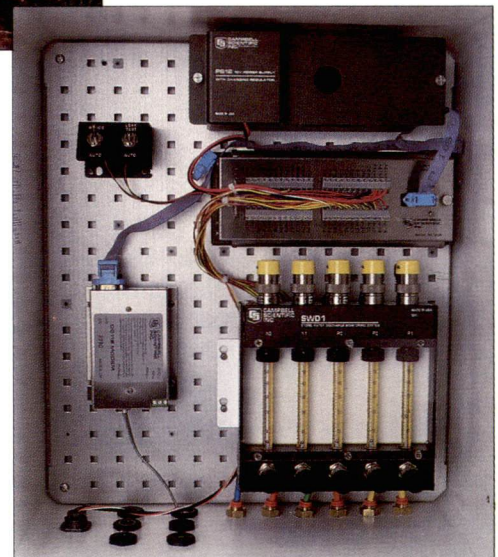


STORM DISCHARGE WATER



SWD1 Storm Water Discharge Monitoring System

- Programs in minutes using menu-driven setup screens
- Accurate, self-calibrating stage measurement
- Calculates flow under most hydraulic conditions
- Flow proportional sampling
- Calls a pager at the start of a storm event
- Site monitoring and data retrieval via phone



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EPA Requirements

The US Environmental Protection Agency (EPA) now requires municipalities and many industries to obtain National Pollutant Discharge Elimination System (NPDES) permits for their separate storm water systems.

The objective of this program is to reduce storm water pollution to the "maximum extent practicable," by detecting and eliminating non-storm water discharges.

Municipalities and counties with populations over 100,000 are required to file a permit application for their storm water collection systems. Water quality data must be gathered at 5 to 10 representative major outfalls during as many as three representative storm events. Flow proportional samples must be taken, refrigerated, and then analyzed for 140 pollutants. Industrial requirements are similar.

System Configuration

Campbell Scientific's Storm Water Discharge Monitoring System (SWD1) automates measurement, data storage, sampler control, and telemetry of results. Flow is measured in a flume, weir, or circular pipe. The typical system consists of a CR10 datalogger, power supply, double bubbler (for stage measurement), water sampler, rain gage, phone modem, and field enclosure (Figure 1). The SWD1 is compatible with most commercially available water samplers.

Rainfall is recorded as it occurs; flow status is recorded once an

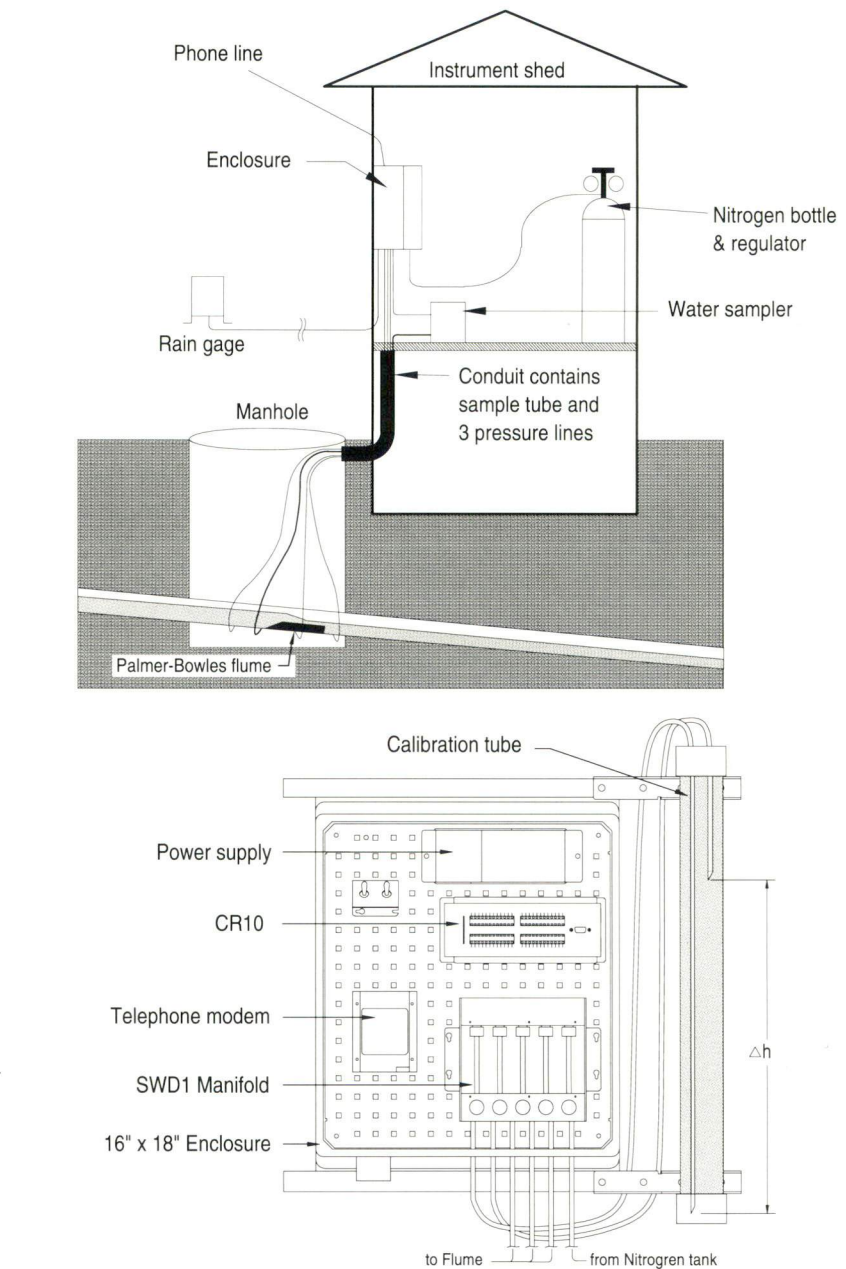


Figure 1. Typical installation (above); SWD1 components (below).

hour. Once runoff begins, measurements are made once a minute and data are recorded at 5 minute intervals. When specified rain or stage thresholds are exceeded, options allow for alerting personnel via a telephone paging system or modem with voice synthesizer. A manual "grab" sample can then be taken early in the runoff event.

The rainfall and flow data are stored in the datalogger's memory

over the duration of the event. The CR10 totalizes cumulative flow and triggers the sampler to take first-flush and flow-proportional samples; it also verifies and records the time of each successful sample (Figure 2).

The storm runoff data are retrieved during a site visit or via telecommunications (phone modem link to computer).

Double Bubbler

The SWD1 system contains a self-calibrating double bubbler system for stage measurements. Bubbler systems detect level by measuring the pressure required to force nitrogen bubbles from submerged tubes. A single pressure transducer is mounted to a manifold fitted with multiple lines. The data logger opens and closes electronic valves on the manifold to "switch in" each line to be measured. The pressure transducer measures atmospheric pressure, two points in a calibration tube, and up to three points in a primary device (Figure 1). The first three values are used to calculate a multiplier and offset value for the stage measurements. This technique compensates for temperature effects and long-term drift in the transducer, thus producing a more accurate measurement.

Flow Equations

The system contains program options with flow equations for most flumes and weirs, as well as Manning's Equation for circular pipes. The system also supports measurements in a Palmer-Bowles flume where the SWD1 will choose one of three equations depending on the flow condition (open channel, submerged, or surcharged full pipe flow).

Support Software

Model PC151 SWD1 Support Software is a series of menu-driven programs that simplify use of the SWD1. The following functions are supported:

- **Program the station**
User enters primary device type, sample volume, data intervals, and other site-specific parameters (Figure 3).
- **View real-time data**
Displays the current conditions at the site; values are updated every minute.

- **Retrieve data**
Collects data stored in the station and archives it in the base station computer.
- **View archived data**
Time of measurement and data values are displayed in labeled columns.

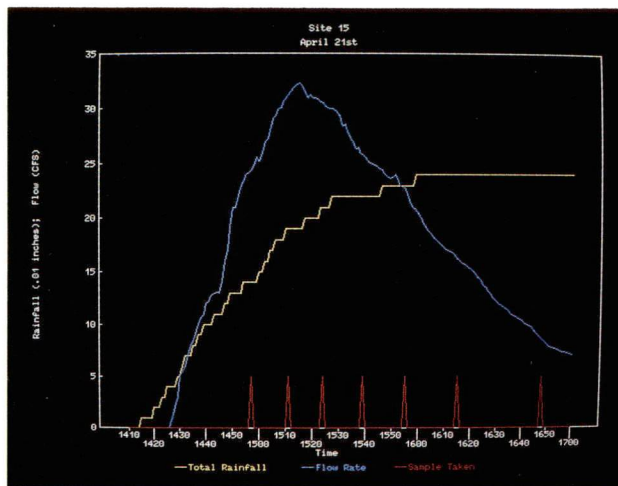


Figure 2. Data can be imported into commercially available spreadsheet or graphic programs.

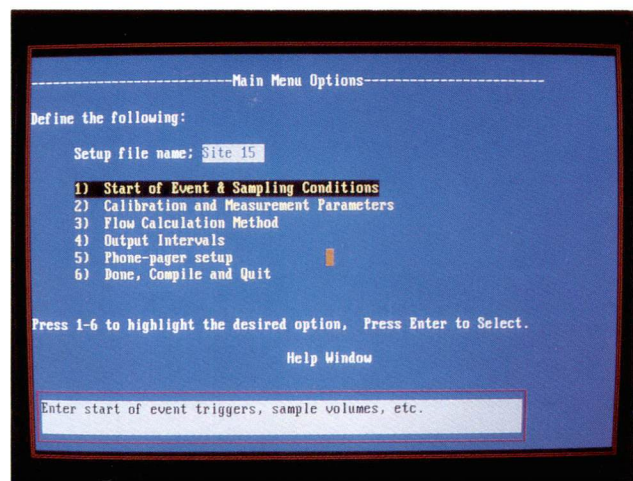


Figure 3. PC151 SWD1 Support Software prompts for entry of site-specific parameters.

Specifications

- Number of orifice lines for stage measurements: up to three
- Measurement range: 0 to 5 psi (0 to 11.5 feet)*
- Accuracy: $\pm 0.05\%$ of Full Scale Range
- Temperature range: System: -25 to +50°C
Calibration tube: Freezing point of solution used
- Maximum system pressure: 20 psi
- Recommended bubble rate: 1 to 3 bubble(s)/second
- Sampler control:
 - Flow proportional: 12-volt one-second pulse
 - First flush: (user-selectable) change of state from 0 to 5 volts or 5 to 0 volts (no load)
- Power requirements: 9.6 to 16 VDC. 110 VAC recommended to float-charge internal battery. Solar panel and external battery recommended where AC power is not available.
- System current drain: Average pre-event current drain: 25 mA
Average current drain during event: 97 mA

User-Supplied Accessories

- 1/4" NPT female pipe fittings and corresponding tubing (details in manual).
- Nitrogen bottle (typically 225 ft³) with an automatic pressure-relieved regulator.
- Water sampler
- Primary device

*Assumes fresh water measurement; higher ranges available on special order



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