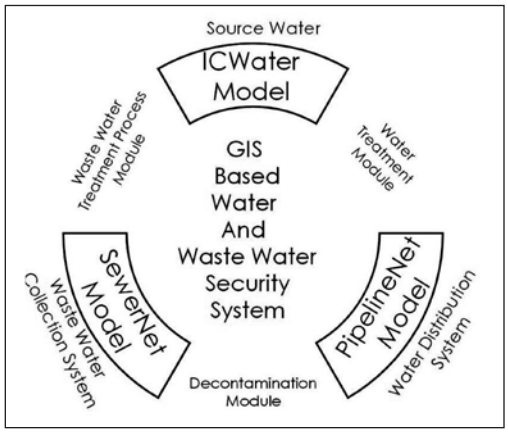
Integrated GIS-Based Consequence Assessment Model for Sewer and Stormwater

The nation's wastewater infrastructure—consisting of approximately 16,000 publicly owned wastewater treatment plants, 100,000 major pumping stations, 600,000 miles of sanitary sewers, and another 200,000 miles of storm sewers—is one of America's most valuable resources, with treatment and collection systems valued at more than $2 trillion. Taken together, the sanitary and storm sewers form an extensive network that runs near or beneath key buildings and roads, and is contiguous to many communication and transportation networks.



GIS-Based Water and Wastewater Security System.

Significant environmental damage, impacts to recreation, and contaminated water supplies can be attributed to losses in wastewater treatment. Security at wastewater plants may not have received the attention it should have.

The USDA Forest Service, Environmental Protection Agency (U.S. EPA) and Technical Support Working Group (TSWG) sponsored the development of two major components of the Integrated Water Quality Security System (IWQSS): ICWater and PipelineNet.

- ICWater is a GIS-based contaminant time-of-travel and dispersion model that interfaces with real-time stream flow data. This model tracks contaminants to a water supply intake.
- PipelineNet is a GIS-based hydraulic and water quality model that calculates the concentration of contaminants in a water distribution system and assesses the consequences to the population and critical facilities served by the water utility.

These components do not address wastewater security issues. Utilities need additional modeling capabilities that: 1) help utilities properly decontaminate drinking water; 2) quantify the effectiveness of physical, chemical, and biological processes in treating contaminated drinking water; and 3) integrate GIS and wastewater collection system models (urban drainage, stormwater, and sanitary sewers) to enable utilities to perform consequence assessment of wastewater systems during and after a hazardous event (either man-made or natural). At present there are no freely available GIS-based sewer and stormwater systems that can simulate the consequences of an attack on the wastewater collection infrastructure.

The two primary elements of clean-up and decontamination are treatment of the contaminated pipelines and disposal of the contaminated water. Once a water distribution system is contaminated, water utilities take two actions. First, they stop the spread of contaminated water (isolation) and, second, they decontaminate and clean up the contaminated water and pipelines. After a contamination incident, wastewater utilities may be called upon to treat water that has chemical or biological contamination.

BENEFITS

- Allows for a comprehensive evaluation of wastewater system performance during and after hazardous events.
- Allows utility officials to make more informed decisions that manage and mitigate the impacts of hazardous releases within the water supply and wastewater collection infrastructure.

RELATED PRODUCTS

Identify, Screen, and Treat Contaminants to Ensure Wastewater Security (03CTS2S)

Emergency Response Plan Guidance for Wastewater Systems (03CTS4S)

Feasibility Testing of Support Systems to Prevent Upsets (03CTS7S)

Strategy, Guidance, and Decision Support Systems for Deployment and Development of Upset Early Warning Sensor Systems for Wastewater Collection and Treatment Operations (04CTS9S)

Detailed Protocols for Treatment Process, Standard Response, and Collection System Disruptions (04CTS11S)

AVAILABLE FORMAT

Online PDF posted on WaterISAC.org.

Refer to: **STOCK NO. 04CTS10S**

For more information, log on to **www.werf.org**.

SewerNet Features

- Non-proprietary software.
- Fully integrated SWMM functionality with a Geographic Information System.
- Applicable to any storm, combined or sanitary sewer system.
- Single-event or continuous simulation.
- Dynamic routing of contaminated stormwater and/or sanitary flow.
- Integrated chemical, biological, and radiological properties database with direct internet access to U.S. EPA's Water Contaminant Information Tool (WCIT).
- Includes GIS asset layers for: Toxic Chemical Release Inventory Locations, Hazardous Waste Sites, and Municipal and Industrial Facilities located across the continental United States.
- Upstream Network Query Report identifies asset features upstream of a user-defined network location.
- Analysis results secured in portable animation files (AVI format).
- Consequence analysis of a variety of contamination scenarios such as:
  - A direct release of a biological or chemical agent into a manhole or other entry point of the sewer system.
  - The collection of contaminated water flushed from hydrants or other devices directly connected to a drinking water distribution system.
  - The collection of wastewater generated from the normal activities occurring in homes, businesses, and other facilities that might have received contaminated drinking water.
- Import external flushing information derived directly from a PipelineNet Application Network or with a manually generated compatible input text file.

The "Integrated GIS-Based Consequence Assessment Model for Sewer and Stormwater" application, called SewerNet, helps to address the security needs of the wastewater community. The application will enable utility officials to make more informed decisions that will help them manage and mitigate the impacts of hazardous releases within the water supply and wastewater collection infrastructure.

SewerNet integrates ESRI's ArcGIS and U.S. EPA's Sewer and Water Management Model (SWMM) hydraulic model, enabling wastewater/stormwater collection systems to perform assessment analysis of facilities affected by a hazardous event (either man-made or natural). The application is designed as an ArcGIS extension that operates with the same function, look, and feel as the stand-alone SWMM model. The customized GIS environment provides a rich data integration platform with enhanced assessment reporting capabilities. A fully integrated biological, chemical, and radiological database facilitates pollutant characterization.

The SewerNet application can be used for emergency, planning, and normal operations.

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