

“Only Rain Down the Drain”

SFPUC turns to mobile GIS to manage water pollution prevention efforts.

Stormwater runoff is the major source of water pollution in the United States. Motor oil, fertilizers, pesticides, and other contaminants mix with rainwater as it runs through parking lots, yards, and streets into storm drains and catch basins before flowing to treatment plants and bodies of water. Unfortunately, people sometimes compound the problem by discarding trash, household chemicals, and pet waste into those same drains and catch basins.

The San Francisco Public Utilities Commission (SFPUC) has launched a major program called “Only Rain Down the Drain” that seeks to reduce these pollutants at their sources through



Since the SFPUC has marked and mapped only about ten percent of the city's catch basins and storm drains, the city has seen a jump in dumping reports from citizens. The curb-marking program will be completed in three years.

a series of public outreach, inspection, monitoring, and technical assistance initiatives. Educating residents on the importance of keeping contaminants out of the stormwater system is a key aspect of the program, which SFPUC coordinates and implements using mobile GIS technology.

The vast majority of San Francisco's 20,000 street drains are actually catch basins connected to a combined sewer system where stormwater and sanitary wastewater flow into common pipes routed to treatment plants. Each catch basin is equipped with a sump designed to trap heavy debris such as leaves, sticks, grease, and other potential pollutants to keep them from reaching the treatment plant. City workers regularly clear the sumps.

“It's far less expensive to trap pollutants at the catch basin than it is to separate them at the treatment plant,” said Lewis Harrison, SFPUC's Water Pollution Prevention Program Manager.

Harrison explained that a smaller number of street drains in the city carry stormwater directly to streams, rivers, and eventually, San Francisco Bay. Pollutants that find their way into these storm drains inflict even greater damage on the environment because the contaminated water passes through the pipes completely untreated.

In early 2005, SFPUC began installing plastic curb markers on every catch basin and storm drain. The markers read, “No Dumping: Only Rain Down the Drain” and each marker includes a phone number where residents can report illegal dumping or drain back-ups. Before the start of this program, SFPUC had made the decision to leverage its enterprise GIS database with mobile technology. The curb marker program presented SFPUC with its first opportunity to take GIS into the field.

“We decided to use the GeoXT handheld GPS receivers to manage the placement of the markers and to inventory the location and condition of the stormwater collection system,” said Lily

Dryden, SFPUC Enterprise GIS Coordinator. “By including this information in our GIS, the city can quickly follow up on illegal dumping reports for enforcement purposes.”

VESTRA Resources (Redding, CA) supplied a complete mobile GIS package that included the GeoXT handhelds (www.trimble.com) running ESRI's (www.esri.com) ArcPad software and the Trimble (www.trimble.com) GPScorrect™ extension for ESRI ArcPad. In addition, VESTRA recommended the purchase of the Trimble® GPS Analyst™ extension for ESRI ArcGIS software that creates a seamless workflow between the enterprise geodatabase and the GeoXT handhelds in the field.

“SFPUC is a very sophisticated user of GIS technology with more than 200 layers in its geodatabase. That geodatabase is accessed by every department via ArcIMS, said John Jarnagin, VESTRA GIS Analyst project manager at the time. “With so many people accessing the data, we suggested that each department select a data steward who is solely responsible for managing the mobile GIS data before it goes out to the field and after GPS data collection has occurred.”

Curb Marker Program

In the curb marker program, the SFPUC's Bureau of Environmental Regulation and Management (BERM) typically performs the marker installation and field data collection. Before each day's work, the BERM data steward uses the GPS Analyst extension within ArcGIS to define the geographic area assigned to the field crew and clips out the relevant data layers for loading into the GeoXT handheld. A field crew

usually takes data layers that it needs to find the catch basins and then references them to the surroundings—street centerlines, parcel maps, and black-and-white aerial imagery.

Once in the field, the crew uses the GPS receivers to collect the location of the newly installed curb marker. The field technician then opens a customized ArcPad applet on the GeoXT handheld's screen to input a description of the drain or basin condition, taking careful note of any repair or cleaning that is needed. Field crews rely on the FAA's Wide Area Augmentation System (WAAS) for real-time differential correction when it is available. The GPSCorrect extension automatically acquires the satellite data necessary for post-processing both for WAAS real-time differential and uncorrected (autonomous) data.

When the field crews return to the BERM office, the data steward downloads collected location and attribute data from the GeoXT handhelds onto a desktop computer. The steward opens the GPS Analyst extension inside of ArcGIS and verifies the collected data. GPS Analyst utilizes the Internet to search for and access available differential correction data from a local GPS base station. The software automatically performs the postprocessing needed to achieve the submeter location accuracy required by SFPUC, spatially adjusting GPS field data in comparison with the base station data. The edited and processed data is then uploaded to the enterprise geodatabase where work orders are generated for maintenance on the catch basins that were flagged in the field for repair or cleaning.

With updated storm drain and catch

basin locations in the geodatabase, the GIS plays multiple roles in the water pollution prevention program. As telephone calls are received from citizens reporting illicit dumping, the GIS can cross-reference a street address or intersection name supplied by the caller to pinpoint the basin. A maintenance crew can quickly be dispatched to clean contaminants from the sump. If a visual display of calls indicates a concentration of infractions from a specific neighborhood, then door hangers and flyers are distributed to educate those residents about the program.

To date, SFPUC has marked and mapped about ten percent of the city's catch basins and storm drains. And already, the city has seen a jump in the number of dumping reports from concerned citizens. The curb-marking program will be completed in three years. **GE**