

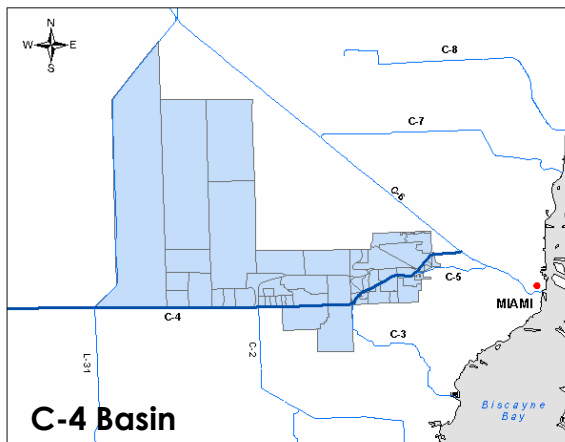
# XP Software

## Case Study | Taking C-4 to the next level: Flood Protection In Miami Dade County



Jeremy McBryan, P.E., CFM  
Brent Whitfield, E.I., CFM  
Raul Mercado, P.E.,

Miami-Dade County has experienced remarkable growth over the past thirty years, with a population that has grown to 2.3 million. Consequently, difficulties exist in maintaining a stormwater management system that meets the increased needs of the community. Unusually large precipitation events in 1999 and 2000 caused flooding in some Miami neighborhoods that were built in low-lying areas before established stormwater management regulations. As a result of the failure of existing stormwater infrastructure, the county commission created a Flood Management Task Force which received support from the Florida Department of Community Affairs, the South Florida Water Management District, the U.S. Army Corps of Engineers, the Federal Emergency Management Agency and several local municipalities. The centerpiece of the planning phase for updating the existing system was the C-4 Canal Flood Mitigation Project Basin Study,



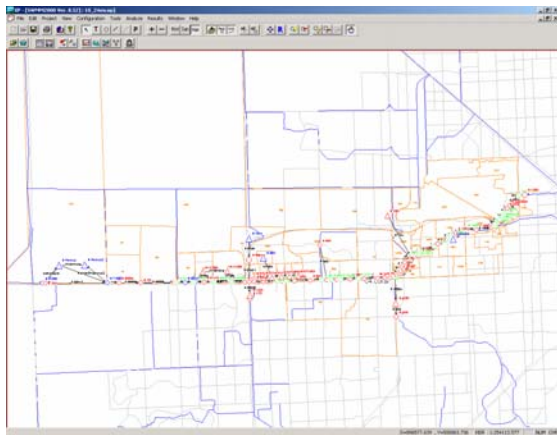
a hydrologic and hydraulic model of the C-4 Canal Basin. This modeling effort, completed by PBS&J using XP-SWMM 2000 version 8, allowed for the evaluation of the mitigation benefits provided by different system

enhancements and operational scenarios and led to implementation of several improvements well ahead of schedule. In addition, studies are in progress or have been completed in basins adjacent to the C-4 Basin.



The C-4 Basin covers an area of about 55,130 acres or approximately 86 square miles and is located in northeastern Miami-Dade County. The C-4 Basin includes a diverse variety of land use types including approximately 35% urban and industrial, 10% mining, and 55% wetlands. The basin includes the Miami International Airport, the Cities of Belen, Sweetwater and parts of the City of Miami. In addition, the Cities of Coral Gables, West Miami and South Miami are indirectly impacted by the drainage conditions in the C-4 Basin. Generating an accurate C-4 model in XP-SWMM proved to be challenging considering the hydrologic and hydraulic characteristics of the basin.

The system is significantly influenced by groundwater flows from the Everglades, the highly transmissive Biscayne Aquifer and the operation of surface water control structures. After calibration and verification, proposed solutions were then modeled to alleviate flooding in the problem areas. To date, projects totaling almost \$40 million have been implemented as a result of the analysis.



*For this project, PBS&J is utilizing XP-SWMM version 9 to prepare the hydraulic and hydrologic model of the C-4 Canal Basin.*

Since the completion of the C-4 Canal Flood Mitigation Project Basin Study, the Miami-Dade County Department of Environmental Resources Management selected PBS&J to develop a Stormwater Master Plan for the C-4 Canal Basin to provide DERM a more comprehensive understanding of the watershed and to allow for evaluation of various water quality and water quantity Best Management Practices. The C-4 Basin Stormwater Master Plan, a portion of the Central Miami-Dade County Watershed Planning Project, includes the following components: statistical analysis of rainfall, hydrologic and hydraulic modeling, pollutant loading estimates, water quality modeling, identification and ranking of water quality and quantity problem areas,

identification and evaluation of best management practices and cost estimating of best management practices. For this project, PBS&J is utilizing XP-SWMM 2000 version 9 to prepare the hydraulic and hydrologic model of the C-4 Canal Basin.

Because of the unique hydrology of the region, an integral component of the DERM modeling effort was LIDAR elevation data from the United States Army Corps of Engineers. A Digital Elevation Model (DEM) was produced and conceptual sub-basins were generated using Arc Hydro, while stormwater infrastructure maps and aerial images were used to further refine these sub-basins per DERM standards. Once the basins were delineated, the DEM was used to generate stage-area tables for each sub-basin. In a low-relief watershed, there can be significant overland flow between sub-basins. In order to analyze this component of the regional hydrology, natural section links were created between adjacent sub-basin nodes and data for these links were extracted LIDAR-based DEM. Calibration and verification has been completed and floodplain maps are currently being produced. Water Quality modeling has also commenced.

In addition, PBS&J has developed a model of the adjacent C-3 Canal Basin to assess the potential impact of increased municipal stormwater pumping into the C-3 and C-4 Canals as a follow-up study to the C-4 Canal Flood Mitigation Project Basin Study. This C-3 Model was merged with the C-4 Model and re-calibrated. PBS&J is currently working to develop an XP-SWMM hydrologic and hydraulic modeling of the neighboring C-6/Miami River Basin. In summary, local, state and federal agencies, working together with stakeholders, have implemented flood mitigation facilities and processes that will ultimately reduce flooding in the Northern and Central Miami Dade County.