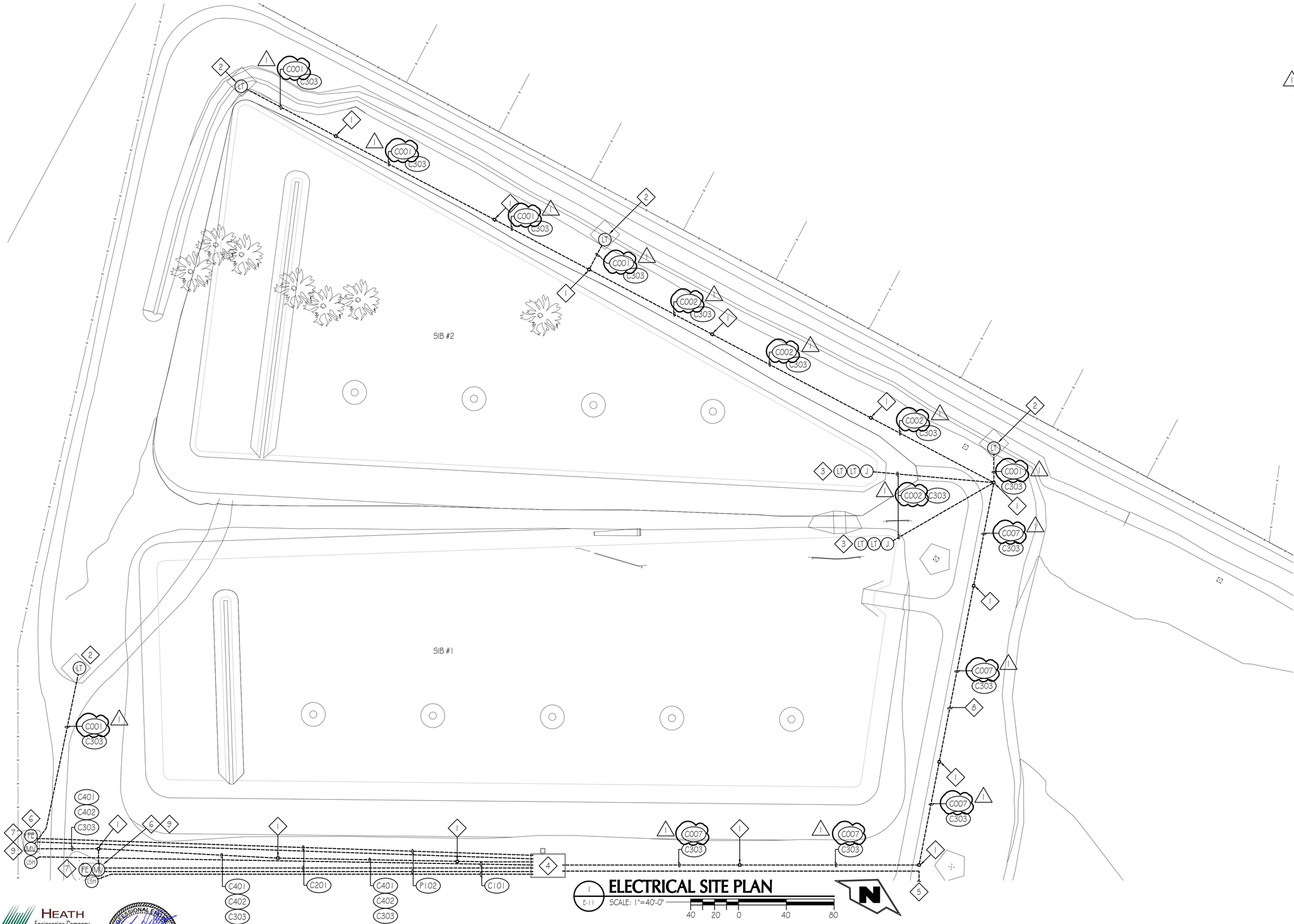
PROJECT ENGINEER

SCALE: AS SHOWN

METROPOLITAN WATER DISTRICT OF SALT LAKE & SANDY
3430 EAST DANISH ROAD
COTTONWOOD HEIGHTS, UT 84093

LC063 ASR PILOT TESTING – PHASE 1
CIVIL DETAILS
MONITORING WELL COMMUNICATION DETAIL

SHEET: CD–108
262.08.200



DRAWING NOTES

1. PROVIDE PULL BOXES EVERY 150FT OR AS NEEDED FOR A SMOOTH WIRE PULL WITHIN THE RECOMMENDATIONS OF THE WIRE MANUFACTURER, AND AS JUNCTION BOXES.
2. MONITORING WELL. INSTALL (1) IN-SITU LEVEL TROLL 700 SUBMERSIBLE LEVEL TRANSDUCER INTO MONITORING WELL. DRILLED BY OTHERS. SEE CIVIL DETAIL FOR MOUNTING.
3. SIB LEVEL SENSORS. INSTALL (2) IN-SITU LEVEL TROLL 700 SUBMERSIBLE LEVEL TRANSDUCERS INTO SIB LEVEL MONITORING LOCATION. SEE DETAIL FOR MOUNTING.
4. ASR WELL. SEE ENLARGEMENT.
5. SEE OVERALL SITE PLAN FOR CONDUIT BANK
6. SIB METER VAULT. (1) SIEMENS MG 5100W MAG FLOW METER, AND (1) ACTUATED 10" SEGMENTED BALL VALVE. EVERYTHING NEEDS TO BE NEMA 6P PROLONGED SUBMERGED.
7. COIL ONLY ON THE FLOW METER BRINGING IT BACK TO THE PROFIBUS. SPECIAL FLOW METER WIRE GOES INTO THE BUILDING. HEAD IN THE WELL HOUSE, THEN PROFIBUS TO THE PLC.
8. CONTINUOUS RUNS OF HDPE BECAUSE OF HIGH WATER TABLE AND CORROSIVE SOILS.
9. MOTORIZED VALVE CONTROLLER MOUNTED OUTSIDE SIB METER VAULT.

GENERAL NOTES

A. ALL LT'S WILL BE VISIBLE ON THE WELL HOUSE HMI AND SENT BACK TO SCADA VIA FIBER.

B. RUN POWER AND CONTROL CONDUITS IN SEPARATE TRENCHES. KEEP CONDUITS 10' FROM WATER LINES.

1 E-11 **ELECTRICAL SITE PLAN**
SCALE: 1"=40'-0"
40 20 0 40 80

FILE NAME: 5/1/2023 2:41 PM - I:\22113\01 - DWG\ELEC\SHEET\22113-E-11.DWG - KINKADE MINSON
FILE DATE:

HEATH Engineering Company

HANSEN ALLEN & LUCE inc ENGINEERS

PROFESSIONAL ENGINEER # 11573207-2202 ROBERT J. HILLYER 04/12/23 STATE OF UTAH

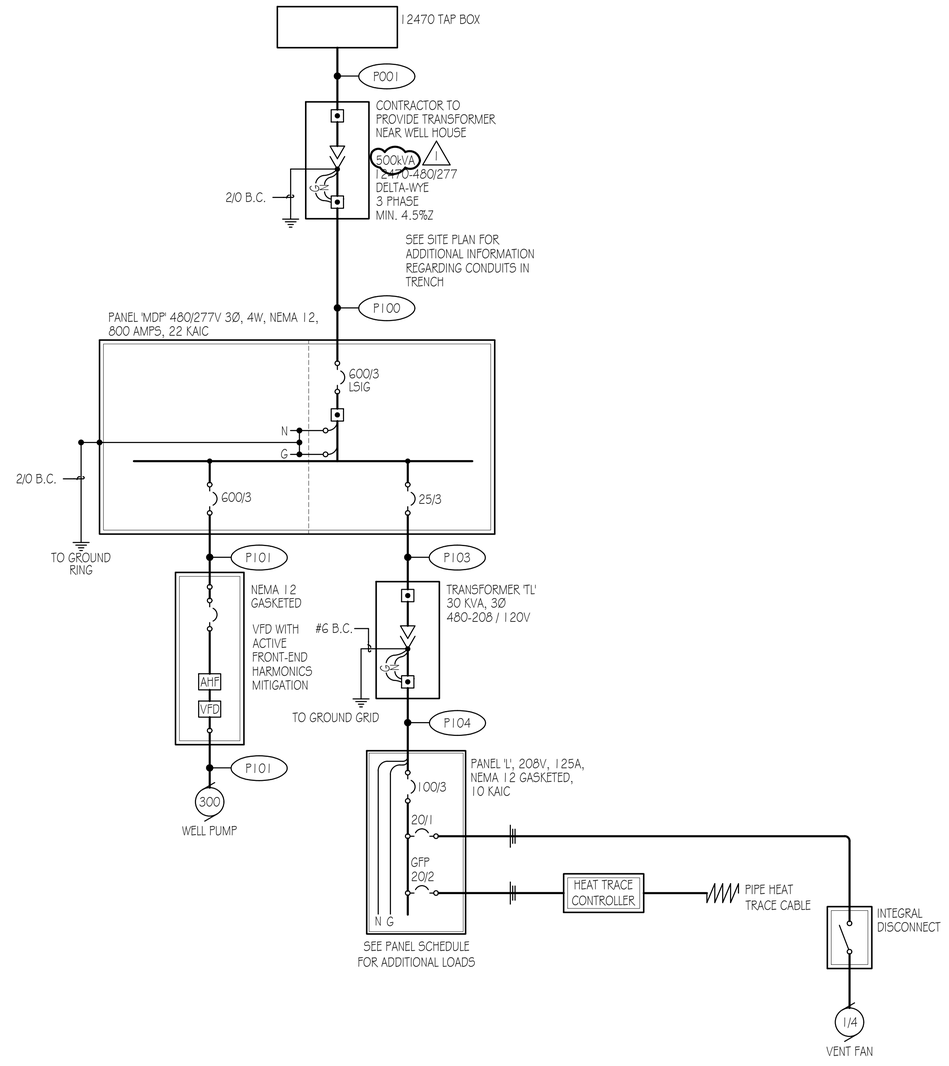
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DRAFTED	KGM	2				
CHECKED	RJH	1	05/01/23	ADDENDUM #1	RJH	RJH
DATE	May 2023	NO.	DATE	REVISIONS	BY	APVD.

SCALE AS SHOWN

METROPOLITAN WATER DISTRICT OF SALT LAKE & SANDY
3430 EAST DANISH ROAD
COTTONWOOD HEIGHTS, UT 84093

LC063 ASR PILOT TESTING – PHASE 1
ELECTRICAL
SITE PLAN

SHEET E-11
262.08.200



ONE-LINE DIAGRAM

SCALE: NONE

FILE NAME: 5/1/2023 2:41 PM - I:\22113\01 - DWG\ELEC\SHEET\22113-E-61.DWG - KINKADE MINSON
FILE DATE:

HEATH Engineering Company

HANSEN ALLEN & LUCE inc ENGINEERS

PROFESSIONAL ENGINEER # 11573207-2202 ROBERT J. HILLYER 04/12/23 STATE OF UTAH

DESIGNED	RJH	3				
DRAFTED	KGM	2				
CHECKED	RJH	1	05/01/23	ADDENDUM #1	RJH	RJH
DATE	May 2023	NO.	DATE	REVISIONS	BY	APVD.

SCALE: NONE

METROPOLITAN WATER DISTRICT OF SALT LAKE & SANDY
3430 EAST DANISH ROAD
COTTONWOOD HEIGHTS, UT 84093

LC063 ASR PILOT TESTING – PHASE 1
ELECTRICAL
SCHEDULES

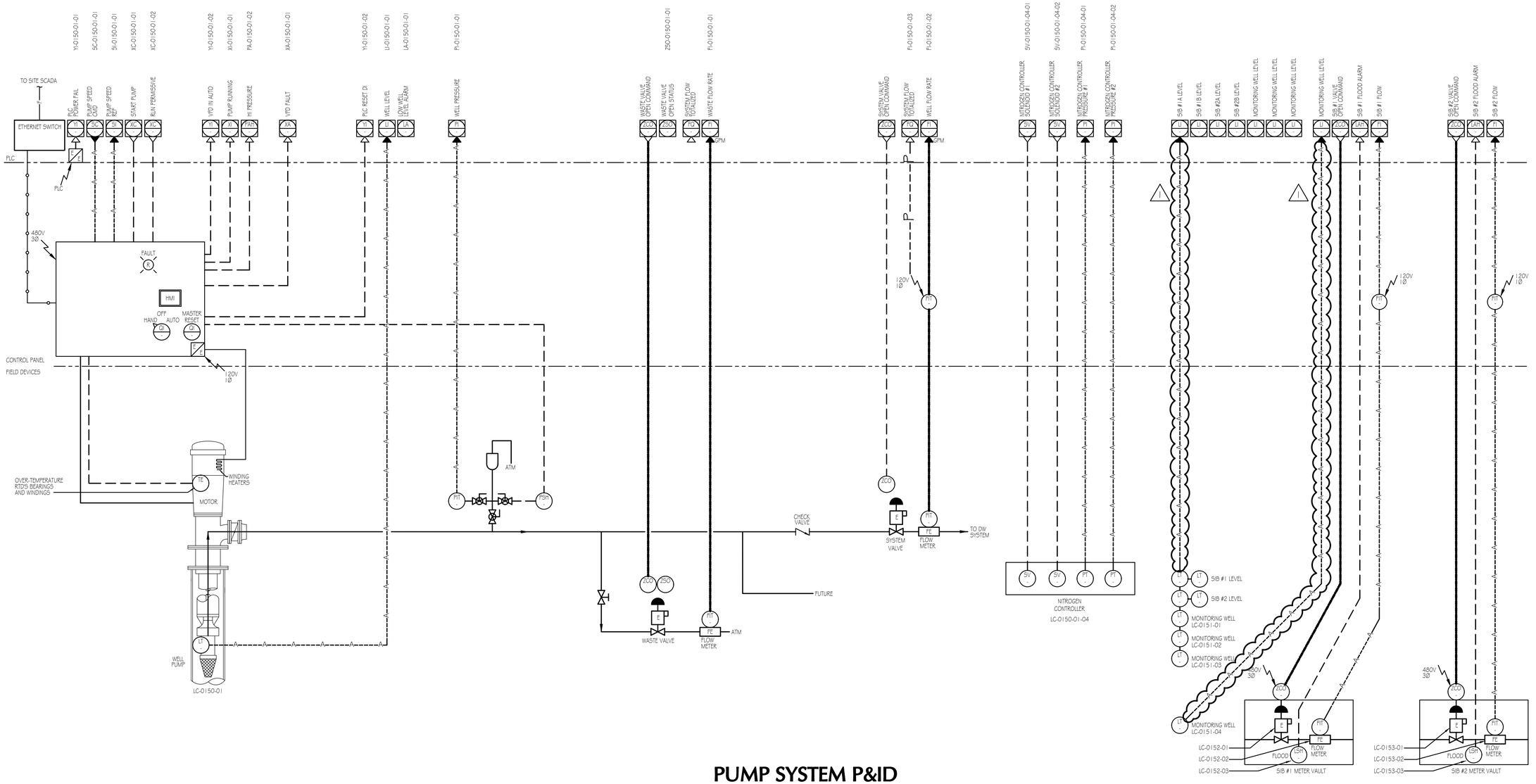
SHEET E–61

262.08.200

ASR WELL - 0150-01-XX

ASR WELL WIRE TAG - XX-0150-01-XX-XX (WIRE NUMBER)

REFER TO AND FOLLOW METROPOLITAN WATER DISTRICT OF SALT LAKE AND SANDY DISTRICT ENGINEERING GUIDES - INSTRUMENTATION AND CONTROL DESIGN GUIDELINES.



PUMP SYSTEM P&ID

SCALE: NONE

OPEN TAGS IF NEEDED:
LC-0153-XX
LC-0154-XX

FILE NAME: 5/1/2023 2:41 PM - I:\22113\01 - DWG\ELEC\SHEET\22113-I-61.DWG - KINKADE MINSON
FILE DATE:

HEATH Engineering Company

HANSEN ALLEN & LUCE inc ENGINEERS

PROFESSIONAL ENGINEER # 11573207-2202 ROBERT J. HILLYER 09/12/23 STATE OF UTAH

DESIGNED	RJH	3				
DRAFTED	KGM	2				
CHECKED	RJH	1	05/01/23	ADDENDUM #1	RJH	RJH
DATE	May 2023	NO.	DATE	REVISIONS	BY	APVD.

SCALE: NONE

METROPOLITAN WATER DISTRICT OF SALT LAKE & SANDY
3430 EAST DANISH ROAD
COTTONWOOD HEIGHTS, UT 84093

LC063 ASR PILOT TESTING – PHASE 1
ELECTRICAL
P&ID DIAGRAM

SHEET I–61

262.08.200

Metro Water District - MW-1

Depth		Sediment Description												Graphic Log		
To	From	Primary	Grain Size	Sorting	Roundness	Texture	Color	Secondary	Grain Size	Sorting	Roundness	Texture	Color	Primary	Secondary	Additional Notes
0	5															
5	10															
10	15															
15	20															
20	25															
25	30															
30	35															
35	40															
40	45	Sand	fg-cg	ps	a-sa		Various	Sand						Sand	Sand	
45	50	Sand	fg-cg	ps	a-sa		Various	Sand						Sand	Sand	
50	55	Sand	fg-cg	ps	a-sa		Various	Sand						Sand	Sand	
55	60	Gravel	fg	ps	a-sa		Various	Sand	fg-cg	ps	a-sa		Various	Gravel	Sand	
60	65	Gravel	fg	ps	a-sa		Various	Sand	fg-cg	ps	a-sa		Various	Gravel	Sand	
65	70	Sand	fg-mg	ms	sa-sr		Various	Sand						Sand	Sand	
70	75	Sand	fg-cg	ps	a-sa		Various	Sand						Sand	Sand	
75	80	Sand	fg-cg	ps	a-sa		Various	Sand						Sand	Sand	
80	85	Sand	fg-cg	ps	a-sa		Various	Sand						Sand	Sand	
85	90	Sand	fg-cg	ps	a-sa		Various	Sand						Sand	Sand	
90	95	Sand	fg-cg	ps	sa-sr		Various	Gravel	fg	ms	a-sa		Various	Sand	Gravel	
95	100	Sand	fg-cg	ps	a-sa		Various	Sand						Sand	Sand	
100	105	Sand	fg-cg	ps	a-sa		Various	Sand						Sand	Sand	
105	110	Sand	fg-cg	ps	a-sa		Various	Sand						Sand	Sand	
110	115	Sand	fg-cg	ps	a-sa		Various	Sand						Sand	Sand	
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120	125	Sand	fg-cg	ps	a-sa		Various	Sand						Sand	Sand	
125	130	Sand	mg-cg	ms	a-sa		Various	Gravel	fg	ms	a-sa		Various	Sand	Gravel	
130	135	Sand	mg-cg	ms	a-sa		Various	Gravel	fg	ms	a-sa		Various	Sand	Gravel	
135	140	Sand	mg-cg	ms	a-sa		Various	Gravel	fg	ms	a-sa		Various	Sand	Gravel	
140	145	Sand	mg-cg	ms	a-sa		Various	Gravel	fg	ms	a-sa		Various	Sand	Gravel	
145	150	Sand	mg-cg	ms	a-sa		Various	Sand						Sand	Sand	
150	155	Sand	mg-cg	ms	a-sa		Various	Sand						Sand	Sand	
155	160	Sand	mg-cg	ms	a-sa		Various	Sand						Sand	Sand	
160	165	Sand	mg-cg	ms	a-sa		Various	Sand						Sand	Sand	
165	170	Sand	mg-cg	ms	a-sa		Various	Sand						Sand	Sand	
170	175	Sand	fg-cg	ps	a-sa		Various	Sand						Sand	Sand	
175	180	Sand	fg-cg	ps	a-sa		Various	Sand						Sand	Sand	
180	185	Sand	mg-cg	ms	a-sa		Various	Sand						Sand	Sand	
185	190	Sand	mg-cg	ms	a-sa		Various	Sand						Sand	Sand	
190	195	Sand	mg-cg	ms	a-sa		Various	Sand						Sand	Sand	
195	200	Sand	mg-cg	ms	a-sa		Various	Sand						Sand	Sand	
200	205	Sand	mg-cg	ms	a-sa		Various	Sand						Sand	Sand	
205	210	Sand	mg-cg	ms	a-sa		Various	Sand						Sand	Sand	
210	215	Sand	fg-cg	ps	a-sa		Various	Sand						Sand	Sand	
215	220	Sand	fg-cg	ps	a-sa		Various	Sand						Sand	Sand	
220	225	Sand	fg-cg	ps	a-sa		Various	Sand						Sand	Sand	

225	**230**	**Sand**	mg-cg	ms	a-sa		Various	**Sand**						Sand	Sand	
230	**235**	**Sand**	mg-cg	ms	a-sa		Various	**Sand**						Sand	Sand	
235	**240**	**Sand**	mg-cg	ms	a-sa		Various	**Sand**						Sand	Sand	
240	**245**	**Sand**	fg-cg	ps	a-sa		Various	**Sand**						Sand	Sand	
245	**250**	**Sand**	fg-cg	ps	a-sa		Various	**Sand**						Sand	Sand	
250	**255**	**Sand**	mg-cg	ms	a-sa		Various	**Sand**						Sand	Sand	
255	**260**	**Sand**	mg-cg	ms	a-sa		Various	**Sand**						Sand	Sand	
260	**265**	**Sand**	mg-cg	ms	a-sa		Various	**Sand**						Sand	Sand	
265	**270**	**Sand**	mg-cg	ms	a-sa		Various	**Gravel**	fg	ms	a-sr		Various	Sand	Gravel	
270	**275**	**Sand**	mg-cg	ms	a-sa		Various	**Gravel**	fg	ms	a-sr		Various	Sand	Gravel	
275	**280**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
280	**285**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
285	**290**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
290	**295**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
295	**300**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
300	**305**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
305	**310**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
310	**315**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
315	**320**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
320	**325**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
325	**330**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
330	**335**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
335	**340**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
340	**345**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
345	**350**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
350	**355**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
355	**360**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
360	**365**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
365	**370**	**Gravel**	fg	ms	sa-sr		Various	**Sand**	mg-cg	ms	a-sa		Various	Gravel	Sand	
370	**375**	**Sand**	fg-cg	ps	a-sa		Various	**Sand**						Sand	Sand	
375	**380**	**Sand**	fg-cg	ps	a-sa		Various	**Sand**						Sand	Sand	
380	**385**	**Sand**	mg-cg	ms	a-sa		Various	**Sand**						Sand	Sand	
385	**390**	**Sand**	mg-cg	ms	a-sa		Various	**Sand**						Sand	Sand	
390	**395**	**Sand**	fg-cg	ps	a-sa		Various	**Sand**						Sand	Sand	
395	**400**	**Sand**	fg-cg	ps	a-sa		Various	**Sand**						Sand	Sand	
400	**405**	**Sand**	mg-cg	ms	a-sa		Various	**Sand**						Sand	Sand	
405	**410**	**Sand**	mg-cg	ms	a-sa		Various	**Sand**						Sand	Sand	
410	**415**	**Sand**	mg-cg	ms	a-sa		Various	**Clay**	clay			sticky	md brn	Sand	Clay	
415	**420**	**Sand**	mg-cg	ms	a-sa		Various	**Sand**						Sand	Sand	
420	**425**	**Sand**	mg-cg	ms	a-sa		Various	**Sand**						Sand	Sand	
425	**430**	**Sand**	mg-cg	ms	a-sa		Various	**Sand**						Sand	Sand	
430	**435**	**Sand**	mg-cg	ms	a-sa		Various	**Clay**	clay			sticky	md brn	Sand	Clay	

Metro Water District - MW-2

Depth		Sediment Description												Graphic Log		
To	From	Primary	Grain Size	Sorting	Roundness	Texture	Color	Secondary	Grain Size	Sorting	Roundness	Texture	Color	Primary	Secondary	Additional Notes
0	5	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	Driller noted cobbles & boulders
5	10	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
10	15	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
15	20	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
20	25	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
25	30	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
30	35	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
35	40	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
40	45	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
45	50	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
50	55	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
55	60	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
60	65	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
65	70	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
70	75	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
75	80	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
80	85	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
85	90	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
90	95	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
95	100	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
100	105	Sand	fg-cg	ps	A-SA		Various	Sand						Sand	Sand	Cemented sand/gravel
105	110	Sand	fg-cg	ps	A-SA		Various	Sand						Sand	Sand	Cemented sand/gravel
110	115	Sand	fg-cg	ps	A-SA		Various	Sand						Sand	Sand	Cemented sand/gravel
115	120	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	Driller noted cobbles & boulders
120	125	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
125	130	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
130	135	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
135	140	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
140	145	Sand	fg-cg	ps	A-SA		Various	Sand						Sand	Sand	Trace of silt
145	150	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	Driller noted cobbles & boulders
150	155	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
155	160	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
160	165	Sand	mg-cg	ps	A-SA		Various	Sand						Sand	Sand	""
165	170	Sand						Sand						Sand	Sand	
170	175	Sand						Sand						Sand	Sand	
175	180	Sand						Sand						Sand	Sand	
180	185	Sand						Gravel						Sand	Gravel	
185	190	Sand						Sand						Sand	Sand	
190	195	Sand						Sand						Sand	Sand	
195	200	Sand						Sand						Sand	Sand	
200	205	Sand						Sand						Sand	Sand	
205	210	Sand						Sand						Sand	Sand	
210	215	Sand						Sand						Sand	Sand	Cemented sand/gravel
215	220	Sand						Sand						Sand	Sand	Cemented sand/gravel
220	225	Sand						Sand						Sand	Sand	Cemented sand/gravel

225	**230**	**Sand**						**Sand**						Sand	Sand	Cemented sand/gravel
230	**235**	**Sand**						**Sand**						Sand	Sand	Cemented sand/gravel
235	**240**	**Sand**						**Gravel**						Sand	Gravel	Cemented sand/gravel
240	**245**	**Sand**						**Gravel**						Sand	Gravel	Cemented sand/gravel
245	**250**	**Sand**						**Gravel**						Sand	Gravel	Cemented sand/gravel
250	**255**	**Sand**						**Gravel**						Sand	Gravel	Cemented sand/gravel
255	**260**	**Sand**						**Gravel**						Sand	Gravel	Cemented sand/gravel
260	**265**	**Sand**						**Gravel**						Sand	Gravel	Cemented sand/gravel
265	**270**	**Sand**						**Gravel**						Sand	Gravel	Cemented sand/gravel
270	**275**	**Sand**						**Gravel**						Sand	Gravel	Cemented sand/gravel
275	**280**	**Sand**						Sand						Sand	Sand	Cemented sand/gravel
280	**285**	**Sand**						Sand						Sand	Sand	
285	**290**	**Sand**						Sand						Sand	Sand	
290	**295**	**Sand**						Clay						Sand	Clay	Maybe 10-15% Clay max
295	**300**	**Sand**						Clay						Sand	Clay	Maybe 10% Clay max
300	**305**	**Sand**						Sand						Sand	Sand	
305	**310**	**Sand**						Sand						Sand	Sand	
310	**315**	**Sand**						Sand						Sand	Sand	
315	**320**	**Sand**						Sand						Sand	Sand	
320	**325**	**Sand**						Sand						Sand	Sand	
325	**330**	**Sand**						Sand						Sand	Sand	
330	**335**	**Sand**						Sand						Sand	Sand	
335	**340**	**Sand**						Sand						Sand	Sand	
340	**345**	**Sand**						Sand						Sand	Sand	
345	**350**	**Sand**						Sand						Sand	Sand	
350	**355**	**Sand**						Sand						Sand	Sand	
355	**360**	**Sand**						Sand						Sand	Sand	
360	**365**	**Sand**						Sand						Sand	Sand	
365	**370**	**Sand**						Sand						Sand	Sand	
370	**375**	**Sand**						Sand						Sand	Sand	
375	**380**	**Sand**						Sand						Sand	Sand	
380	**385**	**Sand**						Sand						Sand	Sand	
385	**390**	**Sand**						Sand						Sand	Sand	
390	**395**	**Sand**						Sand						Sand	Sand	
395	**400**	**Sand**						Sand						Sand	Sand	
400	**405**	**Sand**						Sand						Sand	Sand	
405	**410**	**Sand**						Sand						Sand	Sand	
410	**415**	**Sand**						Sand						Sand	Sand	
415	**420**	**Sand**						Sand						Sand	Sand	
420	**425**	**Sand**						Sand						Sand	Sand	
425	**430**	**Sand**						Sand						Sand	Sand	
430	**435**	**Sand**						Sand						Sand	Sand	
435	**440**	**Sand**						Sand						Sand	Sand	Driller noted it was really hard drilling
440	**445**	**Sand**						Clay						Sand	Clay	Maybe 10% Clay max - Driller noted it was really hard drilling
445	**450**	**Sand**						Sand						Sand	Sand	Driller noted it was really hard drilling

Metro Water District - MW-3

Depth		Sediment Description												Graphic Log		
To	From	Primary	Grain Size	Sorting	Roundness	Texture	Color	Secondary	Grain Size	Sorting	Roundness	Texture	Color	Primary	Secondary	Additional Notes
0	5	Sand	fg-cg	ps	A-SA		Various	Sand	fg-cg	ps	A-SA		Various	Sand	Sand	
5	10	Sand	fg-cg	ps	A-SA		Various	Sand	fg-cg	ps	A-SA		Various	Sand	Sand	
10	15	Sand	fg	ws	SA-SR		Various	Sand	fg-cg	ps	A-SA		Various	Sand	Sand	
15	20	Sand	fg-cg	ps	A-SA		Various	Gravel	fg	ps	A-SA		Various	Sand	Gravel	
20	25	Sand	fg	ws	SA-SR		Various	Gravel	fg	ps	A-SA		Various	Sand	Gravel	
25	30	Sand	fg-cg	ps	A-SA		Various	Sand	fg-cg	ps	A-SA		Various	Sand	Sand	
30	35	Sand	fg-cg	ps	A-SA		Various	Gravel	fg	ps	A-SA		Various	Sand	Gravel	
35	40	Gravel	fg	ps	A-SA		Various	Sand	fg-cg	ps	A-SA		Various	Gravel	Sand	
40	45	Sand	mg-cg	ps	A-SA		Various	Sand	mg-cg	ps	A-SA		Various	Sand	Sand	
45	50	Sand	mg-cg	ps	A-SA		Various	Sand	mg-cg	ps	A-SA		Various	Sand	Sand	
50	55	Sand	mg-cg	ps	A-SA		Various	Sand	mg-cg	ps	A-SA		Various	Sand	Sand	
55	60	Sand	mg-cg	ps	A-SA		Various	Sand	mg-cg	ps	A-SA		Various	Sand	Sand	
60	65	Sand	mg-cg	ps	A-SA		Various	Sand	mg-cg	ps	A-SA		Various	Sand	Sand	
65	70	Sand	fg-cg	ps	A-SA		Various	Sand	fg-cg	ps	A-SA		Various	Sand	Sand	
70	75	Sand	mg-cg	ps	A-SA		Various	Sand	mg-cg	ps	A-SA		Various	Sand	Sand	
75	80	Gravel	fg	ps	A-SA		Various	Sand	mg-cg	ps	A-SA		Various	Gravel	Sand	
80	85	Sand	fg-cg	ps	A-SA		Various	Sand	fg-cg	ps	A-SA		Various	Sand	Sand	
85	90	Sand	mg-cg	ps	A-SA		Various	Sand	mg-cg	ps	A-SA		Various	Sand	Sand	
90	95	Sand	fg-cg	ps	A-SA		Various	Sand	fg-cg	ps	A-SA		Various	Sand	Sand	
95	100	Sand	fg-cg	ps	A-SA		Various	Sand	fg-cg	ps	A-SA		Various	Sand	Sand	
100	105	Sand	mg-cg	ps	A-SA		Various	Sand	mg-cg	ps	A-SA		Various	Sand	Sand	
105	110	Sand	mg-cg	ps	A-SA		Various	Sand	mg-cg	ps	A-SA		Various	Sand	Sand	
110	115	Gravel	fg	ms	A-SA		Various	Sand	mg-cg	ps	A-SA		Various	Gravel	Sand	
115	120	Sand	fg	ws	A-SA		Various	Sand	fg	ws	A-SA		Various	Sand	Sand	
120	125	Gravel	fg	ms	A-SA		Various	Sand	mg-cg	ps	A-SA		Various	Gravel	Sand	
125	130	Sand	mg-cg	ws	A-SA		Various	Sand	cg	ws	A-SA		Various	Sand	Sand	
130	135	Sand	mg-cg	ws	A-SA		Various	Sand	cg	ws	A-SA		Various	Sand	Sand	
135	140	Sand	mg-cg	ws	A-SA		Various	Sand	cg	ws	A-SA		Various	Sand	Sand	
140	145	Sand	mg-cg	ws	A-SA		Various	Sand	cg	ws	A-SA		Various	Sand	Sand	
145	150	Sand	mg-cg	ws	A-SA		Various	Sand	cg	ws	A-SA		Various	Sand	Sand	
150	155	Sand	mg-cg	ws	A-SA		Various	Sand	cg	ws	A-SA		Various	Sand	Sand	
155	160	Sand	mg-cg	ws	A-SA		Various	Sand	cg	ws	A-SA		Various	Sand	Sand	
160	165	Sand	mg-cg	ws	A-SA		Various	Sand	cg	ws	A-SA		Various	Sand	Sand	
165	170	Sand	mg-cg	ws	A-SA		Various	Sand	cg	ws	A-SA		Various	Sand	Sand	
170	175	Sand	mg-cg	ws	A-SA		Various	Sand	mg-cg	ws	A-SA		Various	Sand	Sand	
175	180	Sand	mg-cg	ms	A-SA		Various	Sand	mg-cg	ms	A-SA		Various	Sand	Sand	
180	185	Sand	mg-cg	ms	A-SA		Various	Sand	mg-cg	ms	A-SA		Various	Sand	Sand	
185	190	Sand	fg-mg	ws	SA-SR		Various	Sand	fg-mg	ws	SA-SR		Various	Sand	Sand	
190	195	Sand	fg-cg	ps	A-SA		Various	Sand	fg-cg	ps	A-SA		Various	Sand	Sand	
195	200	Sand	mg-cg	ps	A-SA		Various	Sand	mg-cg	ps	A-SA		Various	Sand	Sand	
200	205	Sand	fg-cg	ps	A-SA		Various	Sand	fg-cg	ps	A-SA		Various	Sand	Sand	
205	210	Sand	fg-cg	ps	A-SA		Various	Sand	fg-cg	ps	A-SA		Various	Sand	Sand	
210	215	Sand	fg	ws	SA-SR		Various	Sand	fg	ws	SA-SR		Various	Sand	Sand	
215	220	Sand	fg-cg	ps	A-SA		Various	Sand	fg-cg	ps	A-SA		Various	Sand	Sand	
220	225	Sand	fg-mg	ws	SA-SR		Various	Sand	fg-mg	ws	SA-SR		Various	Sand	Sand	

225	**230**	**Sand**	mg-cg	ms	A-SA		Various	**Sand**	mg-cg	ms	A-SA		Various	Sand	Sand
230	**235**	**Sand**	mg-cg	ms	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
235	**240**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand
240	**245**	**Sand**	fg	ws	SR		Various	**Sand**	fg	ws	SR		Various	Sand	Sand
245	**250**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand
250	**255**	**Sand**	mg	ms	A-SA		Various	**Sand**	mg	ms	A-SA		Various	Sand	Sand
255	**260**	**Sand**	mg	ms	SA-SR		Various	**Sand**	mg	ms	A-SA		Various	Sand	Sand
260	**265**	**Sand**	mg-cg	ms	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
265	**270**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand
270	**275**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand
275	**280**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand
280	**285**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
285	**290**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
290	**295**	**Sand**	fg	ws	SA-SR		Various	**Sand**	fg	ws	SA-SR		Various	Sand	Sand
295	**300**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand
300	**305**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
305	**310**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand
310	**315**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
315	**320**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
320	**325**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
325	**330**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
330	**335**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
335	**340**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
340	**345**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
345	**350**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
350	**355**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand
355	**360**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand
360	**365**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand
365	**370**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
370	**375**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
375	**380**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand
380	**385**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand
385	**390**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
390	**395**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand
395	**400**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand
400	**405**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand
405	**410**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
410	**415**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
415	**420**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
420	**425**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
425	**430**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
430	**435**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand
435	**440**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
440	**445**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
445	**450**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
450	**455**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
455	**460**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
460	**465**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand
465	**470**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand
470	**475**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand

475	**480**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand	
480	**485**	**Sand**	mg-cg	ps	A-SA		Various	**Sand**	mg-cg	ps	A-SA		Various	Sand	Sand	
485	**490**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand	
490	**495**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand	
495	**500**	**Sand**	fg-cg	ps	A-SA		Various	**Sand**	fg-cg	ps	A-SA		Various	Sand	Sand	

SECTION 2
SITE INVESTIGATION AND CHARACTERIZATION

SECTION 2
SITE INVESTIGATION AND CHARACTERIZATION

The District's LCWTP site was selected for recharge testing based on suitable hydrogeology future expansion potential and proximity to and cost effectiveness of using existing District infrastructure and water supplies. Field investigations were conducted to characterize the soils and geology at the site, design a monitoring well system for the project, and obtain information for design of the recharge facilities and test plans. In January 2006 contract documents, including plans and specification for drilling and well construction, were developed and bids were solicited from qualified drillers. Based on the bids received a contract for well drilling was awarded to Remediation Technologies, Inc. Competitive prices quotes for geotechnical and analytical laboratory testing were also solicited. Based on the quotes received the geotechnical testing was awarded to Intermountain GeoEnvironmental Services, Inc.(IGES). Analytical lab work for soil and water samples was awarded to America West Analytical Laboratory, Inc. (AWAL), a Utah certified environmental testing lab. Some water quality testing for the project was performed in-house at the Districts' in-house laboratory at the LCWTP. The Districts lab is certified by the State of Utah for the parameters tested for in this project. Figure 2-1 provides the locations for the site investigation components including backhoe test pits, exploratory borings, and deep and shallow monitoring wells. The field investigations included the following components:

BACKHOE TEST PITS

Six (6) shallow backhoe test pits were excavated in the pilot test area on December 15, 2005. The backhoe pits were excavated by District staff and equipment and shallow subsurface lithology logged by BC&A. Test pit geologic logs are provided in Appendix A. Bulk soil samples were obtained and submitted for laboratory permeability testing and geochemical tests. Large cobbles with gravel and sand where encountered in the test pits. The test pits ranged from 6 to 8 feet in depth. The depth of the test pits was limited by caving of the cobble layer at about 6 feet. Excavation was very difficult due the size and amount of cobbles present. Cobbles up to 1 foot diameter were found. Due to the amount of cobbles found there was concern the permeability of the material would be low because of the large percentage of impermeable material (cobble). Minor fine grained silty sand layers were observed. No water or indications of perched water in the past were noted in the test pits. The test pits identified water treatment plant sludge up to 3 feet in thickness overlying a portion of the pilot test area.

SHALLOW VADOSE ZONE (DRY) MONITORING WELLS

Four (4) shallow air rotary borings were initially drilled, sampled, and completed as vadose zone monitoring wells (dry wells) between March 2-6, 2006. The purpose of the wells was to obtain shallow soil information and construct a monitoring system for any perched water zones that could develop during the recharge testing and impact adjacent property owners. A primary concern with the recharge project was the potential to cause basement flooding. Soil boring logs and well construction details are provided in Appendix A. The four original wells were labeled VW-1, VW-2, VW-3 and VW-4. VW-1, VW-2, and VW-3 are located on the east and north sides of the pilot test area and are 25 feet deep. VW-4 was installed on the west property

boundary and is 75 feet deep. After recharge testing of the Basin began perched water was observed in the vadose wells on the east and north sides of the site. As a result five (5) additional shallow vadose wells, VW-5, VW-6, VW-7, VW-8, and VW-9, were installed along the north end of the property at depths ranging from 25 to 29 feet deep.

DEEP BORINGS AND MONITORING WELLS

Two (2) 100-foot deep air rotary borings were drilled and sampled for soils characterization. These borings provided geologic information for design of pilot testing the infiltration basin, infiltration distribution lines, and vadose zone well. Soil samples were obtained continuously for geologic logging and selected samples were submitted to a laboratory for sieve analysis (grain size distribution), permeability testing, unsaturated hydraulic properties, and geotechnical and chemical properties. In addition, two (2) air rotary boreholes were drilled and sampled to depths of 425 and 325 feet and completed as deep monitoring wells at total depths of 303 feet (MW-1) and 283 feet (MW-2) respectively. The deep monitoring wells were to be completed in the deep principal Salt Lake Valley Aquifer, however, the depth of the deep principal aquifer was greater than what was projected. The drilling equipment used for the project was not capable of going deeper than about 425 feet. As a result a decision was made to complete the monitoring wells in the uppermost water bearing zone beneath the site. The uppermost water bearing zones beneath the site appear to be perched aquifers on top of clay layers. The deep borings were 8-inch diameter and completed as 4-inch diameter PVC monitoring wells for water quality and water level monitoring. Following completion, the monitoring wells were developed and water quality samples were obtained multiple times for analytical testing.

MICROGRAVITY SURVEYS

Microgravity surveys of the area around the pilot test site were conducted as part of the project. This work was conducted by the University of Utah Geophysics Department under subcontract to BC&A. The methodology and results are described in detail in the Micro-Gravity Survey Results section of this report. The surveys provided a way to map and track the mass of recharged water and assist in estimating the lateral extent of spreading as it infiltrates. The microgravity method has been previously used on the Weber Basin WCD artificial recharge project at the mouth of Weber Canyon. A total of eight surveys were conducted before, during, and after the pilot testing.

GEOTECHNICAL AND GEOCHEMICAL TESTING

Soil samples were selected and submitted to a geotechnical laboratory for saturated and unsaturated hydraulic properties testing. Soil samples from the borings were also submitted to an analytical laboratory for inorganic ions and metals content. The soils chemistry information was used for geochemical evaluation of the recharge testing.

RESULTS OF SITE CHARACTERIZATION

Information from the field investigation drilling and testing program was evaluated to refine recharge rate estimates and pilot testing designs. The evaluation includes geologic logs, permeability and infiltration testing data, deep aquifer water levels, and water quality

information. Subsurface site characterization consisted of drilling four (4) deep borings (B1, B2, MW-1 and MW-2), nine (9) shallow borings (VW-1 though 9), and six (6) test pits (TP-1 through 6). Figure 3-1 shows the locations of wells, borings and test pits.

The soils underlying the LCWTP site consist predominantly of granitic, well-rounded, well-graded, mixed sand, gravel, and cobbles. The cobbles range in size up to two (2) feet in diameter. At depths greater than 250 feet there are several intervals of clay creating perched aquifer zones. MW-1 and MW-2 monitoring wells are completed in the upper most perched aquifers beneath the site. Detailed geologic logs for all wells, borings and test pits are found in Appendix A.

Geologic cross sections are presented in Figures 2-2 and 2-3. The figures show the District site is underlain by extensive coarse grained, high permeability sediments. MW-1 is the only deep boring to show any shallow fine grained sediments. A clay was logged at 30 to 35 feet in MW-1. It is believed this clay layer was not laterally extensive because it is not present in the other deep borings. Aside from this one shallow clay layer, the next clay layer was not encountered till a depth of 200 feet in MW-1. Between 200 and 300 feet a total of 25 feet of clay was logged in MW-1. Water was first detected at a depth of about 295 feet on top of a 10-foot thick clay layer. The boring was extended through the clay layer and unsaturated soils were encountered to a depth of 425 feet. The results indicate the water encountered at 300 feet was a perched water zone and the depth to water in the deep principal aquifer must be greater than 425 feet beneath the site. MW-2 did not show any clay layers till a depth of 285 feet, however, saturated soils were encountered at about 260 feet. MW-2 was also extended below the clay at 285 feet and unsaturated soils were encountered also indicating perched groundwater. The depth to the uppermost groundwater beneath the site is about 255 feet on the north boundary of property and about 290 in the center of the test area. There is a significant difference in water levels between MW-1 and MW-2. The static water level in MW-2 is approximately 25 feet higher than in MW-1. A possible explanation is the clay layers found in MW-1 below 200 feet dip steeply to the north and create separate zones of perched water beneath the site.

SOILS GEOTECHNICAL TESTING

Laboratory geotechnical testing was performed on selected soil samples collected from the backhoe test pits and borings discussed above. Twenty samples were submitted for grain size characterization by sieve analysis. Eight samples were tested for saturated hydraulic conductivity or permeability. Five samples were characterized for unsaturated hydraulic properties. The samples submitted to the lab were selected to represent the range of soil types found at the site (i.e., coarse grained gravels to fine grained clays). Geotechnical laboratory test results are summarized in Table 2-1. Geotechnical laboratory test data sheets are provided in Appendix B.

The hydraulic conductivity values ranged from a high of 5.4 feet per day (ft/day) to a low of 0.02 ft/day. The highest permeability was found in relatively shallow soils from VW-1 at a depth of 15 to 25 feet. Figure 2-4 presents a composite soil profile for the site with results of permeability testing. The figure indicates the highest permeability sample was near surface and that underlying soils have lower permeability. Although very generalized, this result is a

plausible explanation for the development of shallow perched water beneath the site during testing.

Laboratory permeability results were used to estimate the recharge rates that would be achieved during testing of the three recharge methods. The highest permeability value of 5.4 ft/day was used to estimate the recharge rates and size the water supply pipeline to the test facilities. It was anticipated the actual infiltration rates achieved would be lower because the average soil permeability over the test area would be less the maximum value and clogging by fine sediment during the testing would reduce the achievable recharge rate. The refined recharge rate estimated for the entire Basin was 5.4 ft/day (over 1.4 acres), or about 1,700 gallons per minute (gpm). The estimated recharge rate for the vadose recharge well was 50 gpm. The estimated recharge rate for the IDL was 85 gpm per 300 feet of trench, or 425 gpm for all the IDL trenches. The total estimated recharge rate for simultaneous testing of the three recharge methods was about 2,200 gpm and was less than the estimated supply rate of 2,600 gpm through the 10-inch diameter pipeline. Based on these estimates it was believed all three recharge facilities could be simultaneously tested.

SOILS GEOCHEMICAL TESTING/LEACHABILITY CHARACTERIZATION

Soil geochemical and leachability characterization testing was performed on selected soil samples collected from the borings discussed above. Soil samples were analyzed for inorganics and total metals. In addition, the soils were also tested by a leaching procedure to determine the amount of inorganics/metals that could be mobilized by the recharge activities. The Synthetic Precipitation Leaching Procedure (SPLP) Method 1312, is a geochemical extraction procedure to determine the mobility of both organic and inorganic analytes present in the soil. A description of the SPLP Method 1312 and detailed SPLP test results are provided in Appendix C. Detailed soil inorganic and total metals digestion test results are found in Appendix D.

Table 2-2 provides a summary of total inorganics and metals concentrations in soils beneath the site. The data indicate there is a normal range of variability in the results with no particular soil type showing anomalous concentrations. None of the total metals concentrations by themselves appear to be excessively high and are within the normal range of values for soils in the area. Table 2-3 summarizes the leach testing that was conducted. The results show the leachate that would be generated by artificially recharging Little Cottonwood Creek water at the site meets all Utah drinking water standards for inorganics. The quality of the leachate water is very good and there is no indication of mobilization of inorganics from the recharge water or operations.

Table 2-1 Geotechincal Testing Results Summary

Boring or Well ID	Depth (ft bgs)	Sample ID	Log Lithology	Sieve Analysis			Saturated Hydraulic Conductivity		Est. Porosity (%)	Specific Gravity (g/cm^3)	Absorption
				Gravel	Sand	Silt & Clay	(cm/sec)	(ft/day)			
B-1	27	B-1 (27')	Sandy Gravel & Cobbles	13.1%	77.1%	9.8%	-	-	-	2.63	2.0%
B-1	91-97	B-1 (91-96/97')	Brown Sandy Limestone Gravel	32.0%	58.1%	9.9%	-	-	-	2.69	1.5%
B-2	25-35	B-2 (25-35')	Light Brown Sandy Gravel & Cobbles	28.3%	62.8%	8.9%	-	-	-	-	-
B-2	90-97	B-2 (90-95/97')	Light Brown Sandy Gravel & Cobbles	61.5%	34.6%	3.9%	3.40E-04	0.96	12.23	2.67	1.8%
VW-1	15-25	B-3 (15-25')	Granitic Gravel & Cobbles	29.6%	63.8%	6.6%	1.90E-03	5.39	17.8	2.60	2.3%
VW-2	15-25	B-4 (15-25')	Gravelly Sand	53.7%	42.8%	3.5%	8.00E-04	2.27	14.5	2.64	1.9%
VW-3	15-25	B-5 (15-25')	Gravelly Sand	27.4%	58.3%	14.3%	-	-	-	2.61	2.4%
VW-4	15-25	B-6 (15-25')	"Salt & Pepper" Granitic Sand	46.9%	49.9%	3.2%	-	-	-	2.64	1.9%
MW-1	20-25	B-7 (20-25')	Light Brown Gravelly Sand & Cobbles	8.4%	82.1%	9.5%	-	-	-	-	-
MW-1	35-85	B-7 (35-85/105')	Dark Brown Sandy Gravel	44.4%	49.9%	5.7%	3.40E-04	0.96	12.3	2.70	1.9%
MW-1	180-185	B-7 (180-185')	Dark Brown Sandy Gravel	33.0%	54.2%	12.8%	-	-	-	-	-
MW-1	240-255	B-7 (240/246-255')	Dark Yellow/Brown Clayey Fine Sand	3.8%	22.6%	73.6%	5.40E-06	0.02	29.8	2.64	2.7%
MW-1	295-310	B-7 (295/305-310')	Yellow/Orange/Brown Clay	0.0%	8.0%	92.0%	-	-	-	-	-
MW-1	400-425	B-7 (400/415-425')	Orange/Brown Gravelly Silty Sand	30.4%	51.3%	18.3%	1.30E-05	0.04	16.6	2.67	1.8%
MW-2	110-125	B-8 (110-125')	Olive Brown Gravelly Silty Sand	47.0%	43.0%	10.0%	-	-	-	2.72	1.6%
MW-2	175-190	B-8 (175-190')	Olive Brown Sandy Gravel	31.7%	53.8%	14.5%	-	-	-	2.70	2.2%
MW-2	255-280	B-8 (255-280')	Olive Brown Gravelly Silty Sand	46.8%	35.6%	17.6%	-	-	-	2.65	1.8%
MW-2	305	B-8 (305')	Brown Fine Sand	57.0%	38.6%	4.4%	7.20E-04	2.04	16.7	2.66	1.5%
TP-2	0-6	TP-2	Sandy Granitic Gravel	51.2%	37.0%	11.8%	-	-	-	2.66	0.1%
TP-5	0-7	TP-5	Silty Granitic Gravel	54.9%	34.9%	10.2%	1.90E-04	0.54	18.3	2.65	1.5%

Table 2-2 Summary of Soils Leachability Testing

Parameter	Units	Little Cottonwood Creek Feedwater (5/29/07)	SPLP Test Results							Average All Metro Soils
			SPLP Method Blank (LCC Feedwater)	Metro MW1 5-20'	Metro MW1 50-85'	Metro MW1 185-200'	Metro MW1 240-250'	Metro MW1 295-305'	Metro MW1 400-420'	
				Sand & Gravel	Sand & Gravel	Sand & Gravel	Clayey Silty Sand	Clayey Silty Sand	Silty Sand & Gravel	
Alkalinity,(As CaCO3)	mg/l	40	<10	63	86	73	63	58	56	67
Aluminum	mg/l	<0.10	<0.10	0.55	0.57	0.15	0.24	0.16	<0.10	0.28
Ammonia (as N)	mg/l	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Antimony	mg/l	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Arsenic	mg/l	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Barium	mg/l	0.033	0.031	0.028	0.042	0.023	0.021	0.019	0.019	0.03
Beryllium	mg/l	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Bicarbonate (As CaCO3)	mg/l	40	<10	52	41	36	46	37	36	41
BOD	mg/l	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Boron	mg/l	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Cadmium	mg/l	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Calcium	mg/l	16	18	16	16	15	13	16	16	15
Carbon Dioxide	mg/l	4	0.1	0.1	<0.10	<0.10	0.1	<0.10	0.1	0.05
Carbonate (As CaCO3)	mg/l	<10	<10	10	46	37	17	20	20	25
Chloride	mg/l	12	11	11	11	11	11	11	11	11
Chromium	mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.055	<0.010	0.01
Chromium, hexavalent	mg/l	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
COD	mg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
Color	ccu	5	5	12	16	8	12	7	7	10
Conductivity	µmhos/cm	130	100	160	230	200	180	180	170	186.67
Copper	mg/l	0.013	0.0077	0.0049	0.0047	<0.0040	<0.0040	<0.0040	<0.0040	<0.0040
Cyanide, Free	mg/l	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoride	mg/l	0.17	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Hardness (as CaCO3)	mg/l	56	58	58	58	58	58	58	58	58
Hydroxide	mg/l	<10	<10	<10	<10	<10	<10	<10	<10	<10
Iron	mg/l	0.079	0.44	0.44	0.44	0.44	0.44	0.44	0.44	0.44
Lead	mg/l	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Magnesium	mg/l	3.8	4.4	4.4	4.4	4.4	4.4	4.4	4.4	4.4
Manganese	mg/l	0.0066	0.017	0.017	0.017	0.017	0.017	0.017	0.017	0.02
Mercury	mg/l	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020	<0.00020
Nickel	mg/l	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Nitrate/Nitrite (as N)	mg/l	0.21	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Odor	mg/l		0	0	0	0	0	0	0	0.00
pH @ 25° C	pH units	7.3	8.94	8.94	8.94	8.94	8.94	8.94	8.94	8.94
Phosphate, ortho (as P)	mg/l	<0.050	0.091	0.091	0.091	0.091	0.091	0.091	0.091	0.091
Potassium	mg/l	<1.0	2.6	2.6	2.6	2.6	2.6	2.6	2.6	2.60
Selenium	mg/l	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Silicon	mg/l	2.4	4.1	4.1	4.1	4.1	4.1	4.1	4.1	4.1
Silver	mg/l	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050	<0.0050
Sodium	mg/l	7	13	13	13	13	13	13	13	13
Sulfate	mg/l	13	14	14	14	14	14	14	14	14
Surfactants (MBAS)	mg/l	<0.08	<0.08	<0.08	0.15	<0.08	<0.08	<0.08	<0.08	<0.08
TDS	mg/l	66	74	96	100	120	110	100	96	104
Thallium	mg/l	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020	<0.0020
Total Organic Carbon	mg/l	<1.0	1.1	1.8	1.1	1.2	<1.0	<1.0	1.5	0.93
Turbidity	NTU	0.77	0.17	3.2	2.2	2.5	3.4	2	1.6	2.48
Zinc	mg/l	0.045	0.024	0.028	0.024	<0.010	<0.010	<0.010	<0.010	0.01

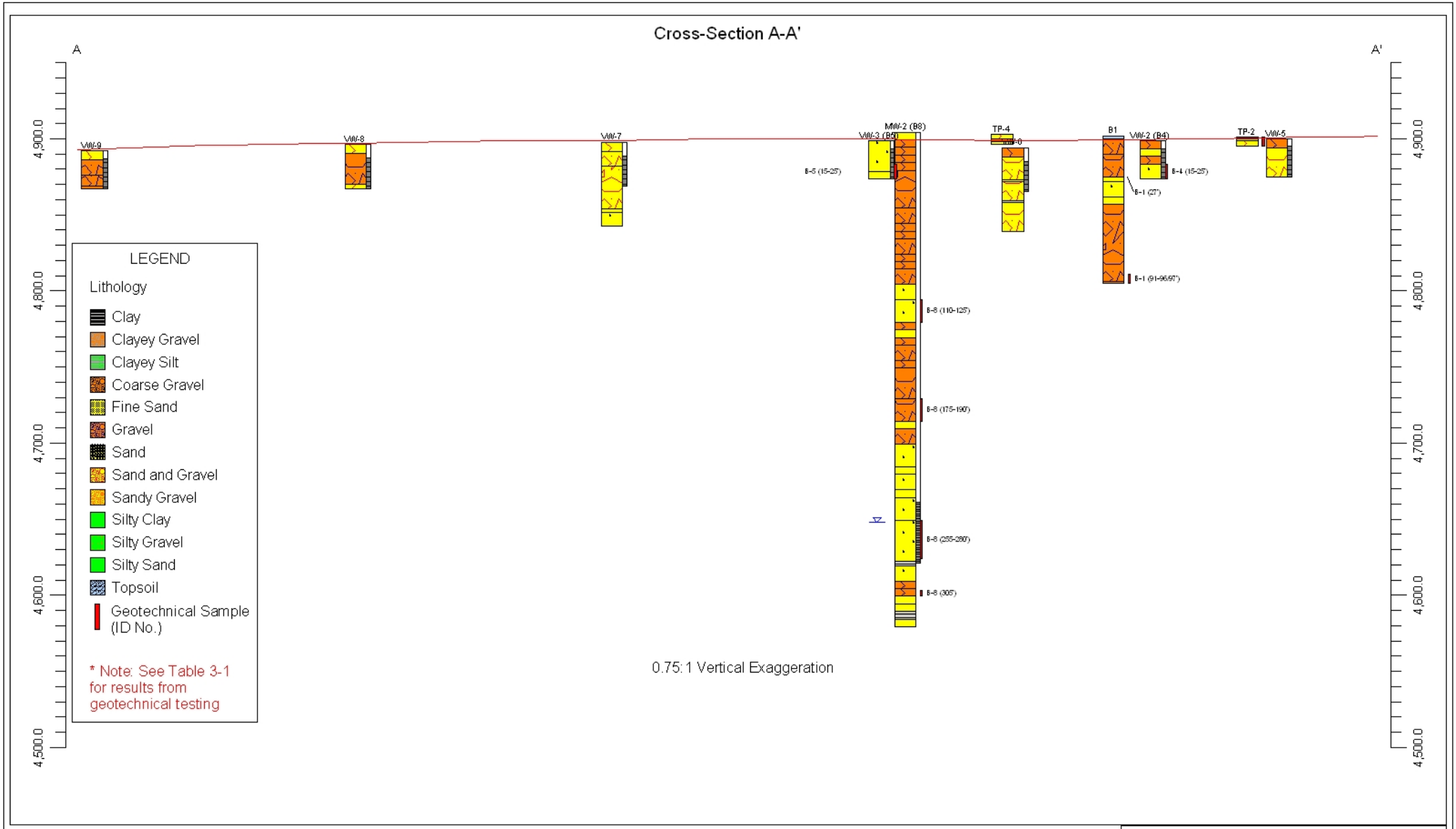


Figure 2-2
Cross Section A-A'

Metro ASR Water Bank Project

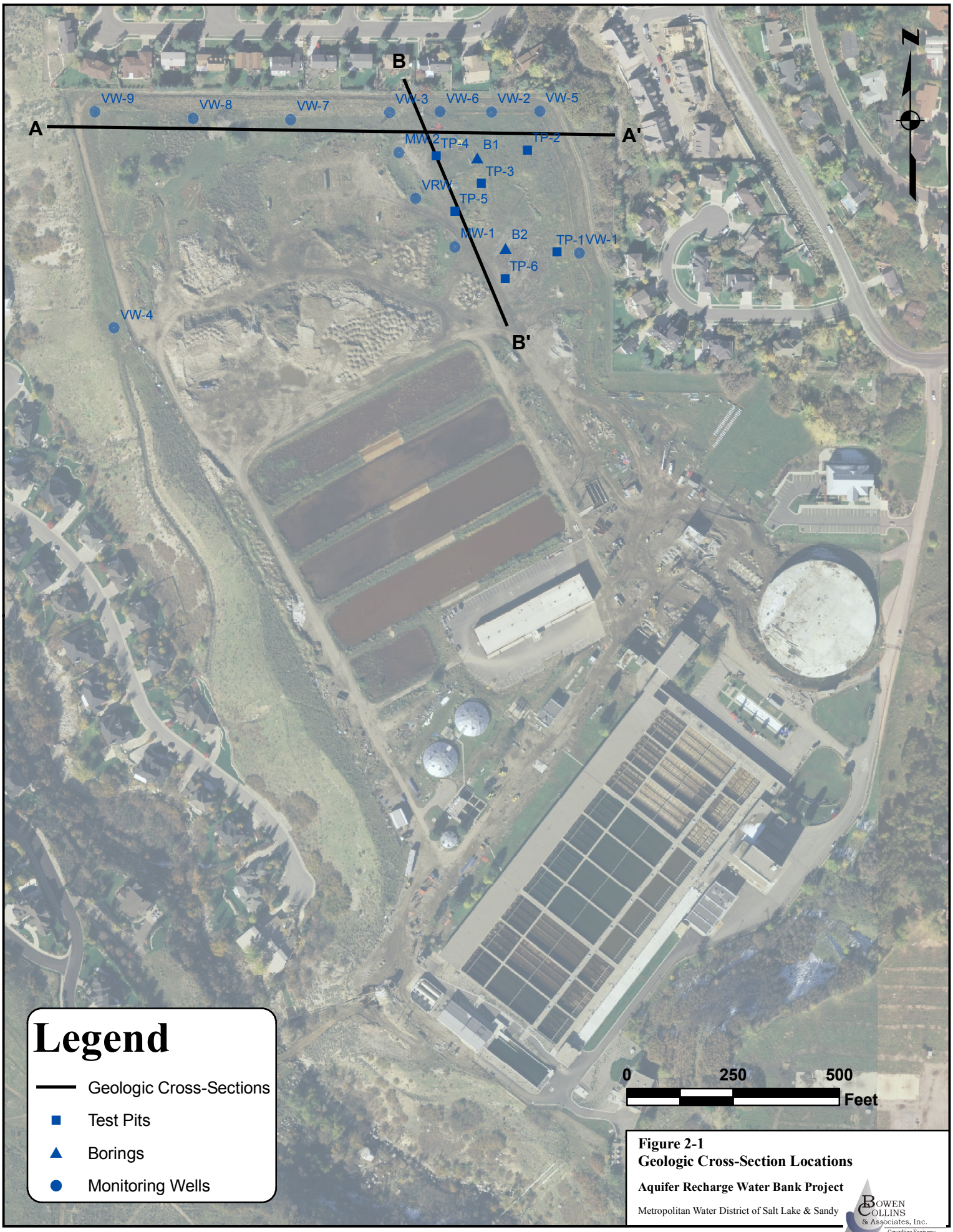


Figure 2-1
Geologic Cross-Section Locations

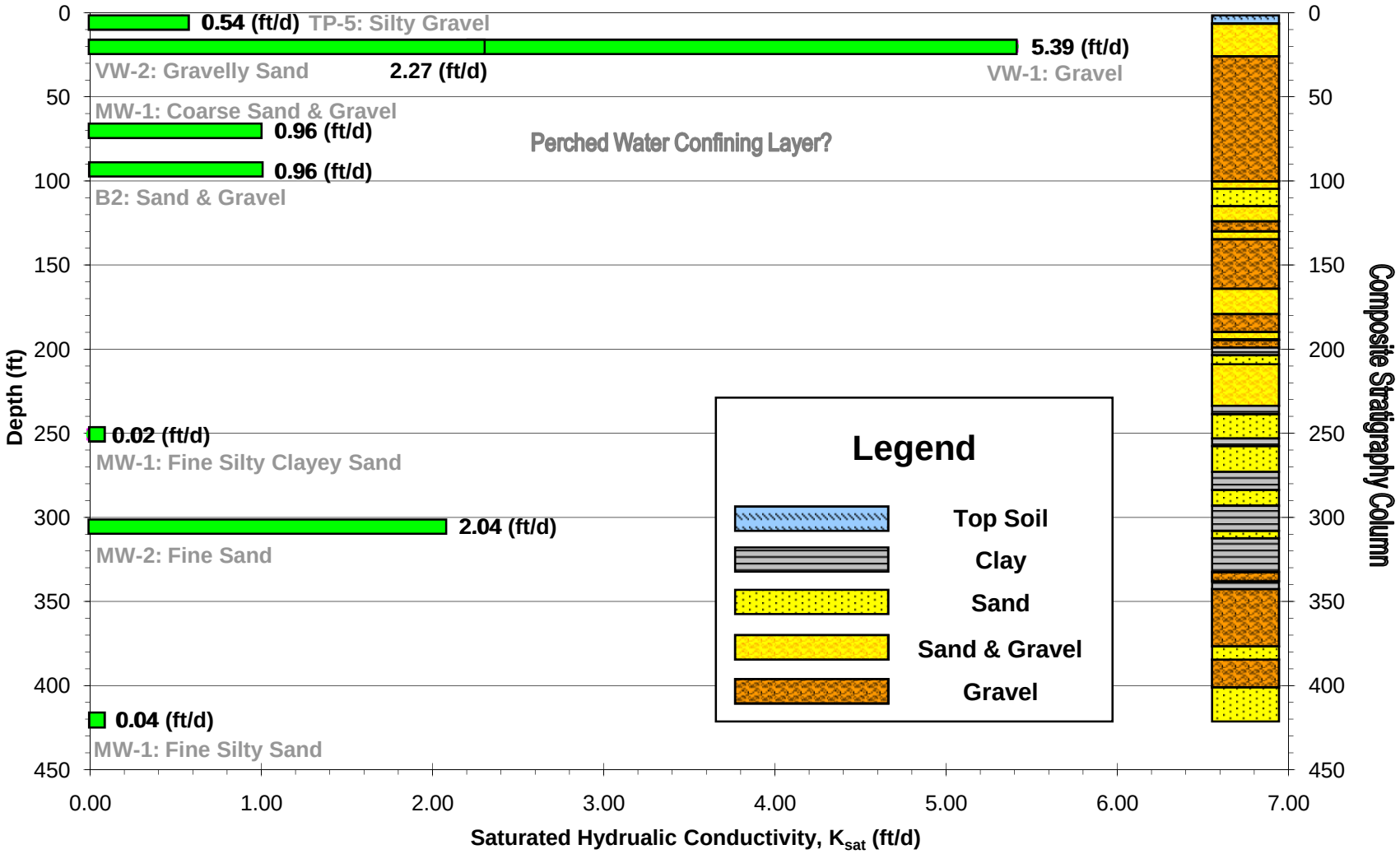
Aquifer Recharge Water Bank Project

Metropolitan Water District of Salt Lake & Sandy

Bowen Collins & Associates, Inc. Consulting Engineers

Printing Date: May 7, 2008
File: P:\Metro Water District SLC\ASR Project\GIS\Report Figures\Figure 2-1 - Geologic Cross-Section Locations.mxd

Figure 2-4
Depth & Permeability Profile



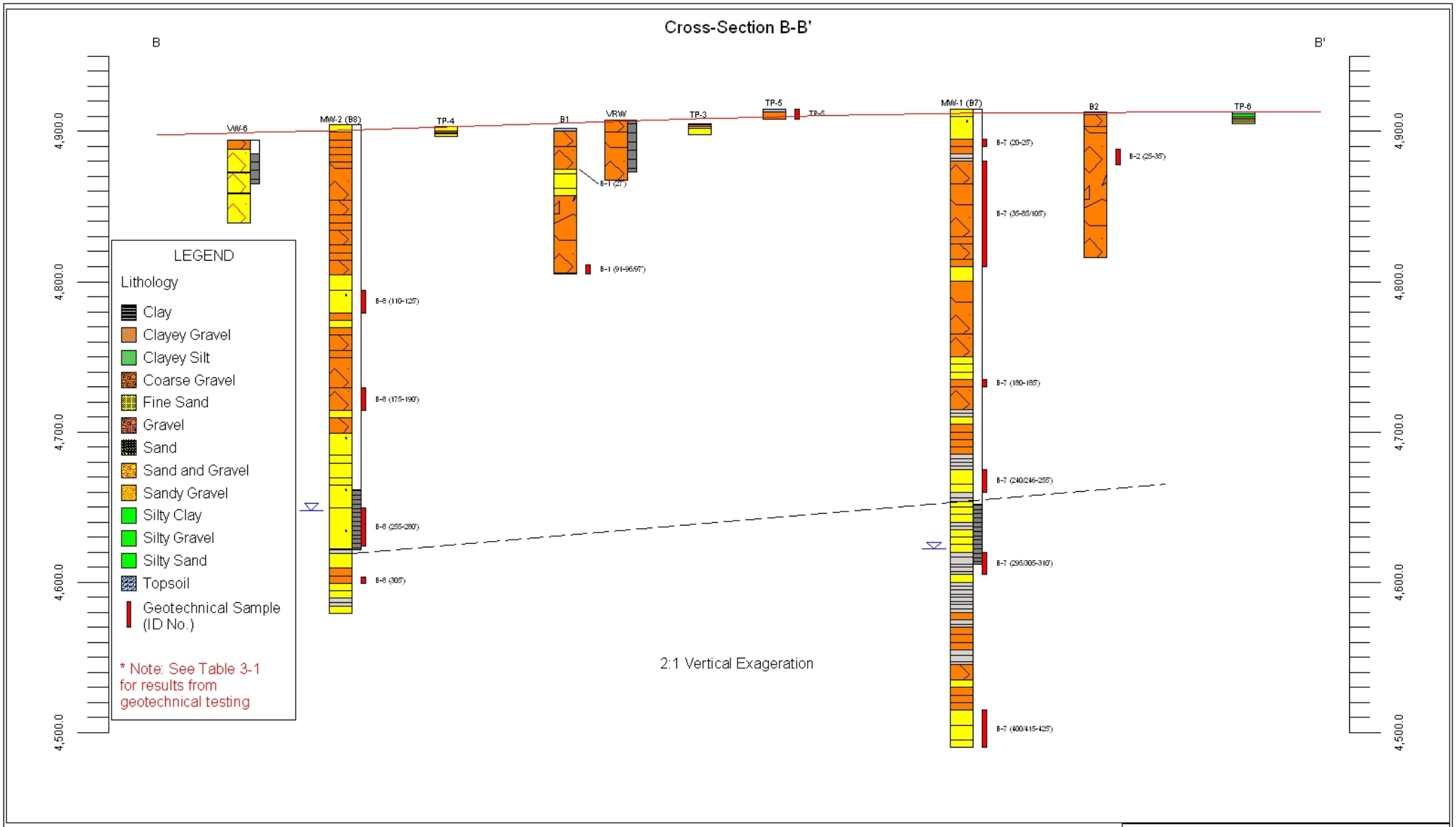


Figure 2-3
Cross Section B-B'

Metro ASR Water Bank Project