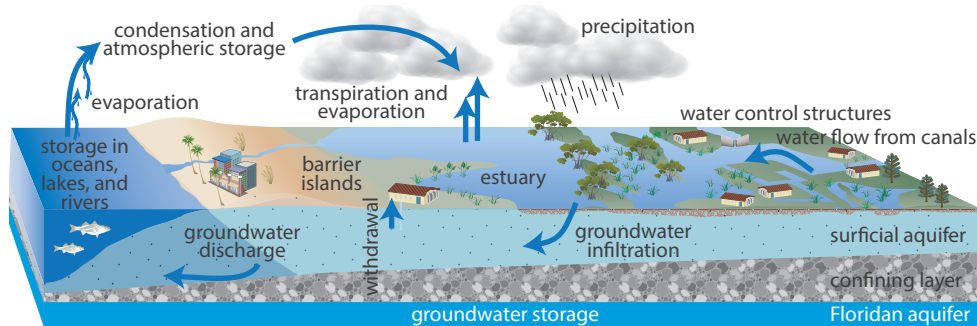


# Identifying freshwater flows

## Understanding flows

To maintain proper health, estuaries require a delicate balance of fresh water from the watershed, combined with salt water from the ocean. Altered freshwater flows and salinity levels can adversely affect estuarine ecosystem services such as recreational opportunities which fuel the local economy. To understand how fresh water reaches the Rookery Bay estuary, **hydrologic modeling** is used to create a computer-based representation of the water cycle, which is the movement of water on, above, and under the earth's surface. Data inputs include precipitation, evaporation, transpiration, irrigation, and land use. A local scale model was created for the Rookery Bay watershed, which is located between Naples and Marco Island in southwest Florida.



Big Cypress Basin South Florida Water Management District

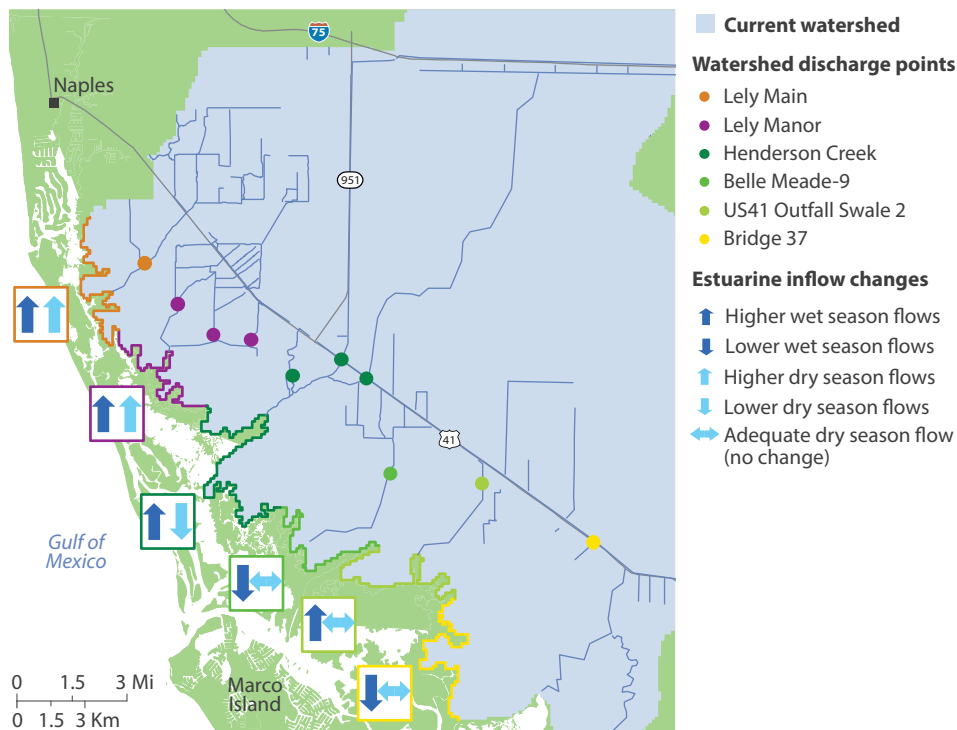
Top: A conceptual diagram illustrating water cycle processes included in the local scale model.  
Bottom: An intricate system of canals, weirs, and ponds are operated seasonally to shunt water off the land to prevent flooding in the summer, and hold back water to recharge aquifers in winter.

## Changes in historic flows

- When compared to historical model results, all ten watershed discharge locations have altered flows due to the construction of canals, roads, and developments with varying effects on the timing and amount of water reaching the estuary.
- In areas with medium to dense residential development, flows were greater than historical flows, year round.
- Two sub-basins east of Henderson Creek typically showed water deficits, likely due to flow diversions into canals, or flow obstructions such as developments and roads.

## Modeling flow averages

The Rookery Bay model was derived from an existing regional model developed by Big Cypress Basin South Florida Water Management District and Collier County. It was refined from 1,500 square foot grid cell size to 375, which represents better resolution, and the simulation period was increased to include a 10-year data set, from 2002 through 2012.



The historic watershed was 247 square miles of undeveloped wetlands that provided freshwater to the estuary through uninterrupted sheet flow. The current watershed is 167 square miles with ten freshwater discharge locations. The arrows (map above) show the changes in flow under current conditions when compared to historic conditions.

## Management recommendations

Based on the best-available science, the following recommendations will support the restoration and continued health of the Rookery Bay watershed and estuary:



**Address altered flow distributions** by correcting inflow excesses and deficits by sub-basin. The general trend is excessive flows to the west of Collier Boulevard and deficits to the east.

**Restore hydroperiods** within the southern Belle Meade flow-way to historic conditions by mitigating the draw-down and draining effects of nearby canals (Collier Boulevard/Henderson Creek Canal and I-75 Canals).

**Increase dry season flows** to the Henderson Creek sub-basin to as close to historic levels as possible (3–5 cubic feet per second).

**Address and improve the aging infrastructure and lack of best management practices** within the communities along Henderson Creek and the Collier Boulevard/Henderson Creek Canal.

**Increase comprehensive and inclusive watershed planning and prioritization** in the region to better accomplish cost-effective management goals, including the implementation of these recommendations.

**Complete a salinity model for the estuary** and couple it with the Rookery Bay watershed model to develop a comprehensive and predictive upstream/downstream management tool to evaluate restoration efforts and capital improvement projects.

**Update and maintain the local scale model and salinity model** on a regular basis so that it can be used as a management tool.

**Establish comprehensive monitoring and mapping efforts** at the 10 watershed discharge points and the corresponding downstream open water estuary sites to evaluate the success of restoration projects.



Top to bottom: Hydrologic restoration of Rookery Bay mangroves; Rookery Bay routinely convenes stakeholders to discuss water resources management; field monitoring of freshwater flows.



70% of rainfall occurs from May through October, while peak water usage by seasonal visitors and agriculture occurs from January through March, which is during the dry season.

## Restoring the Rookery Bay Estuary Project

The Restoring the Rookery Bay Estuary Project focused on collaborative watershed management through hydrologic, ecologic, and social science research, education, and partnerships. Guided by a diverse stakeholder group, the effort was coordinated by the Rookery Bay National Estuarine Research Reserve in Naples, Florida, and resulted in a wide range of management recommendations.

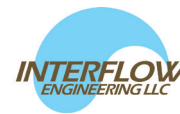
Funding for this project was provided to the Rookery Bay National Estuarine Research Reserve in 2012–2015 by the National Estuarine Research Reserve System's (NERRS) Science Collaborative which is a cooperative agreement between the National Oceanic and Atmospheric Administration (NOAA) and the University of New Hampshire under NOAA grant NA09NOS4190153.

For more information, visit [www.rookerybay.org/restoreRB](http://www.rookerybay.org/restoreRB)  
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Cover photo courtesy of Rookery Bay Reserve



NATIONAL ESTUARINE RESEARCH RESERVE SYSTEM SCIENCE COLLABORATIVE

