

Document 00911

NOTICE OF
ADDENDUM NO. ¹

Date of Addendum: 4/17/15

PROJECT NAME: Lift Station Renewal / Replacement Project – Woodway #1 Lift Station Replacement

PROJECT NO: R-000267-109B-4

BID DATE: April 23, 2015 (There is no change to the Bid Date.)

FROM: J. Timothy Lincoln, P.E., City Engineer
City of Houston, Department of Public Works and Engineering
611 Walker Street
Houston, Texas 77002
Attn: Akhter Hussain, P.E., Project Manager

TO: Prospective Bidders

The referenced Addendum forms a part of the Bidding Documents and will be incorporated into the Contract documents, as applicable.

Written questions regarding this Addendum may be submitted to the Project Manager following the procedures specified in Document 00200 – Instructions to Bidders. Immediately notify the City Engineer through the named Project Manager upon finding discrepancies or omissions in the Bid Documents.

This Addendum includes:

ADDENDUM SYNOPSIS

Changes to Project Manual
 Bidding Requirements
 Specifications
Changes to Drawings
Clarifications

DATED: 4/17/15

Ravi Kaleyatodi
Ravi Kaleyatodi, P.E.
Senior Assistant Director
Engineering & Construction Division
Department of Public Works and
Engineering

END OF DOCUMENT

Document 00910

ADDENDUM NO. 1

Date of Addendum: 4/17/15

PROJECT NAME: Lift Station Renewal / Replacement Project – Woodway #1 Lift Station Replacement

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This Addendum forms a part of the Bidding Documents and will be incorporated into the Contract documents, as applicable. Insofar as the original Project Manual and Drawings are inconsistent, this Addendum governs.

This Addendum uses the change page method: remove and replace or add pages, or Drawing sheets, as directed in the change instructions below. Change bars (|) are provided in the outside margins of pages from the Project Manual to indicate where changes have been made; no change bars are provided in added Sections. Reissued Drawing Sheets show the Addendum number below the title block and changes in the Drawing are noted by a revision mark and enclosed in a revision cloud.

CHANGES TO THE PROJECT MANUAL

BIDDING REQUIREMENTS

1. Document 00010 – Table of Contents. Replace pages 00010-8 and 00010-9.

SPECIFICATIONS

2. Document 13440 – Pump Station Control System. Replace document in its entirety.
3. Document 16105 – Power System Study. Add document in its entirety.

CHANGES TO THE DRAWINGS

4. Plan Sheet C107 titled "Woodway L.S. Prop. Overall Improvements" – Remove and Replace this sheet in its entirety.
5. Plan Sheet S8 titled "Control Building, Wall/Footing Plan & Section"- Add to Plan Set.
6. Plan Sheet E7 titled "3 Pump Single Line Diagram"- Remove and Replace this sheet in its entirety.
7. Plan Sheet E14 titled "Conduit Schedule For 480V 3 Pump System"- Remove and Replace this sheet in its entirety.
8. Plan Sheet E15 titled "Device Rating Schedule For 3 Pump System"- Remove and Replace this sheet in its entirety.
9. Plan Sheet D12 titled "Concrete Paving Details 3"- Remove and Replace this sheet in its entirety.

CLARIFICATIONS

10. Question from Contractor: Please list Flowserve as an acceptable manufacturer for submersible sewage pumps in Section 11311. Please see attached Pump Curve

Response: Contractor is allowed to use pump manufacturers not listed in Section 11311 provided that the pump meets the criteria listed in Section 11311- "Submersible Wastewater Pumps" and the EOR approves the pumps as an approved equal product substitution via submittals during the construction project.

11. Question from Contractor: What is the wet well lined with?

Response: Any protective spray-on or hand applied coatings meeting the criteria included in Section 09904 – “Protective Coatings for Wastewater Wet Wells” is acceptable.

12. Question from Contractor: Is 300 GPM the peak wet weather flows required for bypass pumping? Both the construction phase and the post substantial completion phase?

Response: Yes, see Section 01110 paragraphs 1.02 (A) (2) and (3); as well as, paragraph 1.06 (A)(5) of the Project Manual for additional clarification.

13. Question from Contractor: Can the time be extended by 60 days to allow coordination time with other contractors? This would make the project time 365 days instead of the 300 currently in the bid form.

Response: Per Document 00410A the contract time is 301 days.

14. Question from Contractor: Are there any special requirements from wastewater operations about the bypass system? 7 day test? Etc.

Response: No, Diversion Pumping should comply with specification 01506.

15. Question from Contractor: Can the lift station be 7 day tested before the proposed by others gravity work is complete?

Response: Yes, the Contractor for Contract WBS No. R-000267-109A-4 is directed to work from downstream to upstream and coordinate work with the Contractor of Contract WBS No. 000267-109B-4.

16. Question from Contractor: Is there a detail for the drop manhole on the 12” force main tie in? The standard force main discharge manhole from the city has a max discharge size of 24”. Alternatively can the 12” force main be run to a force main discharge manhole and then gravity to the existing manhole?

Response: Use the standard force main discharge manhole detail 02082-07 that is shown on Sheet D7 (Sheet 118 of 125). The alternate of the 12” force main being run to a force main discharge manhole and then gravity to the existing manhole is not in the scope of work and will not be accepted.

17. Question from Contractor: Currently there is a wimax antenna on site that is not shown on the drawings. Is this antenna to be reused?

Response: The existing antenna, pole, and equipment on site was recently installed. The contractor will evaluate the condition and compatibility of the existing antenna, pole, and equipment and coordinate with the City of Houston Construction project manager whether to replace the existing antenna, pole, and equipment. Should the City of Houston Construction project manager and the contractor agree that the existing antenna, pole, and equipment is usable, the contractor supplied antenna, pole, and equipment should be delivered to the City Wastewater department. Should the Contractor and City of Houston Construction Project Manager conclude that the existing antenna pole, and equipment are not compatible, install new items. All submittals documents for the antenna, pole, and equipment should be submitted and reviewed for approval as normal. The contractor should include in the bid price the cost for supplying and installing all items in the bid document.

18. Question from Contractor: Is the sending and receiving of data to the control center via WiMAX included in our scope?

Response: The data transfer over WiMAX system to Groveway shall be provided by the contractor in coordination with the City of Houston Wastewater SCADA group. All programming for the PLC and HMI can be provided by an approved instrument Contractor or Automation Nation in compliance with specification 13440.

19. Question from Contractor: Will the programming be completed by the City of Houston? Can the programming be completed by any controls manufacturer or is the programming required to be completed by Automation Nation Inc.?

Response: The programming at the Groveway Control Center shall be provided by City of Houston Wastewater Operations Personnel Staff or assigned contractor (Automation Nation). All other programming should be provided by the contractor in compliance with specification 13440.

20. Question from Contractor: What size, type of reinforcing or other related construction information is required for the electrical building pad?

Response: Sheet S8 titled "Control Building, Wall/Footing Plan & Section" has been added to the Plan Set and provides the necessary information for construction of the electrical building pad.

21. Question from Contractor: This question has to do with the specification for fiber optic cable under the instrument and control portion of the bid. Will this project required new fiber optic cable?

Response: *Fiber optic cable is not required under the instrument and control portion of the bid. See specification 13440.*

END OF ADDENDUM NO. 1

DATED: *E.L.N.*

Ravi Kaleyatodi
Ravi Kaleyatodi, P.E.
Senior Assistant Director
Department of Public Works and
Engineering

END OF DOCUMENT

Edward L. Nagorski



4/16/2015

<u>Doc. No.</u>	<u>Document Title</u>	<u>Doc. Date</u>
DIVISION 6 - WOOD AND PLASTICS		
06610	FIBERGLASS REINFORCED PLASTICS PULTRUDED GRATING	05-30-2007
DIVISION 9 - FINISHES		
09901	PROTECTIVE COATINGS	01-01-2011
09901S	PROTECTIVE COATINGS	01-15-2014
09904	PROTECTIVE COATINGS FOR WASTEWATER WET WELLS	01-01-2011
09917	CORROSION PROTECTIVE COATING SYSTEM	10-07-2010
DIVISION 10 - SPECIALTIES		
DIVISION 11 – EQUIPMENT		
11311	SUBMERSIBLE WASTEWATER PUMPS	09-04-2013
DIVISION 13 - SPECIAL CONSTRUCTION		
13440	PUMP STATION CONTROL SYSTEM	08-01-2014
13441	SCADA SOFTWARE ENGINEERING SECURITY AND QUALITY REQUIREMENTS	12-26-2013
13446	PRIMARY INSTRUMENTATION DEVICES	01-01-2010
13471	CONTROL CABINET ENCLOSURES	01-01-2010
DIVISION 15 – MECHANICAL		
15050	BASIC MECHANICAL MATERIALS AND METHODS	09-18-2011
15053	PUMP STATION PIPING	09-18-2011
15126	VALVES FOR SEWAGE SERVICE	05-30-2007
DIVISION 16 – ELECTRICAL		
16010	BASIC ELECTRICAL REQUIREMENTS	01-01-2010
16060	ELECTRICAL DEMOLITION	01-01-2010
16105	POWER SYSTEM STUDY	08-01-2014
16111	CONDUIT, FITTINGS, AND BODIES	01-01-2010
16120	600-VOLT BUILDING WIRE AND CABLE	01-01-2010
16121	600-VOLT CONTROL CABLE	01-01-2010
16122	600-VOLT POWER CABLE	01-01-2010
16123	MEDIUM VOLTAGE POWER CABLE	01-01-2010
16125	THERMOCOUPLE EXTENSION CABLE	01-01-2010
16126	INSTRUMENTATION CABLE	01-01-2010
16131	DEVICE, PULL AND JUNCTION BOXES	01-01-2010
16140	WIRING DEVICES	01-01-2010
16160	CABINETS AND ENCLOSURES	01-01-2010

<u>Doc. No.</u>	<u>Document Title</u>	<u>Doc. Date</u>
16161	PANELBOARDS.....	01-01-2010
16165	DISCONNECT SWITCHES.....	01-01-2010
16170	GROUNDING AND BONDING.....	01-01-2010
16195	ELECTRICAL IDENTIFICATION.....	01-01-2010
16290	SURGE PROTECTION DEVICES.....	01-01-2010
16402	UNDERGROUND DUCT BANKS.....	01-01-2010
16410	LOW VOLTAGE POWER FACTOR CORRECTION CAPACITORS.....	01-01-2010
16461	DRY-TYPE TRANSFORMERS.....	01-01-2010
16480	MOTOR CONTROL CENTER.....	01-01-2010
16481	MEDIUM VOLTAGE MOTOR CONTROL CENTER.....	01-01-2010
16510	LIGHTING LUMINAIRES.....	01-01-2010
16640	CATHODIC PROTECTION FOR PIPELINES.....	01-01-2010
16662	MOTOR MANAGEMENT RELAY.....	01-01-2010
16670	LIGHTNING PROTECTION SYSTEM.....	01-01-2010
16910	MANUAL TRANSFER SWITCH.....	01-01-2010

END OF DOCUMENT

Section 13440

PUMP STATION CONTROL SYSTEM

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Programmable logic controllers (PLCs), remote input/output (I/O) units, Human Machine Interface (HMI), and programmer.

1.02 REFERENCES

- A. National Electrical Manufacturers Association (NEMA).
 - 1. NEMA ICS 1 - General Standards for Industrial Control and Systems.
 - 2. NEMA ICS 2 - Standards for Industrial Control Devices, Controllers and Assemblies.
 - 3. NEMA ICS 3 - Industrial Systems.
 - 4. NEMA ICS 6 - Enclosures for Industrial Controls and Systems.
 - 5. NEMA ST 1 - Standard for Specialty Transformers (Except General Purpose Type).
- B. Instrument Society of America (ISA).
- C. Underwriters Laboratories, Inc. (UL).
- D. Factory Mutual (FM).
- E. Institute of Electrical and Electronic Engineers (IEEE).
- F. National Fire Protection Association (NFPA). ANSI/NFPA 70 - National Electrical Code (NEC).
- G. Joint Industrial Council (JIC).
- H. American National Standards Institute (ANSI).

1.03 SUBMITTALS

- A. Submit product data, shop drawings and samples (if samples are requested by the City Engineer) under provisions of Section 01330 - Submittal Procedures.

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1. Submit in complete packages grouped to permit review of related items as outlined in these specifications.
 2. Bind submittals in three-ring binders with complete indexing and tab dividers. Completely tag and label equipment information to correspond with Drawings.
 3. Review of Submittals will be for conformance to Contract Documents and for application to specified functions.
- B. Product Data: Submit descriptive product literature including manufacturer's specifications for each component specified.
- C. Shop Drawings: Indicate layout and mounting of completed assemblies and systems, interconnecting piping and cabling, dimensions, weights, external power and communication connections and programming information.
1. Panel, Console and Cabinet Information.
 - a. Layout drawings, including the following:
 - 1) Front, rear, end and plan views to scale.
 - 2) Dimensional information.
 - 3) Tag numbers and functional names of components mounted in and on panels, consoles or cabinets.
 - 4) Product information on panel components.
 - 5) Nameplate locations and legends, including text, letter sizes and colors to be used.
 - 6) Location of anchoring connections and holes.
 - 7) Location of external wiring and piping connections.
 - 8) Mounting and installation details.
 - 9) Proposed layouts and sizes of graphic display panels.
 - b. Wiring and piping diagrams, including the following:
 - 1) Name of panel, console or cabinet.
 - 2) Wiring sizes and types.

- 3) Piping and tubing sizes and types.
 - 4) Terminal strip numbers.
 - 5) Color coding for each wire and color coding legend.
 - 6) Functional name and manufacturer's designation of components to which wiring and piping are connected.
- c. Electrical control schematics in accordance with JIC standards.
 - d. Plan showing equipment layout in each area.
2. Field Wiring and Piping/Tubing Diagrams
- a. Wiring and piping/tubing sizes and types.
 - b. Terminal strip, device terminal and wire numbers.
 - c. Color coding.
 - d. Designation of conduits in which wiring is to be located.
 - e. Location, functional name and manufacturer's designation of items to which wiring or piping are connected.
 - f. Point-to-point wiring diagrams identifying every termination point and connection.
3. Instrumentation Diagrams
- a. Prepare instrument loop diagrams for analog and digital displays, and control and I/O loop diagrams, using ISA standard symbols in accordance with ISA Standard S5.4. Drawings shall follow the format in Attachment C and include the following:
 - 1) Instrument tag numbers.
 - 2) Functional name, manufacturer's name, product name and model or catalog number of each item.
 - 3) Location of each item.
 - b. Submit loop diagrams, wiring diagrams, PLC and control schematics on 4.7 GB DVD, formatted as AutoCAD files using the latest release of AutoCAD current and available on bid date, or any subsequent version. Identify diagrams, schematics and other files with computer-printed labels affixed to each diskette.

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Leave at least 200,000 bytes free space available on each DVD.

- c. In addition, submit such diagrams and schematics laser-printed on 8.5-inch x 11-inch paper. Use lettering and numerals of at least 1/16-inch nominal height.
4. Programmable Controller System I/O Loop Wiring Diagrams
 - a. Prepare drawings on a module-by-module basis. Include the following information:
 - 1) Rack numbers, module types and slot numbers, module terminal point numbers, and location and identification of intermediate panel and field terminal block and strip numbers to which I/O wiring and power supply wiring is connected. Identify power supply circuit numbers and ratings.
 - 2) Wiring sizes, types, wire numbers and color coding.
 - 3) Designation of conduits in which field I/O wiring is to be run.
 - 4) Locations, functional names, tag numbers and manufacturer's names and model numbers of panel and field devices and instruments to which I/O wiring is connected. Label wiring and cables at both ends and within junction and terminal boxes. Use sleeve-type plastic wire markers covered with clear heat-shrink labels, or machine-printed permanent ink heat-shrink labels by Brady or approved equal.
 - b. For each drawing, submit one reproducible hardcopy and one copy on 4.7 GB DVD, formatted as AutoCAD files using the latest release of AutoCAD current and available on bid date, or any subsequent version. Identify diagrams, schematics and other files with computer-printed labels affixed to each diskette. Leave at least 200,000 bytes free space available on each DVD.
 - c. In addition, submit such diagrams and schematics laser-printed on 11 x 17 inch paper. Use lettering and numerals of at least 1/16 inch nominal height.
5. System Programming Information
 - a. At least six weeks prior to substantial completion, submit detailed programming information consisting of ladder logic and

proposed program code, complete input, output, relay, register and controller identification labels, memory allocation table, and written description of program operation.

- b. Ladder logic diagrams shall contain a written descriptive note for each line of program code describing the function and logic of that line.
- c. Submit documents in hard copy and as computer-readable files 4.7 GB DVD. Leave at least 200,000 bytes free space available on each DVD. PLC, HMI, MPR, VFD and all other operational, installation and application related programs required necessary by the City of Houston with the installation shall be submitted in native programming language files.

D. Quality Control Submittals

- 1. Factory Test Reports: If specified, submit 6 copies.
- 2. Testing Procedures: Submit testing procedures proposed to verify input, output, loop and register operations, system logic verification, and spare memory capacity. Testing procedures shall detail, as a minimum, verification of required functions as follows:
 - a. Verification of pump start, pump stop, and well level alarm outputs by simulation of analog signals representing pump level.
 - b. Verification of each discrete input via external manually-operated switch.
 - c. Verification of each analog input by connection of external analog indicator in input loop.
 - d. Verification of each analog output by connection of external analog indicators.
 - e. Verification of communications system by hardwire connection via modem and wiring to a similar unit. Demonstrate operation and status monitoring of each register specified for external monitoring.
 - f. Verification of spare memory capacity by hard copy printout of full memory bit map after successfully demonstrating that system logic, inputs, outputs and communications features are fully installed and operational.
 - g. Test and verify system with external devices required to

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simulate field connections connected simultaneously for a full system test.

- h. Reconnecting external devices to verify portions of the systems at a time is not acceptable.
 - 3. Certificates: Under provisions of Section 01450 - Contractor's Quality Control, submit manufacturers' certificates that equipment and systems meet or exceed specified requirements.
 - 4. Instructions: Submit manufacturer's installation instructions for each component specified.
 - 5. Field Reports: Submit 6 copies of Manufacturer's Installation Inspection, Field Calibration and Field Testing Reports.
 - 6. Site Acceptance:
- E. Operations and Maintenance (O&M) Data.
- 1. Submit operation and maintenance data notebook in accordance with Section 01782 - Operations and Maintenance Data.
 - 2. Information and drawings submitted must reflect the final installed condition. Revise documents requiring updates following testing and start-up.
 - 3. In addition to the content specified in Section 01782 - Operation and Maintenance Data, provide the following information:
 - a. Name, address and telephone number of the control system supplier's local service representative.
 - b. Complete list of supplied system hardware parts with full model numbers referred to system part designations, including spare parts and test equipment provided.
 - c. Copy of approved submittal information and system shop drawings as specified in Paragraph 1.3, Submittals, with corrections made to reflect actual system as tested, delivered and installed at the site. Provide half-size blackline reproductions of all shop drawings larger than 11 inches x 17 inches.
 - d. Complete up-to-date system software documentation.
 - e. Original copies of manufacturer's hardware, unprotected

software, installation, assembly and operations manuals for the programmable controller and data communication system, single loop and multi-loop controllers and other control system components. In addition to hard copy versions, provide all manuals in PDF format on 4.7 GB DVD.

- f. Instructions for PLC replacement adjustment, and preventive maintenance procedures and materials.
- g. Control system description and system operation sequence instructions.
- h. For each major system/subsystem, in separate binders, submit PLC ladder logic programming documentation (fully annotated of each network headers, logical elements, control descriptions), PLC I/O schematics, control and loop diagrams, electrical drawings, system description, operation instructions and files on 4.7 GB DVD.

F. Project Record Documents

- 1. Submit record documents under provisions of Section 01785 - Project Record Documents.
- 2. Revise system shop drawings, software documentation and other submittals to reflect system as installed. Accurately record locations of controller cabinets and input and output devices connected to system. Include interconnection wiring and cabling information and terminal block layouts on site in the rain all weather writing paper in a suitable drawing pocket installed inside the controller cabinet door.
- 3. Insert half-size blackline prints of wiring diagrams applicable to each control panel in a clear plastic envelope and store in a suitable print pocket or holder inside each control panel.

1.04 QUALITY ASSURANCE

- A. **Manufacturer's Qualifications:** Manufacturer shall be a company specializing in manufacturing products specified in this Section, having proven compatibility with the City's existing facilities and at least 5 years of documented experience. The company shall maintain service facilities within 100 miles of the City of Houston.
- B. **System Integrator / Panel shop Qualifications:** System Integrator / Panel shop shall be a company specializing in installation of products specified in this Section, having proven experience with the City's existing facilities and at

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least 5 years of documented record. The company shall maintain service facilities within 100 miles of the City of Houston.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver products to site in factory-sealed containers. Store and protect products under provisions of Section 01610 - Basic Product Requirements.
- B. Check for damage upon receiving products on site.
- C. Store products in a clean, dry area; maintain temperature in accordance with NEMA ICS 1.

1.06 ENVIRONMENTAL REQUIREMENTS

- A. Maintain temperature above 32 degrees F and below 104 degrees F during and after installation of products.
- B. Maintain area free of dirt and dust during and after installation of products.
- C. Provide temporary heating and air conditioning units and equipment required to maintain environmental conditions specified for control and MCC panels.

1.07 MAINTENANCE SERVICE

- A. Provide manufacturer's maintenance services for programmable logic controllers for one year from Date of Substantial Completion without additional cost to the City.

PART 2 P R O D U C T S

2.01 PROGRAMMABLE LOGIC CONTROLLER (PLC)

- A. Manufacturer and Product: Siemens Model S7-315-2PN/DP; with integral Ethernet, the latest version at the time of delivery, or approved equal
- B. Description: Modular Programmable Controller and Removable 2 MB Micro Memory Card.
- C. Service Conditions
 - 1. Temperature: 32 to 140 degrees F, horizontally installed.
 - 2. Humidity: 5 to 95 percent, non-condensing.
 - 3. Electromagnetic Compatibility: Noise suppression to EN 50082-2, Noise emission to EN50081-2.

4. Vibration: IEC 68, Part 2-6/10 to 58 Hz.
5. Shock: IEC 68, Part 2-27/half-sine: 15 g peak, 11 milliseconds.

D. Configuration

1. Processor Rack: Include processor, power supply, micro memory card, communication modules, and input/output modules with front connectors.
2. Expansion Unit: Include interface module, power supply, communication module, input/output modules, front connectors and necessary connection cables.
3. Mounting Rail: Provide passive mounting rail for processor, power supply, communication, and input/output modules.

E. Processor Unit

1. Integrated Memory: Internal 256 KB minimum
2. Execution Time, Bit Operations: 0.1 microseconds.
3. Execution Time, Word Operations: 0.2 microseconds.
4. Execution Time, Fixed Point Arithmetic: 2 microseconds.
5. Execution Time, Floating Point Arithmetic: 3 microseconds.
6. Ports: See 2.01.H
7. Storage Memory: Micro Memory Card, minimum 2 MB.

F. Power Supply

1. Input: 85-132/170-264 VAC, switch-selectable.
2. Output: 24 VDC, 5-amp.
3. Mounting: On PLC Mounting Rail.
4. Front Panel: Green status LED, On/Off Switch, Input Voltage Selector.
5. Output Terminations: Screw terminations with connector to PLC CPU, plus additional terminations for wiring to other control system 24 VDC needs.

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G. Input/Output Units

1. Spare Input/Output Capacity: At least 25 percent spare capacity of each I/O type installed.
2. Discrete Input Characteristics: 16 points; 24 volts DC.
3. Analog Input Characteristics: 8 channels for configurable in groups of 2, 4 to 20 milliamperes DC.
4. Discrete Output Characteristics: 16 points; Relay.
5. Analog Output Characteristics: 8 channels, 4 to 20 milliamperes DC.

H. Communication Interfaces for Remote Lift Station:

1. Profibus-DP: Integral to CPU, master/slave, capable up to 12 Mbit/sec, configured in standard PLC programming environment. Supports Profibus-DP Master, Profibus-DP Slave, MPI with programmer, HMI and S7 communications.
2. Ethernet Interface: Integral to CPU, 10/100 Mbps with automatic speed detection, supports open TCP/IP, PLC programming, HMI communications, ST Communications, Profinet CBA and Pronet IO-Controller.

I. Ethernet Networking for WiMAX interface

1. Ethernet Switch
 - a. Manufacturer and Model: Siemens Industry, X310
 - b. Design: Industrial, Managed, DIN Rail Mount
 - c. Copper Ports: Ten (10) RJ45, 10/100 Mbps
 - d. Fiber Optic Ports: None
 - e. Configuration Back-up: Include configured C-Plug

J. Programming, Software and Programming Equipment

1. Configure system and program for operation as specified in this Section.
2. System Software: Siemens Step 7 software will be loaned by City for utilization by contractor on this project. Contractor to

supply any other software or interfaces and cables needed to support equipment supplied on this project.

3. Control Program: A generic lift Station PLC Control Program will be provided by Wastewater Operations. Contractor shall provide necessary programming modifications and enter the required variable parameters to provide a complete functional and integrated system. Contractor shall customize the generic software to meet site-specific conditions. The system shall be fully tested to be operational prior to substantial completion.
4. Control Program Data Sheet: Contractor shall complete and submit Lift Station Data Sheet to Control Program Librarian designated by City of Houston. System I/O list shall be submitted with Data Sheet to the City of Houston two weeks prior to the 7-day test where communication can be verified by the Control Center. (Refer to Attachment 13440 A and B)
5. Programmer (City of Houston Wastewater Plant applications only): HP ZBook Mobile Workstation or equivalent current model, new, submitted in the original package including manuals having at least the following features as minimum:
 - a. Operating system: Genuine Windows 7 Professional 64
 - b. Processor: Intel Core i7-4700MQ Processor (2.4 GHz, 4MB L3 cache)
 - c. Memory: 8GB 1600 MHz DDR3L SDRAM.
 - d. Hard drive: 750 GB 7200 rpm SATA, 32GB MSATA SSD
 - e. Optical drive: DVD-ROM; DVD+-RW SuperMulti DL LightScribe; Blue-ray R/RE DVD+/-RW SuperMulti DL
 - f. Display: 15.6 diagonal LED-backlight HD anti-glare
 - g. Graphics: NVIDIA Quadro FX 1800M graphics with 1 GB dedicated GDDR5 video memory.
 - h. I/O Ports: External – 3USB 2.0, 2USB 3.0, 1eSATA, 1 external VGA monitor, 1 Display Port, 1 1394a, 1 stereo microphone in, 1 stereo headphone/line-out, 1 AC power, 1 RJ-11, 1 RJ-45, 1 docking connector, 1 secondary battery connector.
 - i. Slots: 1 Express Card/54, 1 Smart Card Reader, 1 Secure Digital.

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- j. Network interface: Integrated Intel Gigabit Network Connection (10/100/1000 NIC).
 - k. Wireless: HP Mobile Broad (powered by Gobi) with GPS; Intel Centrino Ultimate-N 6300 (3x3) 802.11 a/b/g/n; HP Integrated Module with Bluetooth 2.1 Wireless Technology.
 - l. Energy Efficiency: ENERGY STAR
 - m. Battery: HP Long Life 8-cell (68 WHr) Li-Ion
 - n. Power supply: External 150-watt Smart AC adapter; External 120-Watt Smart AC adapter; External 90-watt Smart AC adapter; HP Fast Charge
 - o. Security management: Standard – Integrated Smart Card Reader, HP ProtectTools, TPM Embedded Security Chip 1.2, Enhanced Pre-Book Security, HP Spare Key (require initial user setup), HP Disk Sanitizer, Enhanced Drive Lock, drive Encryption for HP ProtectTools, Credential Manager for HP ProtectTools, File Sanitizer for HP Protect Tools
 - p. Warranty: HP services offers limited 3-year standard parts and labor onsite, next business day warranty, and toll-free 7 x 24 hardware technical phone support; 1-year limited warranty on primary battery. On-site service and warranty upgrades are also available.
 - q. Preinstalled Microsoft Windows in latest versions currently available that are compatible with HMI software.
 - r. Programming cable and adapter for PLC programming.
 - s. Compaq Workstation carrying case (overall size 18"x13"x5").
- K. Provide at least 25% of each PLC module furnished as spare parts. Minimum spare parts will include the following for each type furnished:
- 1. One discrete input, of each type.
 - 2. One discrete output, of each type.
 - 3. One analog input, of each type.
 - 4. One analog output, of each type.
 - 5. One PLC power supply, of each type.

6. One CPU with Profibus-DP and Ethernet ports.

7. One Ethernet Switch where applicable

L. Connect PLC inputs/outputs including analog inputs through snap-on isolated fused terminal blocks.

M. Separate the AC and control signals from DC and loop signals by at least 6 inches. Provide a barrier between AC and DC within the raceways.

2.02 LOCAL WORK STATION

A. General

1. Manufacturer and Model: Siemens Energy & Automation, TP900 touch panel.
2. Display: 9.0" 800 x 480 TFT LCD Touch Panel.
3. Keyboard: Numeric / Alphabetic Entry.
4. Memory: 12 MB.
5. Memory Card: Two MMC/SD combination slot
6. Operating System: Windows CE
7. Ports: One RS 422/485, USB, Ethernet RJ-45
8. Power: 24 VDC.
9. Certifications: IP65 / NEMA 4 / FM Class I, Division 2 when mounted.
10. Configuration: A generic Lift Station HMI Configuration will be provided by Wastewater Operations. Contractor shall provide necessary modifications and enter the required variable parameters to provide a complete functional and integrated system. Contractor shall customize the generic software to meet site-specific conditions. The system shall be fully tested to be operational prior to substantial completion.
11. Configuration Software: Configuration software not including cable will be loaned by City for utilization by contractor on this project. Contractor to supply any other software needed to support equipment supplied on this project.

PUMP STATION CONTROL SYSTEM

12. Provide necessary cables and connectors to communicate between Operator Panel and PLC processor. Following is a list of sample displays to be provided:
 - a. Display 1: Name/Address.
 - b. Display 2: Screen Listing.
 - c. Display 3 to 5: Pumps 1 to 3 Status Alarms
 - d. Display 6: PLC I/O health Status.
 - e. Display 7: Wet Well Level Set points.
 - f. Display 8: Wet Well Level Readings.
 - g. Display 9: 7-day level trends
13. Supply configuration software, latest version, and download cable.
14. Note: Pump Information and necessary status points shall be configured as needed. All configurations shall be performed by the contractor.

PART 3 EXECUTION

3.01 SYSTEM DESCRIPTION

- A. Level Measurement System: Equip pump station with two independent well level measurement systems, each system consisting of a submersible transmitter and associated cable and installation mounting hardware to provide a 4-20 mA loop signal proportional to well level and recorder as indicated on the Drawings.
- B. Installation: Fabricate and install stilling well for each submersible transmitter.
 1. Support Hardware: Provide mounting hardware shown on the Drawing Z0C01 for supporting 6" Schedule 80 PVC inside support to guide each transmitter cable and cord.
 2. Support cable: 1/8 inch stainless steel 316 cable to support and hold transmitter.
 3. Access manhole: Provide access manhole where the transmitter can easily be removed, installed, and maintained.
- C. Primary Pump Control-Constant Speed Pump used for 3 that are the

same ratings

1. PLC shall monitor the primary level measurement system and control a PLC output to energize a relay to start / stop pumps at preselected well levels as indicated on the Drawings.
2. The primary control system shall monitor a NO contact which closes when the pump is running and shall totalize pump running time and store last 100 entries.
3. The primary control system shall provide first-on first-off alternate sequencing of pump starts.
4. The primary control system shall provide a numerical sequencer to sequence available pumps.
5. The primary control system shall monitor a NO contact which closes when the HOA switch for each pump is in auto.
6. Stagger start times by 10 seconds between pump lead/lag stages to prevent pumps starting at the same time. It responses to a pump signal to run command not confirmed within 20 seconds (through auxiliary feedback, motor amperage report or level indication) shall remove that pump from service and the pump sequence, but transfer the command signal to the next available pump in the same sequence.
7. Phase failure, overload, high temperature, and seal leak (primary mode only), alarms shall cause a pump to stop in either Primary or Back-up mode. Alarm conditions shall keep the pump out of service and shall only be reset through the control panel push-button switch. In power failure condition, control shall automatically operate pumps in primary or back up mode when power is restored without local or remote alarm reset.
8. If a period of 8 hours expires with no pump sequence rotation (one pump running and more than one pump available), the control shall stop the lead pump and rotate the sequence.
9. Provide remote start, stop, and alarm reset capabilities.
10. Low level alarm shall cut all pumps off.
11. The primary control system shall test and select the functioning transmitter to control pumps in the primary mode (PLC).

D. Secondary Pump Control

1. Accomplish via back up pump controller specified in section 13446.

PUMP STATION CONTROL SYSTEM

Pump controls and alternations shall be performed by back up pump control. PLC shall provide a discrete output to select PLC mode of operation, and an independent discrete output for watchdog relay. Upon detection of a failure via the watchdog relay or selecting backup control via PLC, pump control shall be switched from PLC mode to backup mode.

2. Automatic switchover from PLC to backup mode shall also be initiated under the following conditions: When both transmitters fail (under range, 4 milliamps or less), when PLC I/O fails (control status bit tests), or when high level alarm is activated when no pump is running.
 3. Provide manual selector switch for PLC and backup mode.
 4. Provide hardware timer for backup control system to stagger pump starts (add time cubes to pump start relays).
 5. Allow 30 seconds for an automatic rollover to backup system for failure conditions to be true before a transfer takes place. System shall transfer to primary (PLC) when there is no fault and no pump running, or manual selector switch (toggle PLC/backup selector switch).
- E. Pump Status and Alarm Monitoring: PLC shall monitor NO contacts which close to indicate the following:
1. Pump status for each pump.
 2. Auto status for each pump.
 3. Alarm for each pump.
 4. Normal/Emergency power source
 5. Station undervoltage/phase failure alarm.
 6. Intrusion alarm (control building or control panel).
- F. Pump Controls: PLC shall provide an NO contact which closes and provides 120VAC to drive the following discrete pump control outputs:
1. Watchdog relay.
 2. PLC/backup control mode select.
 3. Start/stop for each pump.

4. Reset for each pump.
5. High/low level alarms.
- G. Pump Station Monitoring: Arrange PLC to monitor both wet well level transmitters to indicate pump station alarms or status.
- H. Communications: PLC shall be capable of full two-way communications with the City of Houston Central Control facility. Communications shall have the capability to transmit all station and pump status and alarms, well levels, PLC status and additional information indicated in the Drawings, and shall receive pump start/stop Set points, alarm Set points and miscellaneous data via City of Houston SCADA software package, protocol and WiMAX communication system. Provide necessary hardware and software required to implement the communications system as part of pump station control system work. Programming and modifications required at the City of Houston Central Control facility will be performed by the City of Houston. Contractor shall be responsible for coordinating and performing the communication testing.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions and Drawings. Provide sufficient clearance for calibration and maintenance access.
- B. Do not install products until major construction is complete and building interior is enclosed and heated.
- C. Connect input and output devices as shown on Drawings.
- D. Provide complete programming, testing and verification of the programmable controller and associated inputs and outputs, including work required to interface with the existing City of Houston system.

3.03 MANUFACTURER'S FIELD SERVICES

- A. Prepare and start systems under provisions of Section 01755 - Starting Systems.

3.04 DEMONSTRATION

- A. Provide systems demonstration under provisions of Section 01770 - Closeout Procedures.
- B. Demonstrate operation and programming of controller. Provide 2 sessions of 4 hours of instruction each for 4 persons, to be conducted at project site with manufacturer's representative.

PUMP STATION CONTROL SYSTEM

- C. System demonstration shall include the following:
1. Complete verification of field wiring.
 2. Complete verification of system software.
 3. Demonstration of functionality of each discrete input and output by simulation of actual field device action.
 4. Demonstration of functionality of each analog input and output by actual variations in the process variable (e.g. well level, etc.).
 5. Complete demonstration of each alarm by simulation of actual field device action.
 6. Complete demonstration and verification (status/alarm points) of 2-way communication with City of Houston Central Monitoring Facility.

3.05 TRAINING (City of Houston projects only.)

- A. Provide engineering and programming schools preferably at the Houston offices of the PLC manufacturer or distributor or at the manufacturer's factory, as specified below. This training shall be performed by fully-qualified and manufacturer-certified training personnel who can clearly illustrate experience in teaching previous courses. Obtain approval from the Owner's representative for training facility and course outline before scheduling training.
- B. If such training is provided somewhere other than Houston, then the system supplier shall provide coach airfare (weekday travel), motel expenses (\$95.00/day/person), rental cars (\$50.00/day/2 people), and meal allowances \$35.00/day/person) for selected City personnel for the duration of the schools.
- C. Schedule classes at the City of Houston's convenience. The supplier should not assume that the City's personnel will attend these courses in a continuous and sequential manner. When training is submitted in voucher form, it shall be valid for a minimum of 2 years at no extra cost to the City.
- D. Training shall consist of the following as a minimum:
1. PLC basic/advanced programming/maintenance (5 days): Four (4) people

END OF SECTION

Section 16105

POWER SYSTEM STUDY

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall provide a Power System Study for the electrical power system, including a Short Circuit Study, Coordination Study, Arc Flash Hazard Study, Motor Starting Voltage Drop Study and additional studies as listed below. A Load Flow Study shall be supplemented with appropriate load factors, by the Study Engineer, in consultation with the Owner/Engineer.
- B. The electrical power system shall be deemed to include the utility company's transformer, the Owner's power distribution system, including all existing and new system components, associated with this project. The short circuit and coordination study reports shall provide an evaluation of the electrical power systems and the model numbers and settings of the protective relays or devices and metering or motor monitoring devices for setting by the Contractor.
- C. The Contractor shall include the use of his own forces to obtain all pertinent data necessary for the successful completion of the Power System Studies, including information on all existing and new equipment and wiring pertinent to the Study. This shall be interpreted to include all cable and raceway data, and data from all existing and/or new switchgear, motor control centers, and switchboards. Obtain all existing or new protective device information to include all present settings. The Contractor shall obtain any needed data or information from Contract Documents, various suppliers, the Electric Utility and from conducting his own field investigations. If, in his field investigations, the Contractor encounters conflicts between the Contract Documents and the field conditions, the Contractor shall immediately notify the Owner/Engineer for a resolution to the conflict. Copies of the data obtained, shall be organized and submitted to the Owner/Engineer at the same time of transmittal to the Study Engineer, to show that all the requested data gathering work has been completed.

1.02 RELATED WORK

- A. The related work, associated with this Section, shall include all Sections of the Specifications, and the Contract Drawings.
- B. The Contractor shall diligently prosecute the work of providing the information required, to the Study Engineer, particularly that information required from the Contractor's electrical equipment suppliers.

1.03 SUBMITTALS

POWER SYSTEM STUDY

- A. The Contractor shall, not later than three (3) weeks after Contract Award, provide a submittal of the name and qualifications of the Study Engineer, for approval.
- B. The Contractor shall provide two individual submittals:
 - 1. The first submittal shall be considered a Preliminary Submittal, in that it shall consist only of the Short Circuit Study results, based upon sound engineering reasonable assumptions, where known values are not available. This submittal shall be used by the Study Engineer to ascertain the short circuit current rating of the related equipment. This submittal shall be made for approved prior to any shop drawing submittal being reviewed for electrical equipment for which the results of this preliminary study are required.
 - 2. The final submittal shall be the Final Submittal as defined in this Section. The Contractor is hereby advised that, no electrical equipment for which the results of the final study are required, shall be energized until such results have been applied to such electrical equipment, and certified as Settings Complete by the manufacturer's field representative.
- C. The Contractor shall, upon completion of the studies, submit the studies for approval to the Owner/Engineer. The study submittal shall include all of the input and output data files in electronic format for use directly with the specified study software. The Study shall include an actual size sample of an Arc Flash and Shock Hazard label with typical information shown. The Contractor shall allow not less than three (3) calendar weeks for review of the studies by the Owner/Engineer. The submittal shall not contain unresolved questions, conflicts or selective device coordination conflicts. A submittal containing such questions or conflicts will be returned unreviewed, and shall not be resubmitted until such questions or conflicts have been resolved.
- D. The completed, sealed, and signed studies, with all known issues resolved, shall be submitted to the Owner/Engineer for approval, not less than thirty (30) days prior to site delivery of any equipment containing protective devices requiring selections and settings for certification by the manufacturer. Final copies shall be in electronic form (Adobe PDF formatted files). SKM data files shall be provided at the same time in electronic format.

1.04 REFERENCE CODES AND STANDARDS

- A. The specified studies shall be in accordance with the latest versions of the following codes and standards.
 - 1. IEEE Standard 1584 – IEEE Guide for Performing Arc-Flash Hazard Calculations, Including Amendment 1584a-2004.
 - 2. NFPA-70E – 2004 - Standard for Electrical Safety Requirements for Employee Workplaces.

3. ANSI/NFPA 70 – National Electrical C B. The studies shall be performed using SKM Power Tools Electrical Engineering Analysis Software for Windows.

1.05 QUALITY ASSURANCE

- A. The studies shall be performed by an Electrical Engineering Services firm, who is regularly engaged in power system studies. The studies shall be performed by a Licensed Professional Electrical Engineer of the firm with proficiency in electrical power systems engineering and shall seal and sign the final completed power system studies. The Study Engineer shall be licensed to practice engineering in the state where the electric equipment is to be installed.
- B. The studies shall be performed using SKM Power Tools Electrical Engineering Analysis Software for Windows.
- C. Computer Model Revision Control
 1. The Study Engineer shall check out and receive from the Owner, prior to executing the Study, the base model computer file to be used with the SKM System Analysis computer program. The Study Engineer shall be responsible for the return of this computer file to Owner upon completion of the Study and acceptance of the Report by the Owner/Engineer.
 2. The Study Engineer shall incorporate the Study conducted for this Contract into the overall base model computer file. The updated file shall be returned to the Engineer for review along with the Report Submittal.
 3. The Study Engineer shall forward the updated base model computer file to the Owner upon approval of the Report Submittal. This shall constitute checking this file back in to the Owner. Should the Report Submittal be rejected for any reason, the base model computer file shall be returned to the Study Engineer for further use.

1.06 SCHEDULE OF WORK

- A. The selection of the Study Engineer shall be performed in a timely manner, in accordance with the time specified, and the Study performed and submitted as specified above.
- B. The completed studies, with all known issues resolved, shall be submitted to the Owner/Engineer for approval, as specified above.

PART 2 STUDIES

2.01 ELECTRICAL ENGINEERING SERVICES FIRMS

POWER SYSTEM STUDY

- A. Subject to compliance with the Contract Documents, the following services firms are acceptable:
1. Eaton Corporation Engineering Services
 2. General Electric Co. Engineering Services
 3. Schneider Electric Engineering Services
 4. Rockwell Engineering Services
 5. Siemens Engineering Services
 6. Approved Equal

2.02 SHORT CIRCUIT AND COORDINATION STUDY

- A. Provide a complete short circuit study. Include three phase, phase-to-ground calculations and X/R ratios. Provide an equipment interrupting or withstand evaluation based on the actual equipment and model numbers provided on this project. Generic devices are not acceptable. Normal system operating method, alternate operation, and operations that could result in maximum fault conditions, shall be thoroughly addressed in the study. Provide single phase to ground and three phase to ground fault information. The study shall assume all motors are operating at rated voltage with the exception that motors, identified as "standby," shall not be included. Electrical equipment bus impedances shall be assumed as zero. Short circuit momentary duties and interrupting duties shall be calculated on the basis of maximum available fault current at the switchgear busses, switchboard busses, motor control centers and panelboards. The study shall be performed using actual available short circuit currents as obtained from the Electric Utility. An assumption of infinite bus for the purposes of the study is not acceptable.
- B. Provide a protective device coordination study. The study shall include all electrical equipment provided under this Contract, including Control Panels containing power and protection equipment lighting panels and power panels. The Study shall include any upstream or downstream equipment that has an impact on the Coordination Study. The study shall show transformer damage curves, cable short circuit-withstand curves and motor curves. The phase overcurrent and ground fault protection shall be included, as well as settings for all other adjustable protective devices. All motor monitoring relays and protective or monitoring devices that are a part of a supplier's equipment, such as soft starters or adjustable frequency drives shall be included. Include the last protective device in the Electric Utilities' system feeding each facility being considered. Include all medium voltage switchgear, distribution switchboards, motor control centers and 480 Volt panelboard main circuit breakers. Complete the short circuit study down to the main breaker or largest feeder on all on all 480 Volt panelboards. Panelboard branch circuit devices need not be considered. The phase overcurrent and ground-fault protection shall be included, as well as settings for all other adjustable protective devices. All motor monitoring relays and protective or monitoring devices that

are a part of a supplier's equipment, such as soft starters or adjustable frequency drives, shall be included. Include the last protective device in the Electric Utilities system feeding each facility being considered.

- C. Provide an equipment evaluation study to determine the adequacy of the fault bracing of all bus from the panel board level up to the main switchgear or protective device. Include circuit breakers, controllers, surge arresters, busway, switches, and fuses by tabulating and comparing the short circuit ratings of these devices with the available fault currents.
- D. Selective device coordination is required between protective devices in equipment specified in each Section of the Electrical Specifications, and between each piece of electrical equipment, including existing equipment, supplied for this project. If the Study Engineer, in the course of his work, determines that selective coordination cannot be obtained in or between pieces of existing and new equipment as specified, he shall immediately notify the Contractor, provide his supporting information to the Contractor, who shall transmit the information to the Owner/Engineer for resolution of the problem.
- E. As a minimum, each short circuit study shall include the following:
 - 1. One-Line Diagram:
 - a. Location and function of each protective device in the system, such as relays, direct-acting trips, fuses, etc.
 - b. Type designation, current rating, range or adjustment, manufacturer's style and catalog number for all protective devices.
 - c. Power and voltage ratings, impedance, primary and secondary connections of all transformers. Use the ratings of the actual transformers being provided where available.
 - d. Type, manufacturer, and ratio of all instrument transformers energizing each relay.
 - e. Nameplate ratings of all motors and generators with their sub transient reactance.
 - f. Sources of short circuit currents such as utility ties, generators, synchronous motors, and induction motors. Provide short circuit studies using each source of power separately. The study shall determine if there is sufficient short circuit current to adequately cause interruption of a protective device using the weaker power source (typically local generation), and shall determine if the equipment can safely interrupt the fault if the greater power

POWER SYSTEM STUDY

source is connected. Additional short circuit calculations shall include emergency as well as normal switching conditions as well as normal and emergency power sources described here in.

- g. All significant circuit elements such as transformers, cables, breakers, fuses, reactors, etc. shall be included.
- h. The time-current setting of existing adjustable relays and direct-acting trips, if applicable.

2. Impedance Diagram:

- a. Available MVA or impedance from the utility company.
- b. Local generated capacity impedance.
- c. Transformer and/or reactor impedances.
- d. Cable impedances.
- e. System voltages.
- f. Grounding scheme (resistance grounding, solid grounding, or no grounding).

3. Calculations:

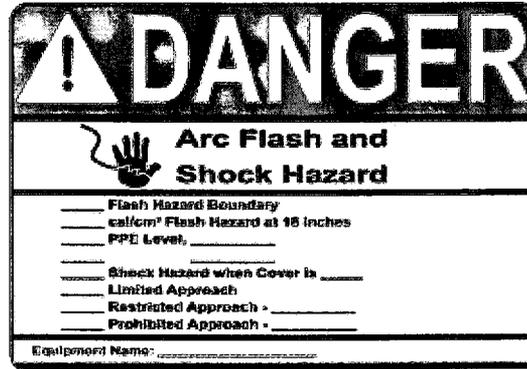
- a. Determine the paths and situations where short circuit currents are the greatest. Assume bolted faults and calculate the 3-phase and line-to-ground short circuits of each case.
- b. Calculate the maximum and minimum fault currents.

F. Provide Time-Current Curves on 8-1/2 X 11 log-log paper. Do not put more than one branch of protective devices on any one coordination curve. Include a one-line diagram and the names of each protective device in the branch on the coordination curve drawing. Provide separate drawings for ground fault coordination curves. Use the names designated in the Contract Documents. Include motor and transformer damage curves, and cable short circuit withstand curves.

G. The study shall include the low resistance ground (LRG) system and all associated components, including the settings of the appropriate relay to detect a single line to ground fault.

2.03 ARC FLASH HAZARD STUDY

- A. The Power System Study shall include an Arc Flash Hazard Study that shall present the level of arc flash hazard for each item of electrical equipment, and the appropriate level of protection required per OSHA standards.
- B. The analysis shall be performed with the aid of computer software intended for the purpose, in order to calculate Arc-Flash Incident Energy (AFIE) levels and flash protection boundary distances.
- C. The analysis shall be performed under worst-case Arc-Flash conditions, and the final report shall describe, when applicable, how these conditions differ from worst-case bolted fault conditions.
- D. The calculations shall be performed in accordance with IEEE 1584-2004 and safe approach requirements determined in accordance with NFPA-70E-2004.
- E. Results of the Analysis shall be submitted in tabular form, and shall include, device or bus name, bolted fault and arcing fault current levels, flash protection boundary distances, personal-protective equipment and AFIE levels.
- F. After approval of the Study, The Study Engineer shall provide and affix labels as may be required for each item of electrical equipment furnished on the project. A typical warning sign shall be submitted with the Study for approval, and as shown below.
 - 1. Flash Hazard Protection Boundary.
 - 2. Limited Approach Boundary.
 - 3. Restricted Boundary.
 - 4. Prohibited Boundary.
 - 5. Incident Energy Level.
 - 6. Required Personal Protective Equipment Class.
 - 7. Type of Fire Rated Clothing.
- G. Size of each label shall be not less than 8 inches wide and 6 inches tall.



2.04 MOTOR STARTING VOLTAGE DROP STUDY

- A. The motor starting study shall be provided for motors over 100 HP, full voltage started.
- B. The study shall select the largest motor on a bus and shall assume all other motors on that bus are running. Where a Main-Tie-Main bus configuration is present, the study shall be done with both Main breakers closed and the Tie breaker open, and with one Main open and the Tie breaker closed.
- C. Where the Utility feeders are feeding the switchgear, the study shall be done for each feeder based on the actual system impedance for each utility feeder.
- D. A motor starting analysis shall be made where on-site standby generation is available to power the MCC using only the available power from the generator. If the generator has been sized to run only part of the load, then the system shall be modeled with only that part of the load running.

PART 3 EXECUTION

3.01 FIELD SERVICES

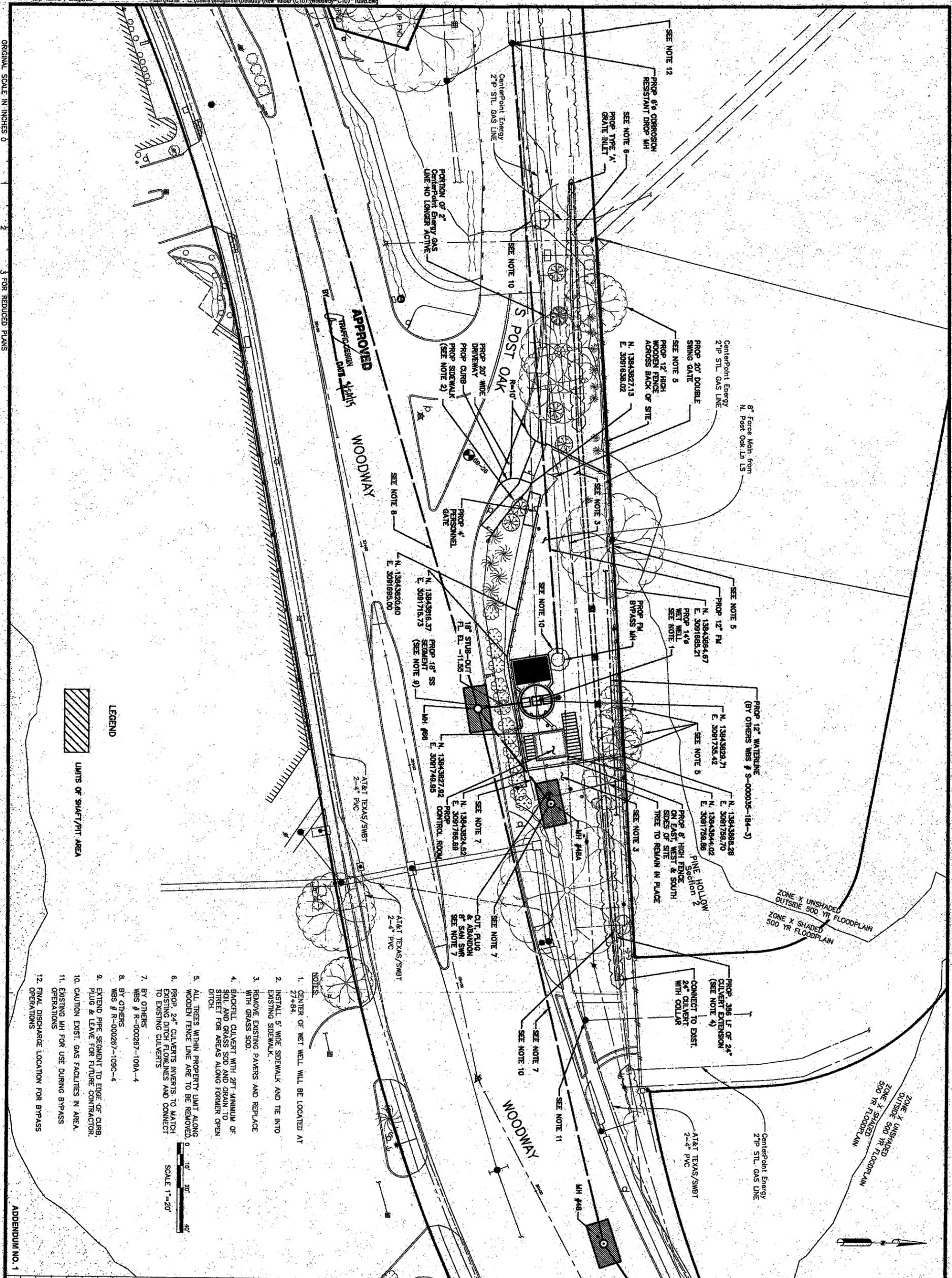
- A. Sign Installation Certification
 - 1. When the sign installation is complete, the Contractor and the Owner/Engineer shall jointly inspect the locations and to provide to the Owner/Engineer's satisfaction that signs are installed in all of the recommended locations indicated in the Study.
- B. Training
 - 1. The Contractor shall provide the services of the Arc-Flash Training Engineer, for a period of not less than one eight (8) hour working day, to conduct a training program for the Owner's personnel, in the care, application and use of protective personal equipment, described by the warning signs installed on the project. The training program shall be

conducted at a location onsite determined by the Owner, and shall include specific equipment locations as may be required for instruction. Applicable information from the Study shall be provided to the attendees.

- C. The cost of Field Services shall be included in the Contract Price.
- D. The Owner reserves the right to videotape the training for the Owner's use.

END OF SECTION

ORIGINAL SCALE IN INCHES 0 1 2 3 FOR REDUCED PLANS



LEGEND
 LIMITS OF SHAFT/PIT AREA

- NOTES**
- CENTER OF WET WELL WILL BE LOCATED AT 27+84.
 - INSTALL 5' WIDE SIDEWALK AND TIE INTO EXISTING SIDEWALK.
 - REMOVE EXISTING PAVERS AND REPLACE WITH GRASS SOD.
 - BACKFILL CULVERT WITH 2FT. MINIMUM OF SOIL AND GRASS SOD AND DRAIN TO STREET FOR AREAS ALONG FORMER OPEN DITCH.
 - ALL TREES WITHIN PROPERTY LIMIT ALONG WOODEN FENCE LINE ARE TO BE REMOVED.
 - PROP. 24" CULVERTS INVERTS TO MATCH EXISTING DITCH FLOWLINES AND CONNECT TO EXISTING CULVERTS.
 - BY OTHERS
 WBS # R-000267-109A-4
 - BY OTHERS
 WBS # R-000267-109C-4
 - EXTEND PIPE SEGMENT TO EDGE OF CURB, PLUG & LEAVE FOR FUTURE CONTRACTOR.
 - CAUTION EXIST. GAS FACILITIES IN AREA.
 - EXISTING MH FOR USE DURING BYPASS OPERATIONS.
 - FINAL DISCHARGE LOCATION FOR BYPASS OPERATIONS.



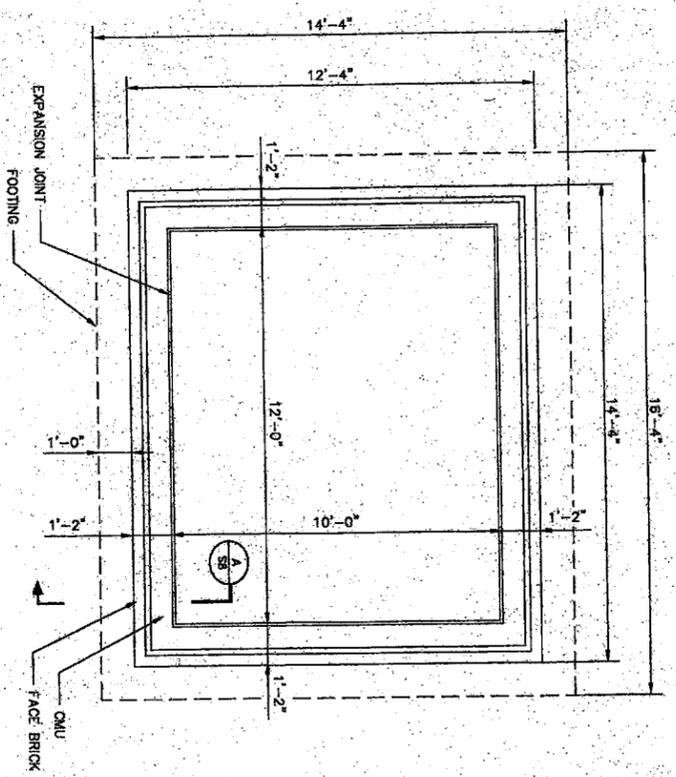
BENCHMARK:
 CITY OF HOUSTON MARKER
 5158-8202 LOCATED IN
 SOUTH-SIDE OF THE INTERSECTION OF
 CARNARVON DR & SANDRINGHAM DR.
 EL. = 60.88 (NAD 88, GCS
 OBSERVATION MADE IN JULY 2012)

IBM:
 CP-8, SET MAG NAIL AT
 STA 26+48.60; 39.23' LT.,
 EL. 45.92

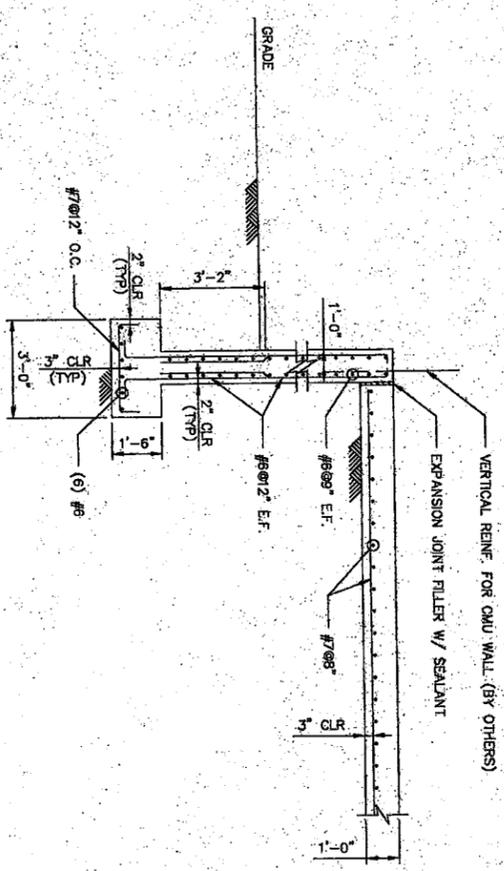
100 YEAR FLOOD ELEVATION =
 43.5 FEET (NAVD88 2001 ADJ.)
 500 YEAR FLOOD ELEVATION =
 49.5 FEET (NAVD88 2001 ADJ.)

<p>ARCADIS 2929 Briarpark Dr Suite 300 Houston, TX 77042 Tel: 713-953-4800 Fax: 713-977-4820 www.arcadis-us.com Texas Registered Engineering Firm F-533</p>		<p>DATE: FEBRUARY 2015 DESIGNED BY: ENAGORSKI DRAWN BY: ENAGORSKI</p>
<p>City of Houston Department of Public Works and Engineering</p>		<p>DATE: 08/24/2015</p>
<p>PROJECT: LIFT STATION RENEWAL/REPLACEMENT PROJECT</p>		
<p>WOODWAY L.S. PROP OVERALL IMPROVEMENTS</p>		
<p>C107</p>		
<p>WSP# R-000267-109B-4 DRAWING SCALE: CITY OF HOUSTON PM AKHER HUSSAIN, P.E. SHEET NO. 20 OF 125</p>		

APPENDIX NO. 1



CONTROL BUILDING WALL/FOOTING PLAN
 SCALE: 3/8" = 1'-0"

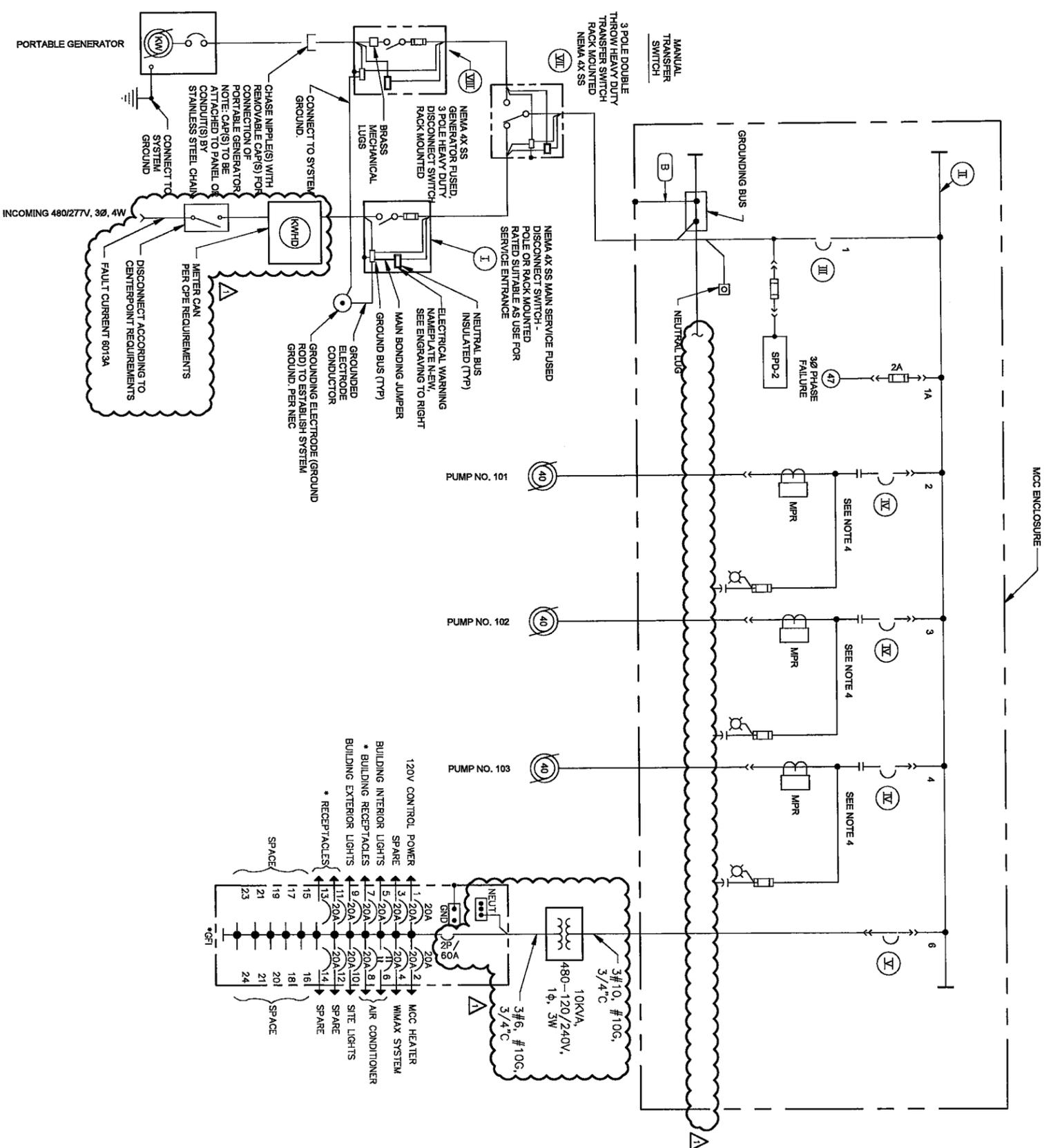


SECTION A-SB
 SCALE: 3/8" = 1'-0"

ORIGINAL SCALE IN INCHES 0 1 2 3 FOR REDUCED PLANS

BENCHMARK:
 CITY OF HOUSTON MARKER
 5158-8202 LOCATED IN
 SOUTH SIDE OF THE INTERSECTION OF
 CARMARVON DR. & SANDRINGHAM DR.
 EL. = 60.88 (NAD: 83, GPS
 OBSERVATION MADE IN JULY 2012)

NO.	DATE	REVISION	APP.
PRIVATE UTILITY LINES SHOWN			
DATE:			
Description: Energy/Air/ground Borehole/Facilities Verification ONLY. <small>(Do not include utility lines shown underground unless - see to the right of the drawing for utility lines.)</small>			
DATE:			
AGENT: TEXAS STATE PUBLIC UTILITIES STORM DAMAGE UNIT			
DATE:			
Certification: Energy/Air/ground Borehole/Facilities Verification ONLY. <small>(Do not include utility lines shown underground unless - see to the right of the drawing for utility lines.)</small>			
DATE:			
DESIGNED BY: EN			
CHECKED BY: NW			
JOB NO. T000267-1-0002			
ARCADIS 2829 Rhinopark Dr Suite 300 Houston, TX 77042 Tel: 713-953-4800 Fax: 713-977-4620 www.arcadis-us.com Texas Registered Engineering Firm: F-533			
DATE: FEBRUARY 2015			
DESIGNED BY: EN			
CHECKED BY: NW			
JOB NO. T000267-1-0002			
WOODWAY #1 LIFT STATION REPLACEMENT STRUCTURAL CONTROL BUILDING WALL/FOOTING PLAN & SECTION S8 (ADDENDUM 1)			
MNS# R-000267-1-0002-1			
DRAWING SCALE:			
CITY OF HOUSTON PM			
AKHER HUSSAIN, P.E.			
SHEET NO. 454 OF 125			



LOAD CALCULATION		
ITEM	HP	FLA*
PUMP NO.101	40 HP	82A
PUMP NO.102	40 HP	82A
PUMP NO.103	40 HP	82A
10 KVA TRANSFORMER		20A
SUBTOTAL		176A
25% OF LARGEST MOTOR LOAD		13A
MINIMUM AMPACITY		188A

* BASED ON SELECTED PUMP MFG DATA

- NOTES:
- FOR DESCRIPTION AND RATINGS OF ITEMS INDICATED WITH ROMAN NUMERAL FLAGS, SEE DEVICE RATINGS SCHEDULE.
 - CONTRACTOR TO COORDINATE POWER FACTOR CORRECTION CAPACITOR SIZE WITH PUMP MANUFACTURER. MINIMUM 95% POWER FACTOR CORRECTION AT FULL LOAD.
 - CONTRACTOR SHALL VERIFY ACTUAL AMPERAGES OF MOTORS AND SIZE STARTERS, MOTOR CIRCUIT PROTECTORS, ETC. ACCORDINGLY.
 - POWER FACTOR CORRECTION CAPACITOR IS REQUIRED FOR EACH PUMP RATED AT 20HP OR GREATER. MOUNT CAPACITOR EXTERNAL TO MCC WITHIN THE CONTROL BUILDING.

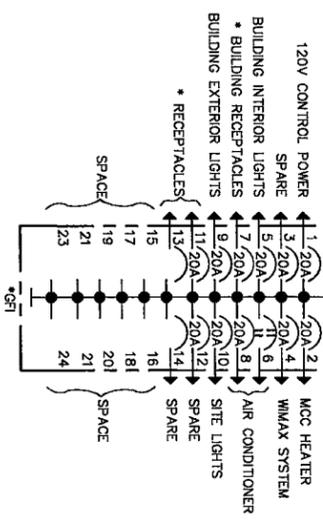
TEXT HEIGHT 9"

WARNING SHOCK HAZARD EXISTS IF GROUNDING ELECTRODE CONDUCTOR OR BONDING JUMPER CONNECTION IN THE EQUIPMENT IS REMOVED WHILE ALTERNATE SOURCE(S) IS ENERGIZED

1/4" 3/16" 2-1/2"

1/8" THICK PHENOLIC NAMEPLATE-RED WITH WHITE LETTERS. CENTER ENGRAVING AND ANCHOR TO ENCLOSURE WITH 3/16 SS SELF TAPPING SCREWS. APPLY SILICON SEALER INSIDE DOOR AT SCREW PENETRATION TO SEAL SCREWS.

ELECTRICAL WARNING NAMEPLATE N-EW ENGRAVING



GAI
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 consulting engineering
 Registration No. F-2893

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 Texas Registered Engineering Firm F-533

DATE: SEPTEMBER 2014
 JOB NO. 140009410002
 DESIGNED BY: EC
 DRAWN BY: DR

CITY OF HOUSTON
 DEPARTMENT OF PUBLIC WORKS AND
 UTILITIES
 LIFT STATION
 RENEWAL / REPLACEMENT
 PROJECT

3 PUMP SINGLE LINE DIAGRAM
E7

WBS# R-000287-1098-4
 DRAWING SCALE: NONE
 CITY OF HOUSTON, PM
 AKHTER HUSSAIN, P.E.
 SHEET NO. 57 OF 125

ADDENDUM NO. 1

DESCRIPTION	SERVICE		ROUTING		CONDUIT & WIRE SIZE
	VOLTAGE	AMPS OR HP	FROM	TO	
A MAIN BONDING JUMPER	480V	--	PANEL NEUTRAL	PANEL GROUND	#10 CU
B EQUIPMENT BONDING JUMPER	--	--	UTILITY PANEL GROUND	PANEL ENCLOSURE	#10 CU
C GROUNDED SERVICE CONDUCTOR	--	--	GROUNDING ELECTRODE NS SERVICE	MAIN SERVICE FUSED DISCONNECT	#10 CU
100 SERVICE ENTRANCE	480V	VARIES	SERVICE	MANUAL TRANSFER SWITCH	UTILITY METERING & MAIN DISCONNECT
100A EMERGENCY POWER	480V	VARIES	MOTOR CONTROL CENTER	GENERATOR DISCONNECT	3-400 KCMIL, #1/0 G, 3PC
100B EMERGENCY POWER	480V	VARIES	CONTROL PANEL OR MOTOR CONTROL CENTER	MANUAL TRANSFER SWITCH OR MAIN DISCONNECT	3-400 KCMIL, #1/0 G, 3PC
100C EMERGENCY POWER	480V	VARIES	MANUAL TRANSFER SWITCH	GENERATOR FUSED DISCONNECT SWITCH	3-400 KCMIL, #1/0 G, 3PC
100D EMERGENCY POWER	480V	VARIES	GENERATOR FUSED DISCONNECT SWITCH	PORTABLE GENERATOR	CAPPED CONDUITS
101 SYSTEM GROUNDING CONDUCTOR	--	--	POWER PANEL	GROUND FIELD	#2 CU
102 SYSTEM GROUNDING CONDUCTOR	--	--	BUILDING STEEL	GROUND FIELD	#2 CU
103 LIGHTNING DOWN LEAD	--	--	LIGHTNING ARRESTOR	LIGHTNING GROUND FIELD	#2 CU
104 GROUND ELECTRODE CONDUCTOR	--	--	CONTROL PANEL OR MOTOR CONTROL CENTER	GROUND FIELD	#2 CU
105 COMMUNICATION	--	--	UTILITY SERVICE	PANEL PPU	#2 CU
200 PUMP NO. 101 POWER	480V	52 AMP	PUMP NO. 101	PUMP NO. 101 JUNCTION BOX	#6
201 PUMP NO. 101 CONTROLS	120V	--	PUMP NO. 101	PUMP NO. 101 JUNCTION BOX	#14
202 PUMP NO. 101 POWER	480V	52 AMP	PUMP NO. 101 JUNCTION BOX	PUMP STARTER	#6
203 COMBINED PUMP CONTROLS	120V	--	PUMP NO. 101 JUNCTION BOX	PUMP STARTER	#14
205 PUMP NO. 101 CONTROLS	120V	52 AMP	STARTER IN MOTOR CONTROL CENTER	CONTROL PANEL	#14
206 PUMP NO. 101 CONTROLS	480V	--	PUMP NO. 101 MOTOR STARTER	POWER FACTOR CORRECTION CAPACITOR	SEE NOTE 4
300 PUMP NO. 102 POWER	480V	52 AMP	PUMP NO. 102	PUMP NO. 102 JUNCTION BOX	#6
301 PUMP NO. 102 CONTROLS	120V	--	PUMP NO. 102	PUMP NO. 102 JUNCTION BOX	#14
302 PUMP NO. 102 POWER	480V	52 AMP	PUMP NO. 102 JUNCTION BOX	PUMP STARTER	#6
305 PUMP NO. 102 CONTROLS	120V	--	STARTER IN MOTOR CONTROL CENTER	CONTROL PANEL	#14
306 PUMP NO. 102 CAPACITOR	480V	--	PUMP NO. 102 MOTOR STARTER	POWER FACTOR CORRECTION CAPACITOR	SEE NOTE 4
400 PUMP NO. 103 POWER	480V	52 AMP	PUMP NO. 103	PUMP NO. 103 JUNCTION BOX	#6
401 PUMP NO. 103 CONTROLS	120V	--	PUMP NO. 103	PUMP NO. 103 JUNCTION BOX	#14
402 PUMP NO. 103 POWER	480V	52 AMP	PUMP NO. 103 JUNCTION BOX	PUMP STARTER	#6
403 COMBINED PUMP CONTROLS	120V	--	PUMP NO. 103 JUNCTION BOX	CONTROL PANEL	COMBINE 400 & 500 TAG
405 PUMP NO. 103 CONTROLS	120V	--	STARTER IN MOTOR CONTROL CENTER	CONTROL PANEL	#14
406 PUMP NO. 103 CAPACITOR	480V	--	PUMP NO. 103 MOTOR STARTER	POWER FACTOR CORRECTION CAPACITOR	SEE NOTE 4
600 LIGHTING PANEL FEEDER	480V	--	MOTOR CONTROL CENTER	LIGHTING TRANSFORMER	#10
601 LIGHTING PANEL GROUND	--	--	LIGHTING PANEL	GROUND FIELD	#10
602 LIGHTING PANEL FEEDER	120/240V	--	LIGHTING TRANSFORMER	LIGHTING PANEL	#1
900 INTRUSION ALARM	24VDC	--	DOOR LIMIT SWITCH	CONTROL PANEL	1PR #16 TSW
1000 LEVEL TRANSMITTER	24VDC	--	TRANSMITTER JUNCTION BOX	TRANSMITTER JUNCTION BOX	1PR #16 TSW
1001 LEVEL TRANSMITTER	24VDC	--	TRANSMITTER JUNCTION BOX	TRANSMITTER JUNCTION BOX	1PR #16 TSW
1002 LEVEL TRANSMITTER	24VDC	--	CONTROL PANEL	TRANSMITTER JUNCTION BOX	1PR #16 TSW
1003 FLOAT SWITCH	24VDC	--	SUMP PUMP MOTOR STARTER	CONTROL PANEL	#14
1100 120 V AC FOR RECEPTACLE	--	--	LIGHTING PANEL	RECEPTACLE NEXT TO LEVEL TRANSMITTER J-BOX	L11 (IND), #2#12 #12G, 1'C, L2 (OUTD)
1101 SUMP PUMP POWER	120V	--	MOTOR STARTER	LIGHTING PANEL	L13 (IND), #2#12 #12G, 1'C, L4 (OUTD)
1200 120 V AC FOR RECEPTACLE	--	--	LIGHTING PANEL	RECEPTACLE NEXT TO PUMP NO. 102 J-BOX	--
1201 EXHAUST FAN	120V	--	MOTOR RATED SWITCH	LIGHTING PANEL	--

- NOTES:
- CONDUITS LABELED 'FUTURE SPACE' ARE TO BE INSTALLED AND CAPPED IN FIELD.
 - ANY CONDUIT REQUIRING A CSFE SEAL SHALL BE A MINIMUM SIZE OF 1 1/2".
 - ALL UNDERGROUND CONDUITS (SINGLE AND MULTI-RUN) TO BE ENCASED IN REINFORCED CONCRETE DUCTBANK.
 - CAPACITOR SIZE SHALL BE PER MOTOR NAME PLATE RATING.
 - CABLES SUPPLIED WITH PORTABLE GENERATOR.

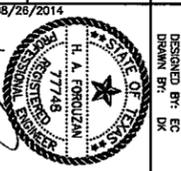
DATE: 9/26/2014
 DESIGNED BY: EC
 DRAWN BY: DK
 JOB NO. TX000841-0002

DATE: 9/26/2014
 DESIGNED BY: EC
 DRAWN BY: DK
 JOB NO. TX000841-0002

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CITY OF HOUSTON
 DEPARTMENT OF PUBLIC WORKS AND UTILITIES
 LIFT STATION
 RENEWAL/REPLACEMENT
 PROJECT

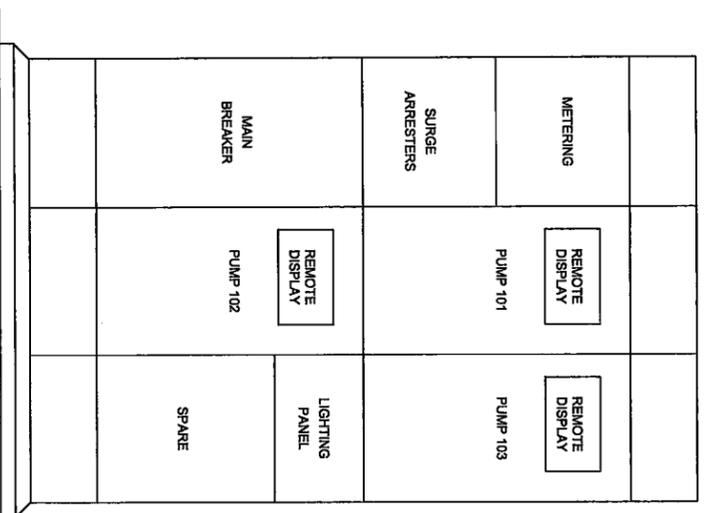
CONDUIT SCHEDULE FOR 480V
 3 PUMP SYSTEM
E14

WBS# R-000287-1095-4
 DRAWING SCALE: NONE
 CITY OF HOUSTON, PM
 AKHTER HUSSAIN, P.E.
 SHEET NO. 54 OF 125

GAI
 Gupta & Associates, Inc.
 Consulting Engineering
 Registration No. F-2693

APPENDUM NO. 1

ITEM	CIRCUIT	DESCRIPTION	RATINGS FOR PUMP SIZES INDICATED
I	---	MAIN DISCONNECT SWITCH	3P, 4W SN
		OPERATING VOLTAGE	480V
		CURRENT RATING	250A
		FUSES TYPE & SIZE	CLASS R 400A
II	---	MOTOR CONTROL CENTER	6013A
		MAIN BUS	480V
		OPERATING VOLTAGE	600A
		SCCR	600A BUS 65KA SYM 5802A
III	1	MAIN BREAKER	MOLDED CASE
		3 POLE - TYPE	FIXED
		OPERATING VOLTAGE	480V
		FRAME SIZE	400A
IV	2 3 4	TRIP SETTING	250A
		INTERRUPT CAPACITY	65KA SYM
		OPERATING VOLTAGE	ACROSS THE LINE 480V
		SIZE/CURRENT RATING	3/65A
V	6	OVERLOAD PROTECTION	SOLID STATE MOR
		TYPE	-
		CT RATIO	-
		LIGHTING PANEL FEEDER BREAKER	-
VI	---	NO. OF POLES	2
		TYPE	MOLDED CASE
		OPERATING VOLTAGE	480V
		FRAME SIZE	100A
VII	---	TRIP SETTING	30A
		INTERRUPT CAPACITY	42KA SYM
		FAULT CURRENT	2064A
		MANUAL TRANSFER SWITCH	3P, 4W SN
VIII	---	OPERATING VOLTAGE	600V
		GENERATOR FUSED DISCONNECT SWITCH	3P, 4W SN
		OPERATING VOLTAGE	600V
		CURRENT RATING	400A
MOTOR CONTROL CENTER ELEVATION LETTER		C	
INDOOR CONTROL PANEL WIDTH (MIN)		48"	
MINIMUM CONTROL BUILDING DIMENSIONS		INSIDE LENGTH	8'-0"
		OUTSIDE LENGTH	8'-6"



- NOTES:
1. PROVIDE PER MANUFACTURERS REQUIREMENTS.
 2. NEW DISCONNECT SWITCH MANUAL TRANSFER SWITCH AND GENERATOR DISCONNECT SWITCH ARE NOT USED ON SERVICE LOADS ABOVE 400A. CONTACTOR SHALL PROVIDE 316 SS NEMA 4X J-BOXES SIZES AS REQUIRED FOR ROUTING FEEDERS TO MCC. REFER TO DRAWING E-05.

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ADDENDUM NO. 1
NONE
CITY OF HOUSTON, PM
AKHTER HUSSAIN, P.E.
SHEET NO. 65 OF 125

DESIGNED BY: ED
DRAWN BY: JK
DATE: SEPTEMBER 2014
JOB NO. 13020041.0002

CITY OF HOUSTON
DEPARTMENT OF PUBLIC WORKS AND
INFRASTRUCTURE
LIFT STATION
RENEWAL/REPLACEMENT
PROJECT

DEVICE RATING SCHEDULE FOR
3 PUMP SYSTEM
E15

DATE: 9/28/2014
REGISTERED PROFESSIONAL ENGINEER
H. A. FORULZAN
77748

DATE: 9/28/2014
REGISTERED PROFESSIONAL ENGINEER
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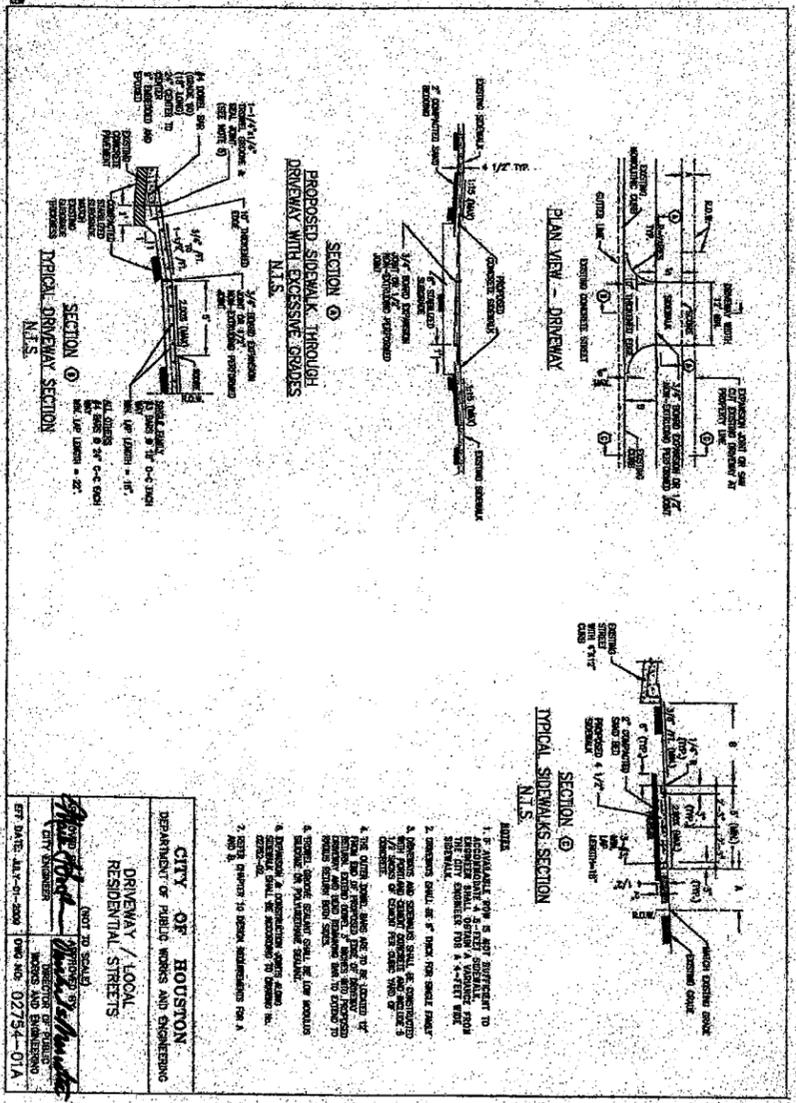
DATE: 9/28/2014
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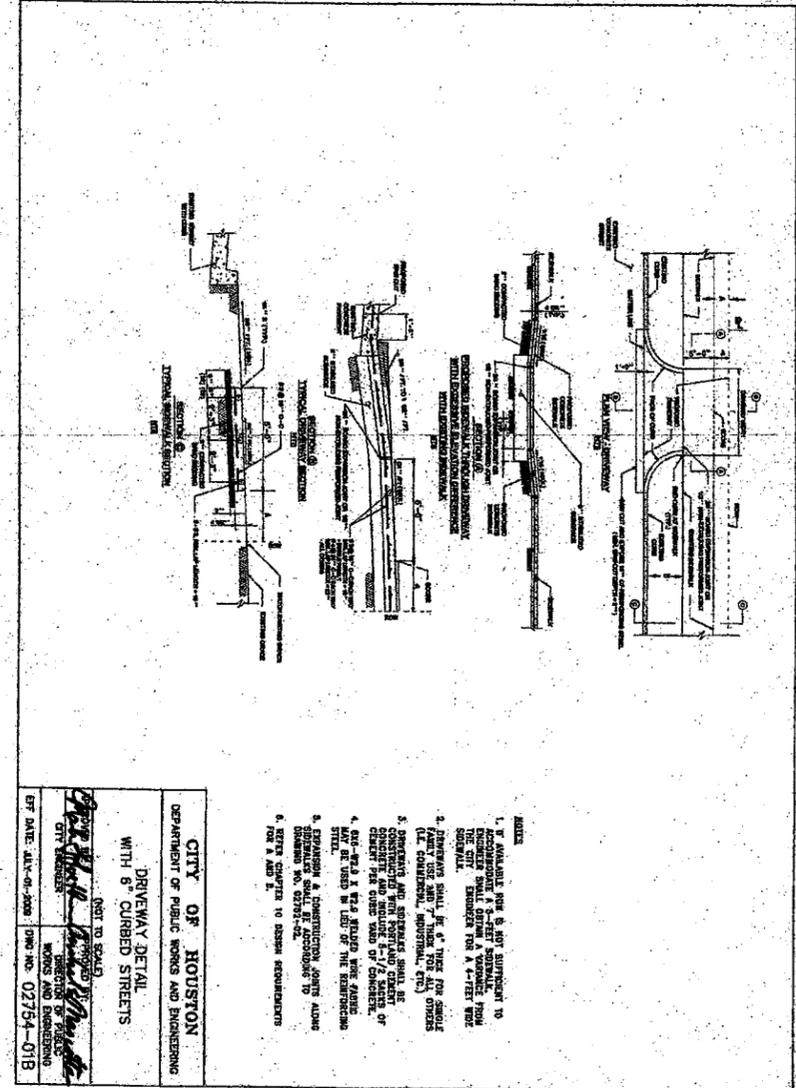


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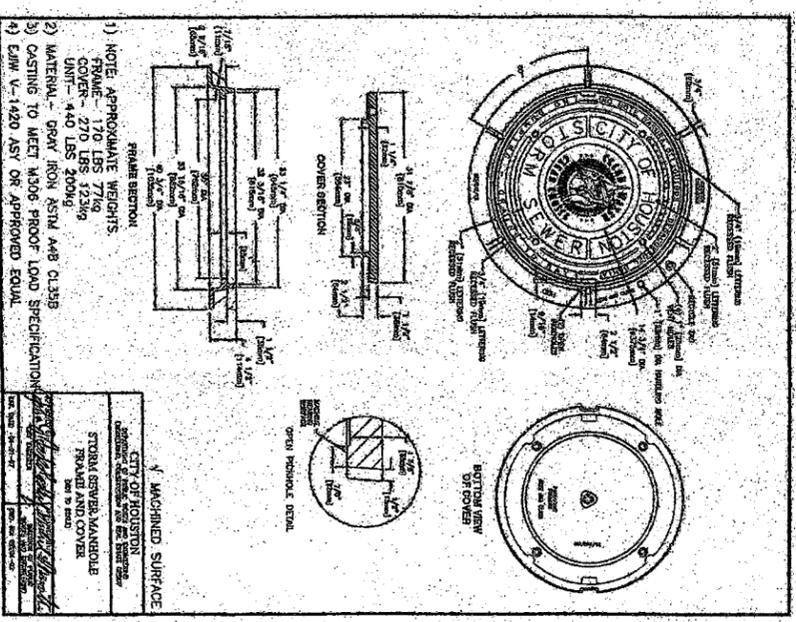
CITY OF HOUSTON
 DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
 DRIVEWAY / LOCAL RESIDENTIAL STREETS
 (NOT TO SCALE)
 CITY ENGINEER: [Signature]
 DATE: JAN-09-2009 DWG NO: 02754-01A

- NOTES**
1. FURNISH 4" MIN. THICKNESS 100% PORTLAND CEMENT CONCRETE WITH 4% STEEL FIBERS FOR 4'-0" FREE WIDTH SIDEWALK.
 2. EXISTING SIDEWALK SHALL BE RECONSTRUCTED TO MATCH THE PROPOSED SIDEWALK.
 3. EXISTING DRIVEWAY SHALL BE RECONSTRUCTED TO MATCH THE PROPOSED DRIVEWAY.
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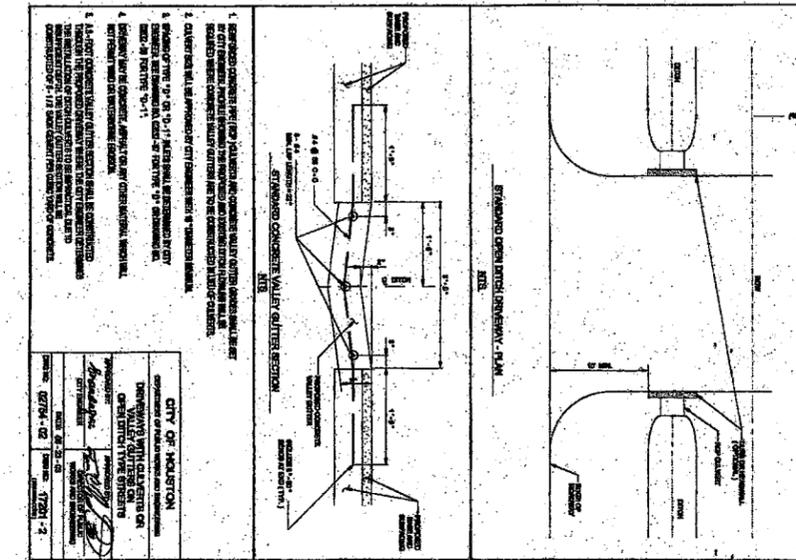
CITY OF HOUSTON
 DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
 DRIVEWAY DETAIL WITH 8' CURBED STREETS
 (NOT TO SCALE)
 CITY ENGINEER: [Signature]
 DATE: JAN-09-2009 DWG NO: 02754-01B

- NOTES**
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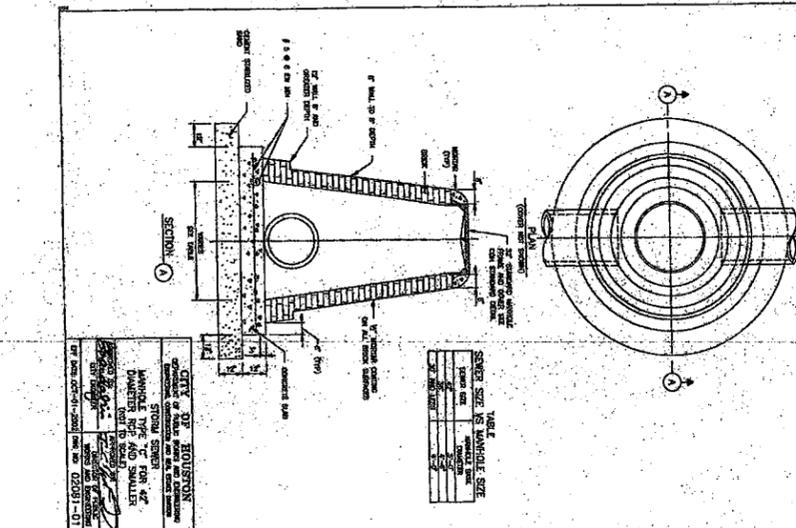
CITY OF HOUSTON
 DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
 DRIVEWAY / LOCAL RESIDENTIAL STREETS
 (NOT TO SCALE)
 CITY ENGINEER: [Signature]
 DATE: JAN-09-2009 DWG NO: 02754-01C

- NOTES**
1. FURNISH 4" MIN. THICKNESS 100% PORTLAND CEMENT CONCRETE WITH 4% STEEL FIBERS FOR 4'-0" FREE WIDTH SIDEWALK.
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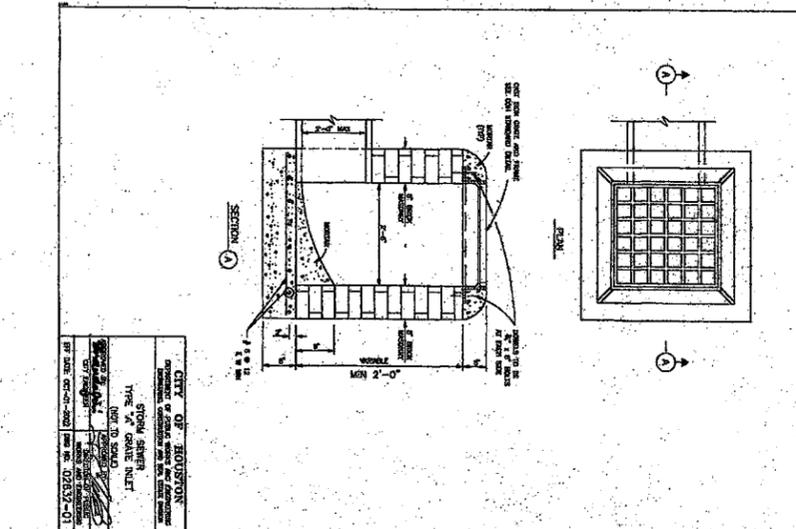
CITY OF HOUSTON
 DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
 DRIVEWAY / LOCAL RESIDENTIAL STREETS
 (NOT TO SCALE)
 CITY ENGINEER: [Signature]
 DATE: JAN-09-2009 DWG NO: 02754-01D

- NOTES**
1. FURNISH 4" MIN. THICKNESS 100% PORTLAND CEMENT CONCRETE WITH 4% STEEL FIBERS FOR 4'-0" FREE WIDTH SIDEWALK.
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CITY OF HOUSTON
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 CITY ENGINEER: [Signature]
 DATE: JAN-09-2009 DWG NO: 02754-01E

- NOTES**
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CITY OF HOUSTON
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- NOTES**
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DATE: FEBRUARY 2015
 JOB NO: 7000041.0002

DESIGNED BY: EN [Signature]
 DRAWN BY: [Signature]
 CHECKED BY: [Signature]

CITY OF HOUSTON
 DEPARTMENT OF PUBLIC WORKS AND ENGINEERING
 LIFT STATION
 RENEWAL / REPLACEMENT
 PROJECT

CONCRETE PAVING DETAILS 3

D12

DRAWING SCALE: AS SHOWN

CITY OF HOUSTON PM
 ANTHONY RUSSAN, P.E.

SHEET NO. 123 OF 125

ORIGINAL SCALE IN INCHES 6" = 1'-0"

2 3 FOR REDUCED PLANS

APPENDIX NO. 1