

Environmental Impacts of the Annual Agricultural Drawdown in Southern Miami-Dade County

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How much water is being released to lower the water table during the Agricultural Drawdown?

**63,000 ac-ft
 21 billion gallons
 $8 \times 10^7 \text{ m}^3$**

is the average amount that is annually discharged during the early agricultural drawdown period (October 15- Dec 30) from S-20F on C-103 and S-21A on C-102. In the discharge volume table below, blue highlights indicate wet years, red highlights indicate dry years.

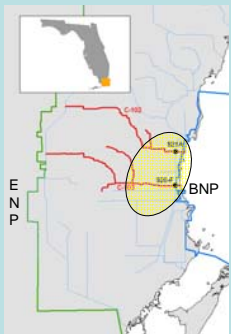
Year	S20-F (ac-ft)	S21A (ac-ft)	Total (ac-ft)
1995	59,272	25,032	84,304
1996	36,797	13,077	49,874
1997	29,295	16,114	45,408
1998	33,712	17,361	51,072
1999	56,778	42,200	98,978
2000	39,389	23,442	62,831
2001	46,387	34,607	80,994
2002	47,328	19,228	66,555
2003	46,534	24,737	71,271
2004	43,400	28,432	71,832
2005	29,255	20,985	50,241
2006	29,781	15,364	45,145
2007	30,007	15,058	45,065
Average	40,610	22,741	63,352

Introduction to Biscayne Bay

Biscayne Bay is located on the southeastern coast of Florida. Prior to urban development, Biscayne Bay had an estuarine environment, and was a nursery ground for a variety of fish and invertebrates. The Bay supported many active fisheries under these conditions, including shrimp, blue crabs, and many different species of fish.

Urbanization and accompanying water management practices have changed the physical characteristics of the bay, which has substantially altered the ecology throughout Biscayne Bay.

The natural system of numerous small creeks that drained through the coastal ridge to the Bay have been gradually replaced by manmade canals. There are now 8 major drainage canals that discharge into Central and Southern Biscayne Bay. These canals drain both urban and agricultural areas, and are the only major source of freshwater to the Bay. Groundwater discharges are kept small by active management of stages in the urban area. Discharge from these canals occurs primarily during the wet season (June-October). There is currently very little discharge during the dry season, allowing marine and hypersaline conditions to dominate for half of the year.



What is the “annual agricultural drawdown”?

Farmers in Southern Miami-Dade County have a long and successful history of farming in the coastal prairies and shallow sloughs of the area. In the East Glades, defined as the area south and east of the coastal ridge and west of Biscayne Bay, row crop production of potatoes, tomatoes, and corn stretches back to the early 1900s. The local drainage canals built by the farmers were enhanced and connected to the Central & South Florida water management system in the 1960's.

A common practice at the end of the rainy season was to rapidly lower groundwater levels throughout Southern Miami-Dade County via the drainage canals so that crops could be planted sooner in the now dry marl soils of the East Glades. The modern discussion of this drawdown amongst water managers dates back to at least 1981 (SFWMD Governing Board minutes, 1981), and the practice was institutionalized soon thereafter (SFWMD Structure Book). Currently, the canal stages are lowered in three coastal canals by 0.8 ft below nominal rainy season limits starting on October 15, and after Dec 30 are held 0.4 ft below rainy season groundwater levels until Apr 30.

The agricultural drawdown has contributed to the chronic damage to the ecology of Biscayne Bay by suddenly reducing the already limited groundwater flows to the bay, rapidly inducing marine and hypersaline conditions in the estuary. At a time when row crop production has largely given way to horticulture and suburban developments, managers may wish to re-evaluate this practice in light of the changing agricultural landscape, increasing urban water demands, droughts, and the ongoing state and federal restoration efforts in the area.

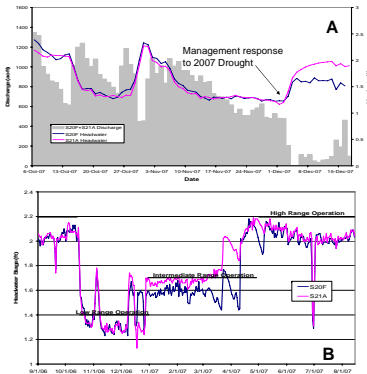


Figure A (top) and Figure B (bottom): time series of groundwater level and canal discharge from S20F and S21A

Figure C (bottom): the surface elevation in Miami-Dade as derived from a LIDAR survey. The East Glades (circled) are located in the coastal plain under the coastal ridge.

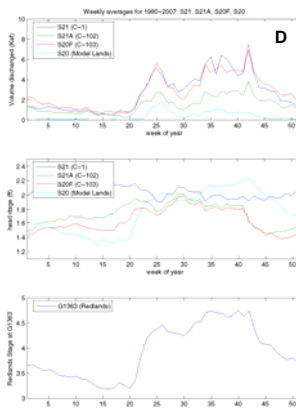


Figure D: (left) A 27 year average of discharges (top) and stages (middle) at the coastal flow control structures, and the groundwater stage (bottom) in the Redlands (western Miami-Dade). S-20 and S-21 are typically not operated under seasonal Ag drawdown rules.

Figure G: (right) Sites BISC 14 and BISC 16 show the same pattern in 2004 and 2005 years. Lowest monthly salinity is in October (12.21-15.17). Highest salinity in May/June (32.08-38.04).

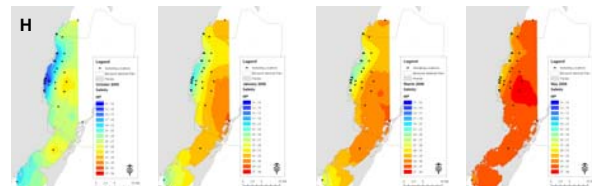


Figure H: (top) Oct 2005 – Nearshore Biscayne Bay has salinity <15ppt due to Late wet season conditions, Ag drawdown discharges (9,740 ac-ft). (left center) Jan 2006 – Only small area on western shoreline remains <20ppt. (right center) March 2006 – All areas are >20ppt. (right) May 2006 – Only very small area remains <30ppt.

What are the nearby impacts of this drawdown activity?

- Contributes to loss of estuarine habitat & function via poor timing of freshwater input
 - Poor habitat for pink shrimp, juvenile seatrout, redfish, snook, etc. (Figure G)
 - Promotes salinities at marine or higher levels (Figure E) that hurt juveniles & allow marine predators inshore
- Removes protection against saltwater intrusion into the Biscayne Aquifer in the region
 - Lowering groundwater when sea levels are at their seasonal maximum enhances intrusion (Figure H)
- Loss of freshwater storage in the Biscayne Aquifer
 - Longer residence time would provide for consumptive uses and flow to the bay further into the dry season

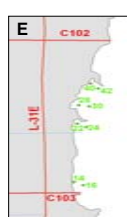


Figure E: (top) Location of salinity monitoring sites and L-31E canal used in the study.

Figure F: (top right) The relationship between nearshore salinity and the head difference from groundwater and bay from 2004-2006 was derived from a least-squares fit (r=0.92) to field data (Fig E). The loss of head cuts off freshwater flows to the bay from groundwater and canals.

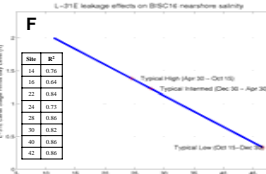


Figure J: (right): the statistical correlation between groundwater levels and stage at S-20F on C-103.

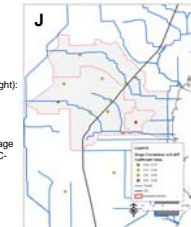


Figure I: (top) The increase in chlorides in a well (G-1254) just south of the East Glades agricultural area, which is typical of the effects of salt water intrusion which is induced by inadequate groundwater levels.



Figure K: (bottom) Restoration features of Alternative O. The effectiveness of many of these features will be impaired by the agricultural drawdown.

Can Management Practices Be Modified to Benefit Both Agriculture and the Natural System ?

In agricultural areas closer to Lake O, farmers use pumps to drain their fields into nearby canals instead of managing the entire water table to provide adequate drainage. Management includes the use of 6 stormwater treatment areas (STAs) that passively treat agricultural runoff before it is released into natural areas. Could such a scheme be an acceptable alternative to annually draining 21 billion gallons of water from 53,000 acres of the county to the benefit of less than 2,000 acres of agricultural land?

Goals of such management modifications:

- A more natural ground water recession rate to promote a longer wet season
- Longer wet season conditions promote estuarine and wetland function
- Estuarine species can become re-established in S Biscayne Bay