

SECTION 020400
AUTOMATED STORMWATER SAMPLING SYSTEM

1. DESCRIPTION

This specification shall govern all equipment and software required for the installation of automated storm water sampling systems for collecting storm water samples in remote locations to meet EPA NPDES requirements for storm water discharges to receiving waters of the United States.

2. EQUIPMENT CERTIFICATION

The contractor shall submit the manufacturer's certification and technical specification for each piece of equipment used in the storm water sampling system stating that the equipment furnished meets or exceeds the specifications herein. Three copies of all submittals shall be made sufficiently in advance of site mobilization to allow inspection and confirmation. Improperly packaged or labeled materials shall be rejected and removed from the job site.

3. SAMPLING STATION

The storm water sampling station shall consist of equipment for measuring flow and collecting storm water samples from conduits or open channels. The basic station shall consist of a programmable measurement and control module with telecommunications capability, a peristaltic pump, and one or more bottles to collect the sample, a temperature measuring device and a rain gauge. Flow measurement shall be performed by an ultrasonic-Doppler flow meter in conjunction with a primary device or the Manning equation. Land-line network communications shall be used at the site. The components of the system shall be rated to NEMA-4X standards or installed in NEMA-4X enclosures. The system shall be enclosed in a vandal resistant lockable welded housing structure.

4. CONTROL STATION

Multiple stations shall be monitored and controlled remotely from an IBM-compatible PC with Storm Control software. Software shall be compatible with existing software on City equipment. The communication protocol used on this system shall be compatible with Campbell Scientific, Inc.'s proprietary PC 208 Software. Storm Control software shall provide the capability to initialize the remotely situated stations, monitor and control their operation and download recorded data. Campbell Scientific, Inc. software (PC208) is required as a minimum to address issues of compatibility.

5. MEASUREMENT AND CONTROL MODULE WITH WIRING PANEL

The measurement and control module shall be programmable controller with built-in data logging capability and facilities for exciting and measuring analog and digital sensors and devices. It shall have a 9-pin communication port which will be used to connect a hand-held console, or to connect remote communication facilities. The module shall be a precision instrument with an instruction set specifically selected for measuring environmental parameters. It shall have a set of eight digital ports which may be programmed as input or output channels to control the sensors or sense their condition. The electronic components shall be housed in an environmentally sealed canister. The canister shall fit into a wiring panel to facilitate field connections. Several levels of electrical transient protection shall be provided in the wiring panel and the electronics canister.

Specifications: Campbell CR10X or approved equal.

A. Input/output

Analog Inputs: 12 single-ended or 6 differential
Digital Control/Status Ports: 8 programmable

- Pulse Inputs: 2
- Excitation Outputs: 3
- Switched 12 Volt Port: 1
- 9-Pin Serial I/O Port: 1
- B. Analog Inputs:
 - Range: +/- 2.5, 7.5, 25, 250, 2500 millivolts, software selectable
 - Resolution: 0.33, 1.00, 3.33, 33.3, 333 respectively
 - Accuracy: 0.2% of FSR over -25 to +50 degrees C
 - 0.1% of FSR over 0 to +40 degrees C
 - Normal Mode Rejection: 70 dB
 - DC Common Mode Rejection: >140 dB
 - Input Resistance: 200 gigohms
- C. Excitation Outputs
 - Range: +/- 2500 millivolts
 - Resolution: 0.67 millivolts
 - Accuracy: Same as voltage input
- D. Digital Control/Status Ports
 - Output Voltages: High 5.0 +/- 0.1 V; Low, 0.1 V
 - Input State: High 3.0 to 5.5 V; Low -0.5 to +0.8 V
- E. Clock Accuracy: +/- 1 minute per month
- F. Memory: 32K ROM; 128K RAM
- G. System Power Requirements: 9.6 to 16 volts.

6. WATER SAMPLING EQUIPMENT

The water sampling equipment shall be ISCO 6700 sampler or approved equal and shall consist of a Controller/Pump assembly, a sample container, a base assembly which holds the sample container and a supply of ice, and a suction line. The Controller/Pump assembly shall consist of a peristaltic pump, a drive motor, a liquid detector, and control electronics housed in a NEMA-4X enclosure. Sample volumes shall be programmed by means of an integral control panel on the sampler. Sampling will be controlled in real-time by electrical signals to a control port. The sampler base shall be capable of holding a 19-liter glass sample container and a supply of ice.

The sample container shall be high quality borosilicate glass. The sample container closure shall be Teflon. With the exception of a short section of silicon hose in the peristaltic pump, the sample suction line shall be Teflon. Suction line shall be provided in continuous runs from each station enclosure to the intake structure in the water stream. All materials that come in contact with the water sample shall be constructed of Teflon, borosilicate glass, or stainless steel. Prior to installation in the water stream, all components shall undergo a rigorous cleaning protocol to remove the potential for contamination of trace metals and organic compounds.

A. Specifications:

Controller/Pump

Sample Volume Accuracy: +/- 10 ml or +/- 10% of programmed volume, whichever is greater

Sample Volume Repeatability: +/- 5 milli liters or +/- 5% of the average sample volume in a set, whichever is greater

Suction Lift: 28 Feet

Line Transport Velocity: 3.0 feet/second at 3 foot suction head

2.2 feet/second at 25 foot suction head

Enclosure: NEMA 4-X, 6

Sampler Housing, Bottle Container

Height: 35 inches maximum
Diameter: 19.96 inches
Capacity: 1-19 liter bottler with stopper

Sample Bottle

Capacity: 19 liters
Material: Borosilicate
Stopper: Solid PTFE with clamp mechanism for transportation
Solid PTFE with 7/16 centered hole for sampling

Suction Line:

3/8 inch I.D. solid-wall FEP Teflon, with wall thickness
of 0.063 +/- 0.006 inches.

B. Cleaning Protocol:

Prior to installation at a site to be sampled, all components that will come in contact with the sample shall be cleaned using appropriate methods to remove low-level organic and trace metal contaminants. This will include all bottles, bottle stoppers, Teflon and silicone tubing, and intake strainers. Cleaning shall be to levels equal to or below project detection limits.

After cleaning, but prior to installation, ten percent of all bottles and Teflon tubing shall have equipment blank analyses performed. The blanks shall be analyzed for the contaminants of concern to the Program. If the limits shown below are exceeded, the entire lot of bottles or tubing shall be re-cleaned and blanks will be reanalyzed. This process is required until documentation can be provided to the City that equipment blanks are free of all contaminants of concern at no additional pay.

Detection limits used for analysis:

One (1) part per million for Total Organic Compounds
(TOC)
One (1) part per billion for zinc, copper, and lead
Two (2) parts per billion for nickel

7. Thermistor

A temperature sensor using a thermistor Campbell 107B or approved equal shall be housed in a waterproof enclosure with a cable attached. The unit shall be suitable for burial or immersion in water.

Specifications:

Accuracy: +/- 1.0 degrees C over -40 to +55 degrees C
+/- 0.1 degrees C over -35 to +48 degrees C

8. SITE ENCLOSURE:

The site enclosure shall be a top-opening, lockable steel box of welded construction with louvers located on the front and sides for ventilation. It shall be designed to be vandal resistant with carriage bolts used to attach hinges and other components that are not welded. Two hasps shall be provided for padlocks. Protective covers shall be welded over the hasps to discourage cutting of the padlocks.

Specifications

Dimensions: 36 inches high x 42 inches wide x 30 inches deep
with open bottom
Material: 12 Gauge Steel
Color: White paint applied over primer on both inside and
outside
Mounting: 2 inch wide internal base flange with 1/2 inch
diameter holes
Cooling: Ventilation is provided by hooded louvers located
near the bottom of the enclosure on the front and
back and near the top of the enclosure on each side.

9. FLOW MEASUREMENT:

An ultrasonic Doppler flow-measurement device ISCO 4150 or approved equal shall be used to measure the average particle velocity across the liquid stream. A pressure sensitive liquid level sensing device shall be incorporated into the transducer housing. The flow measuring device shall be capable of providing real-time velocity, depth, and battery voltage measurements upon command from the Measurement and Control Module with a RS 232 interface. The flow shall be calculated in the Measurement and Control Module from the average velocity and depth provided by the flow meter and the channel geometry.

Specifications:

Velocity Range: -5 to 20 feet/second
Depth Range: 0.1 to 10 feet
Temperature Range:
Logger/Controller: -18 to 60 degrees C Operating
Probe: 0 to 71 degrees C Operating
0 to 50 degrees C Compensated

10. COMMUNICATIONS:

Land-line communications shall be provided with a modem that interfaces with the Measurement and Control Module 9-pin serial port and a public land-line switched telephone network. The modem shall be capable of communication with a Hayes-compatible modem and an IBM-compatible PC.

Specifications:

- A. Standards: Bell 212a, CCITT V.22
- B. Baud Rates: 300,1200
- C. Operation: Full-duplex over standard phone lines
- D. Operating temperature: -25 to +50 degrees C

11. REMOTE STORM CONTROL:

The Storm Control software shall be compatible with existing hardware and software which is owned by the City. The network of Sampling Stations will be monitored and controlled from an IBM-compatible PC equipped with a VGA monitor, appropriate modems, and Storm Control software. The Storm Control software shall provide menu selectable programs to allow an operator to remotely initialize operation, monitor and modify the operation of any of the Sampling Stations, and terminate the operation, all in real time. The software shall have the capability of retrieving logged data remotely from the station at a later time after the event is completed. Data retrieved from each of the station sites shall be stored sequentially in a data base for that site. The Storm Control software shall use the facilities of Campbell Scientific, Inc. PC208 Data Logger Support Software.

The PC208 Data Logger Support Software is a suite of programs that run on an IBM-

compatible PC using the DOS Operating System. PC208 provides proprietary telecommunications protocols to communicate with the Campbell CR10X Data Logger both in real-time and in batch mode. It also has data editing and graphical display facilities.

12. RAIN GAUGE:

An electric tipping bucket rain gauge Texas Electronics 525 or approved equal shall be provided.

Specifications

Resolution: 0.01 inches per tip
Accuracy: 1.0% at 2 inches/hour or less
Signal Output: Momentary unconditioned switch closure of 135 ms average duration.
Material: Body: Anodized aluminum
Receiving Orifice: Gold anodized spun aluminum knife edge collector ring.
Environmental: 0 to +50 degrees C
0 to 100% humidity
Cable: 2-conductor shielded with plastic cover, length is customized to site requirements.

13. SOLAR PANEL:

A solar electric panel shall be provided.

Specifications

Rated Power: 20.0 Watts
Current (typical at load) 1.38 Amps
Voltage (typical at load) 14.5 Volts
Short Circuit Current (typical) 1.60 Amps
Open Circuit Voltage (typical) 18.0 Volts
Module Leakage Current <50 uA at 3000 VDC electrical voltage isolation
Normal Operating Cell Temp. 42 C +/- 2 C
Environment -40 C to 90 C, 0 to 85% humidity
Materials Layered with ethylene vinyl acetate (EVA)

14. SOLAR PANEL REGULATOR:

A solar panel regulator shall be provided.

Specifications

Input Voltage Max 60 VDC VOC
Input Voltage Min 15.0 VDC
Input Current Max 10 A
Charge Stop Voltage 14.35 VDC
Current Consumption 55 mA
Operating Temperature -40 degrees C to +65 degrees C
Operating Humidity up to 100%
Encapsulation Fully Potted with Polymer Resin

Packaging

Injection molded, impact and UV resistant,
ABS plastic enclosure