

Chapter 8: The Water Needs of a Wetland Park: From Establishment (1947) to Congress's Water Guarantee (1970)

A vast wetland ecosystem, the Everglades is vitally dependent on water. As described above in chapter 1, Everglades National Park includes roughly one-quarter of the historic Everglades Basin. In addition, the park lies at the bottom end of a water regime with origins far to the north. Over the last 5,000 years, the flora and fauna of the Everglades have adapted to a yearly cycle of a wet period (the hydroperiod) and a dry period. Historically, the water that reaches the lower Everglades from the north as sheet flow has been critical for maintaining hydroperiods. The lowering of the water level in the dry winter season (typically November to April) allows species like the American crocodile to nest and concentrates fish and crustaceans in shallow pools, providing food for nesting birds. If the winter is too dry or too wet, the effects on wildlife can be severe. Another consequence of shorter than usual hydroperiods is that dead sawgrass fails to form muck to replenish Everglades soils. The salinity of Florida Bay is also affected by the amount of freshwater it receives from the Everglades. Well before the park's establishment, the state-funded construction of drainage canals, the Hoover Dike along the south shore of Lake Okeechobee, and the Tamiami Trail had affected the flow of surface water reaching the lower Everglades. NPS officials in 1947 realized that they were taking responsibility for an environment that was already compromised. They also understood that they would need the cooperation of managers of lands and waters to the north, whose decisions would largely determine how much water flowed into the park.

The Floods of 1947

The year 1947 was marked not only by the dedication of Everglades National Park but by prolonged and disastrous flooding in the region. The rains that year came early and remained heavy through the spring and summer. In the fall, two hurricanes struck, one on September 17 and another on October 11. Some stations in South Florida measured more than 100 inches of rain for the year. The result was widespread flooding and extensive property damage. About five million acres were inundated for up to five months. Particularly hard hit were communities established just west of the Atlantic Coastal Ridge in the Everglades, notably Hialeah, Miami Springs, and

Opa-Locka. Damage was conservatively estimated at \$59 million (the 2014 equivalent of \$627 million). Human casualties were minimal because the Hoover Dike was not breached and the managers of the Everglades Drainage District (EDD)³⁸¹ flushed tremendous amounts of water to the ocean via the St. Lucie Canal and the canalized Caloosahatchee River. In the wake of the damage, farmers, ranchers, and coastal residents were as one in demanding protection from future floods. As Lamar Johnson, chief engineer of the EDD at the time, put it: “Everywhere the tom-toms were beating to prevent a recurrence of the 1947 floods.”³⁸² This started a chain of events that ended in the U.S. Army Corps of Engineers undertaking an unprecedented program of flood control and water management in South Florida.³⁸³

Well before 1947, the EDD and the U.S. Army Corps of Engineers (the Corps) had begun to study ways to better address South Florida’s water problems. Flooding was not the only issue. Soil subsidence was a perennial problem for Everglades farmers, and dry years brought wildfires and muck fires as well as salt water intrusion into drinking water wells. Substantially more was known in the late 1940s about Everglades geology and soils than in the early twentieth century, when the state had built its drainage canals. The U.S. Geological Survey (USGS), the U.S. Soil Conservation Service, the state’s Everglades Experiment Station at Belle Glade, and the Florida Soil Science Society had compiled valuable data in the 1930s and 1940s. One key finding was that a depth of soil sufficient to grow crops was present only in a band extending about 15 to 25 miles south and east of Lake Okeechobee. Farther south in the Everglades, the soils generally were too shallow to support agriculture. Following the 1947 disaster, Florida’s senators, Spessard Holland and Claude Pepper, asked the Corps to develop a comprehensive flood-control plan for South Florida. Expanding upon the work already done by the EDD, the USGS, and others, the Jacksonville District of the Corps hurriedly put together a plan in the final months of 1947.³⁸⁴

381 See chapter 1 for the origins of the Everglades Drainage District (EDD). Because land owners failed to pay the EDD’s taxes and its bond holders tied it up in litigation, the EDD had virtually ceased to function by 1931. State legislation and help from the New Deal’s Reconstruction Finance Corporation put the district back on its feet in the 1940s. By 1947, the EDD was making progress on deferred maintenance on its existing canals and planning for the future. Lamar Johnson, *Beyond the Fourth Generation* (Gainesville: University Presses of Florida, 1974), 153-155.

382 Johnson, 160.

383 Matthew C. Godfrey, *River of Interests: Water Management in South Florida and the Everglades, 1948-2000* (Jacksonville: U.S. Army Corps of Engineers, Jacksonville District, 2003), 32-33; Nelson M. Blake, *Land into Water; Water into Land* (Tallahassee: Florida State University Press, 1980), 176; Davis, *Everglades Providence*, 388; Grunwald, 218.

384 Luther J. Carter, *The Florida Experience: Land and Water Policy in a Growth State* (Baltimore: Johns Hopkins University Press, 1974), 89-91; Godfrey, 29-33. See Godfrey for the pioneering research on the Biscayne Aquifer and South Florida’s water regime done by USGS geologist Garald Parker.

The Central & Southern Florida Flood Control Project

The Central & Southern Florida Flood Control Project (C&SF Project) that the Corps developed was based on two main concepts: storing fresh water in order to later dispense it to various users as needed and getting rid of excess water to prevent flooding. It was the first plan that recognized the Kissimmee River watershed, Lake Okeechobee, and the Everglades as a single, interrelated hydrological system. The project had two primary goals: protecting the lower east coast from flooding and establishing an expanded agricultural area in the northern reaches of the Everglades. Secondary goals included the protection of the wildlife of Everglades National Park as well as preventing soil subsidence and the intrusion of salt water into the Everglades. The plan focused on the engineering works need to accomplish the primary goals. It lacked detail on how the secondary goals would be accomplished. The project's aims were to be achieved by dividing the Everglades into compartments surrounded by levees and then moving water among compartments and canals (figure 8-1, Central and Southern Florida Flood Control Plan). The engineering works planned to accomplish these goals included:

1. The construction of a 100-mile-long perimeter levee located a few miles west of the Atlantic Coastal Ridge. The levee would protect existing communities like Hialeah, Miami Springs, and Opa-Locka and allow for additional residential and agricultural development in East Everglades areas traditionally subject to seasonal flooding.
2. Improving the Hoover Dike and extending it to completely surround Lake Okeechobee. The lake would be the main reservoir for holding South Florida's freshwater.
3. The establishment of three water conservations areas (WCAs) covering 1,500 square miles in Palm Beach, Broward, and Dade Counties. Soils were too thin in these areas to support agriculture, and once surrounded by levees, the WCAs would be available to store water.
4. Establishment of a 700,000-acre Everglades Agricultural Area (EAA), surrounded by levees and equipped with giant pumping stations to move water into and out of it.
5. Expanding the capacity of the existing diagonal canals leading from the Everglades to the Atlantic Ocean and building new ones.
6. Installing plugs near canal outlets to better control salt water infiltration.
7. Undertaking engineering works north and west of Lake Okeechobee, notably the channelization of the Kissimmee River, allowing marshes to be reclaimed for stock grazing and other uses.³⁸⁵

385 Godfrey, 36-37; Carter, 92-93; Blake, 177-178; McCally, 150-153.

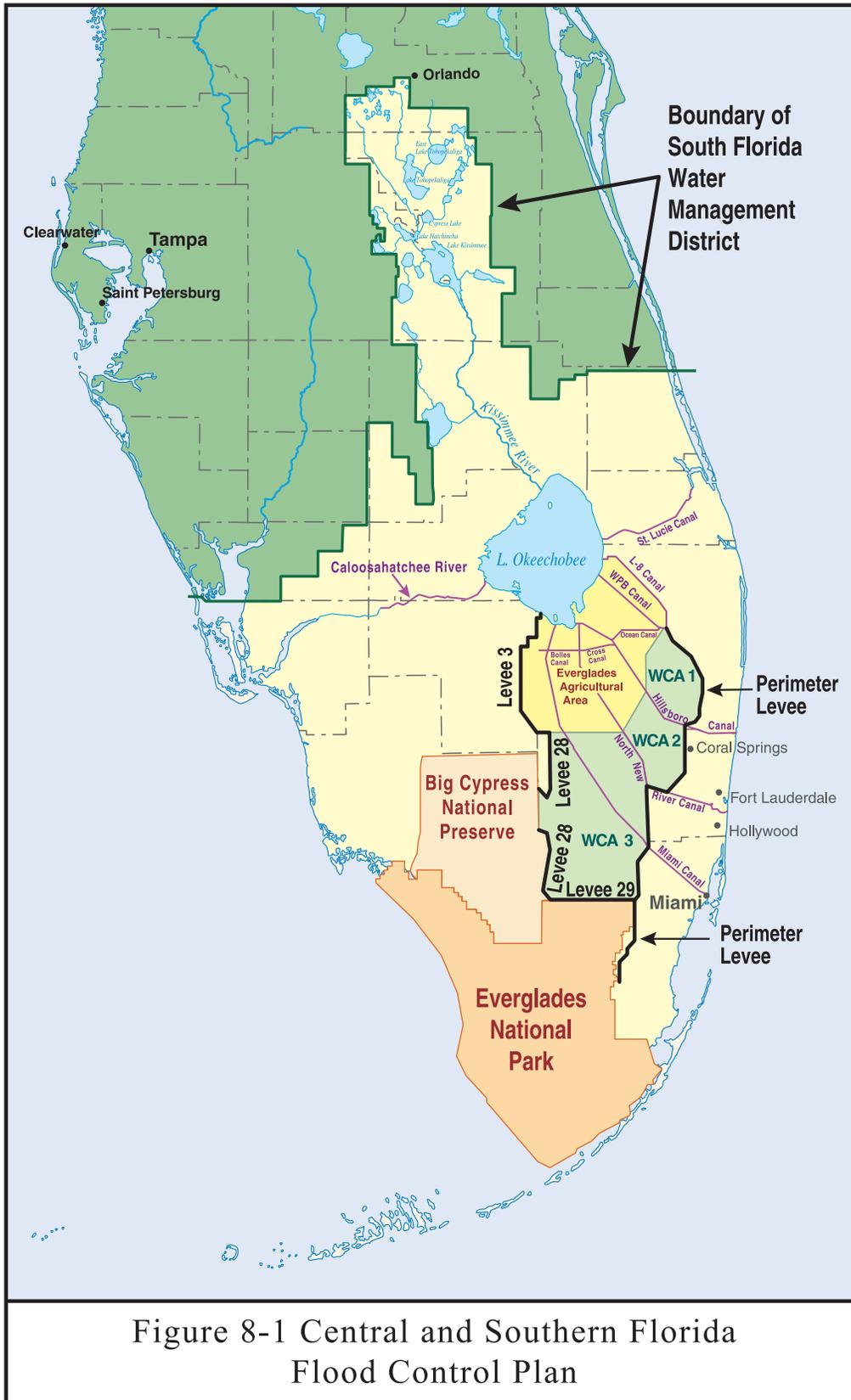


Figure 8-1 Central and Southern Florida Flood Control Plan

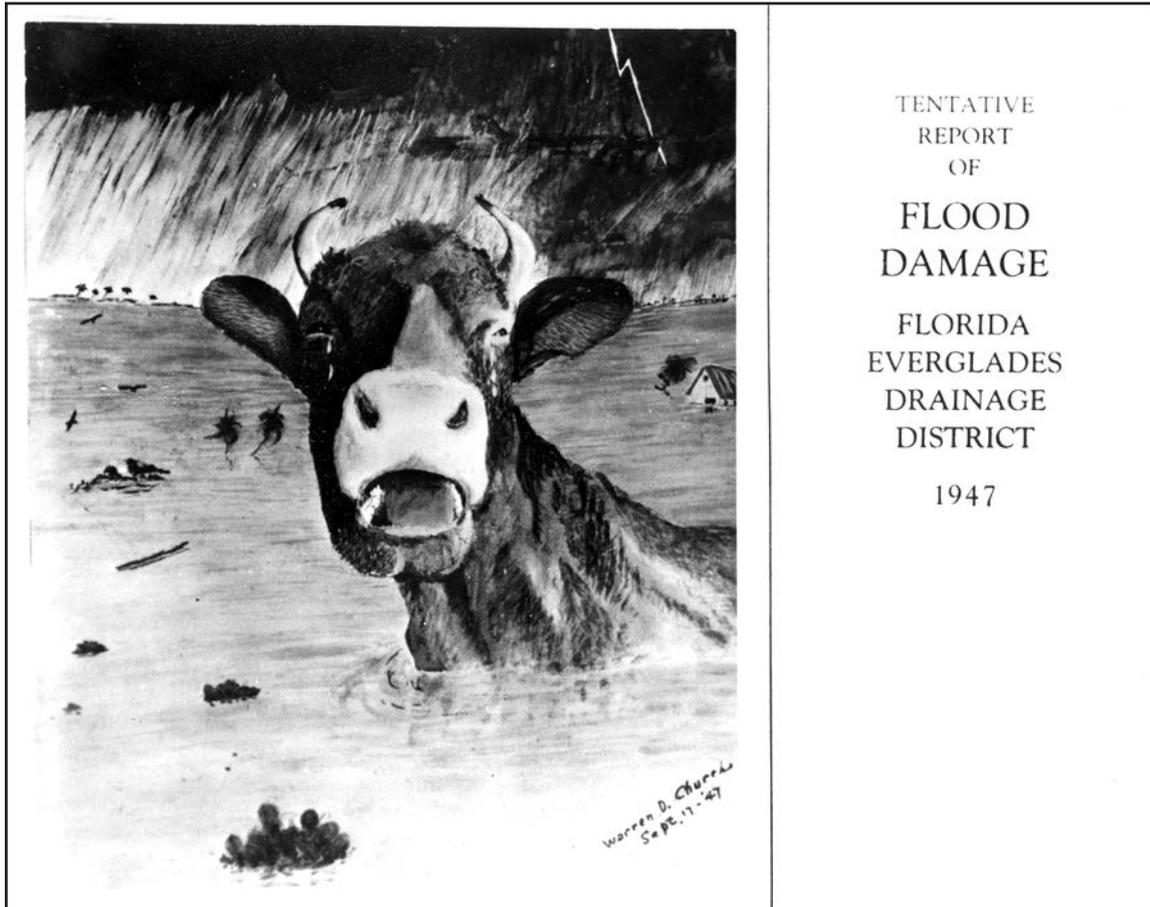
The first six items were planned as phase I of the project and the Kissimmee River work as phase II. The cost of the entire project was estimated at \$208 million, with the federal government covering 85 percent and state and local governments 15 percent. The Corps held public hearings on the plan and consulted with the U.S. Fish & Wildlife Service (FWS) on the plan's effects on fish and wildlife. There is no record of any Corps consultations with the NPS before the plan was released. A few details were changed as the proposal made its way from the Corps' Jacksonville district, by way of the South Atlantic Division and the Board of Engineers for Rivers and Harbors, to Chief of Engineers Raymond A. Wheeler. Wheeler then sent the proposal to Congress, recommending that \$70 million be appropriated to allow the Corps to begin phase I. Led by Senator Holland, Florida politicians and businessmen orchestrated a major publicity and lobbying campaign on behalf of the C&SF Project. The EDD and Palm Beach, Broward, and Dade Counties published a *Tentative Report of Flood Damage*, better known as the "Weeping Cow" book (figure 8-2, Weeping Cow booklet). The report was filled with photographs of the devastation caused by the 1947 flooding. Its familiar name came from the dramatic cover illustration depicting a nearly inundated, crying cow beneath a lightning-filled sky. Project supporters made sure that every member of Congress and President Truman got a copy.³⁸⁶

Reaction of the Department of the Interior to the C&SF Project

In February 1948, before the bill authorizing the C&SF Project went to the Congress, the Corps sent it to the Department of Interior for comment. The project had major implications for several interior agencies: the NPS, the FWS, the Bureau of Indian Affairs, and the U.S. Geological Survey (USGS).³⁸⁷ NPS Director Newton Drury and his aides were unhappy with the short period of time allowed for review. Everglades National Park had been established just the year before, and the Service had not had time to study the water needs of the park. It was obvious to the NPS and major conservation organizations that the C&SF Project would critically affect the water available to the park, but a knowledge base for intelligent comment on the project was lacking. Because of this, Drury sought to have the park's interests explicitly protected in the legislation authorizing the project. In April, he wrote the Department

386 Godfrey, 37-40; U.S. Army Corps of Engineers public notice, Dec. 12, 1947, K. M. Throop, EDD, to Sen. Holland, Feb. 7, 1948, SLH papers, box 178; Asst. SOI William E. Warne to Gen. R. A. Wheeler, Corps, EVER 42242; Blake, 178-179. Godfrey's *River of Interests* offers a detailed account of the relationship between the Corps and the NPS in South Florida from 1947 through 2005. The Corps commissioned this history and at times it is overly deferential to the Corps' point of view.

387 FWS had several wildlife preserves that would be affected by the project, and one of the water conservation areas embraced the Seminole Indian Reservation in Broward County.



TENTATIVE
REPORT
OF
FLOOD
DAMAGE
FLORIDA
EVERGLADES
DRAINAGE
DISTRICT
1947

Figure 8-2. Weeping Cow booklet, 1947

of Interior solicitor recommending that the bill authorizing the C&SF project include language along these lines:

Provided, however, that no work which affects or may affect the Everglades National Park shall be undertaken on said project unless a plan of operation satisfactory to the Director of the National Park Service and the Chief of Engineers has been agreed upon.³⁸⁸

The Service approached Senator Holland about this proposed language, but Holland declined to push for its inclusion. In May, Drury withdrew his request to the solicitor, writing:

Since sending you our memorandum of April 21 we have had informal discussions with representatives of the Department of the Army and believe that any plan

³⁸⁸ Dir. to the DOI Solicitor, Apr. 21, 1948, EVER 42242.

of flood control will be taken up with us insofar as it may affect the Everglades National Park.

Interior's official comments on the C&SF Project went to the Corps on April 13, 1948. The letter stated that the NPS "concur[s] in the general program outlined in your report and its objectives," but added that decisions affecting Everglades National Park needed to be made jointly by the Service and the Corps. The Corps was reminded that the NPS "has had neither time nor resources to make studies on the actual effect of the project on the park." Interior did

state that "the question is not one of too much water, but a guarantee that there shall not be too little." The NPS at this early date believed that the main effects of too little water in the dry season would be salt water intrusion and fires. Only later would the Service have a clearer understanding of how the entire ecological balance in the park depended on the amount, timing, location, and quality of water deliveries. The letter closed by insisting that "it is felt imperative that plans of operation [for the project] should be the subject of negotiated agreements between the Corps of Engineers and the National Park Service *prior* to construction [emphasis added]."³⁸⁹

In the Corps' response to Interior, Chief of Engineers Wheeler expressed his satisfaction with the department's concurrence in the C&SF Project and promised that Interior's comments would be sent to Congress along with the project plan to become part of the official record. Wheeler agreed that it was "essential" that "there be close cooperation and negotiations between the Corps of Engineers and the National Park Service in devising plans and operating procedures which would affect the Everglades National Park." He stopped short of any commitment that the Corps would reach agreement with the NPS *prior* to the construction of any of the project's works, as had been requested by Interior.³⁹⁰

In retrospect, it is evident that the entire history of the conflicts between the Corps and the NPS over the operations of the C&SF Project is foreshadowed in this correspondence from early 1948. Had Director Drury succeeded in getting language protecting the park into the project's authorizing legislation, that history might have been quite different. The project, however, was overwhelmingly motivated by the desire to prevent floods in the expanding communities along the Atlantic coast and to benefit agriculture. In addition, the Truman administration had a decidedly utilitarian conception of the conservation of natural resources; bluntly stated, it favored people over birds. In early 1948, there was no real possibility that Everglades National Park would be singled out among all the beneficiaries of the C&SF Project for special

389 Asst. SOI William E. Warne to Gen. R. A. Wheeler, Corps, EVER 42242.

390 Gen. R. A. Wheeler, Chief of Engineers, Corps, to the SOI, May 21, 1948, EVER 42242.

consideration in the authorizing legislation. The NPS had to settle for the informal, nonbinding assurances of cooperation offered by the Corps.

The Subcommittee on Flood Control and Improvement of Rivers and Harbors of the Senate Committee on Public Works held hearings on the C&SF Project on May 12 through 14, 1948. Florida's congressional delegation did its best to ensure that only strong supporters of the project appeared. Testimony at the hearings emphasized the project's benefits for agriculture and the need to avoid a repeat of the 1947 floods. No NPS officials and no representatives of national conservation organizations testified. John Baker, president of the National Audubon Society, had hoped to testify, but was unable to appear. He did send several letters and telegrams, both to the subcommittee and the Corps, expressing concern that the project overemphasized flood protection and gave insufficient attention to storing water for release in times of drought. Baker believed that the maintenance of high water levels in Lake Okeechobee was critical. He thought that water stored in the lake could be released during drought periods, thus providing sufficient water to allow the formation of bird rookeries within Everglades National Park. Devereux Butcher, executive secretary of the National Parks Association (NPA), visited South Florida in the winter of 1947/1948 and attended the Corps' hearings on the C&SF Project.³⁹¹ In April 1948, Butcher told the NPA's executive committee:

[T]he greatest danger to the park lies in the fantastic plan of the Army Engineers to control floods in south Florida. . . . The effect that this control of the natural flowage of water might have upon wildlife and plant life within the park cannot be determined now, but it could conceivably do irreparable harm.³⁹²

Less than a year later, the Izaak Walton League of America noted that the project had "potential . . . to raise [C]ain in the national park," without offering any further detail. It is apparent that some conservationists from the beginning were troubled by the implications of the project. No one at the time understood just how the project would affect the park, making it impossible for skeptics to go much beyond general statements of concern.³⁹³

Several historians have pointed to the near-universal support, especially in Florida, for the C&SF Project. At the onset, Marjory Stoneman Douglas believed the project "would produce substantial benefits from the preservation of fish and wildlife

391 Godfrey, 41; John H. Baker, NAS, to Col. F. A. Feringa, Corps, May 10, 1948, SLH papers, box 148; "The President Reports to You," *Audubon* 50/2 (Mar./Apr. 1948):121.

392 Minutes of NPA Executive Committee Meeting, Apr. 28, 1948, NPCA papers, series 1, box 13.

393 Izaak Walton League, "Crisis Spots in Conservation," Mar. 1, 1949, IWL papers.

resources.”³⁹⁴ Several large land owners—the Collier Corporation, rancher John Lykes, and dairyman Ernest Graham—did oppose the plan. The Collier Corporation stated that it could not back the plan because it had not received enough information on area hydrology and the details of the engineering works contemplated. Concern over the taxes that would be levied to pay for the works probably was the most important factor in landowner opposition.³⁹⁵ One vocal critic of the project was Edwin C. Menninger, publisher of the *Stuart Daily News*. The huge volumes of water sent down the St. Lucie Canal in 1947 had devastated coastal waters, turning them into a “muddy disaster” and ruining sport fishing. Menninger exhorted Senator Holland:

Some hard-shelled conservationist needs to arise in Congress and awake his associates to the fact that we are not interested in getting rid of the water. The engineers think only in terms of ditches. The greatest service you could render Florida would be to organize a comprehensive program to preserve, impound, and treasure the water, as it is our lifeblood. The longer I live here, the more I am impressed with the necessity of stopping this infernal ditch-digging.³⁹⁶

The C&SF Project was included in the Flood Control Act of 1948, signed by President Truman on June 30, 1948. The act authorized \$70 million for phase I and appropriated \$16.3 million, to become available as soon as state and local authorities had provided their share, amounting to \$3.7 million. The Corps could not immediately begin the project, because the Florida legislature was not due to convene until April 1949. The 1949 session of the legislature enacted three laws that permitted the project to go forward. One measure provided for the elimination of the EDD once its debts had been paid. A second law established the Central and Southern Florida Flood Control District (FCD), which was to take over the responsibilities of the EDD and the old Okeechobee Flood Control District.³⁹⁷ The FCD embraced more than 15,000 square miles extending from Brevard County to Dade County. Finally the legislature appropriated \$3.25 million, representing the state’s initial contribution to construction costs for the C&SF Project. This was the first time the state had allocated any portion of its general revenues to a flood-control project. The only point of contention in the legislature was how to apportion the FCD taxes that would underwrite the local share of construction costs. If taxes were apportioned according to the benefits expected from the project, agricultural interests in the upper Everglades would bear most of

³⁹⁴ Marjory Stoneman Douglas, “What Are They Doing to the Everglades,” c. 1948, cited by Grunwald, 224. Douglas’s first written criticism of the C&SF Project came in 1959, Davis, *Everglades Providence*, 439.

³⁹⁵ Sam C. Collier, Collier Corporation, to Sen. Holland, May 11, 1948, SLH papers, box 178; McCally, 150; Blake, 176.

³⁹⁶ Edwin C. Menninger to Sen. Holland, Mar. 16, 1948, SLH papers, box 178.

³⁹⁷ Florida had created the Okeechobee Flood Control District in 1929 because it was not clear that the EDD had authority to undertake flood control, as opposed to drainage, works. Blake, 145.

the cost. If apportionment was based on property values (the ad valorem basis), urban residents along the coast would pay more than 90 percent of the taxes. At that time, rural interests dominated the Florida legislature, and the ad valorem basis was adopted. This fateful decision ensured that agriculture's water needs would be subsidized by urban land owners, a situation that remains unchanged.³⁹⁸

Implementing the Flood Control Project

The Corps and the FCD shared responsibility for completing and operating the C&SF Project. The Corps designed and built the works, while the FCD was responsible for data collection, land acquisition, and most of the liaison work with local communities. As portions of the system came on line, the FCD was to have day-to-day operating responsibilities. In times of high water and potential flooding, though, the Corps would make final decisions on water releases. A five-member board of directors appointed by the governor oversaw the operations of the FCD. The district established its headquarters at West Palm Beach and named W. Turner Wallis as chief engineer. Wallis's associate, Lamar Johnson, came on as an assistant engineer. Both men had experience in the Everglades dating to the state's drainage work of the 1920s.³⁹⁹

Construction on the project proceeded slowly for several reasons. The original plan had been speedily put together in a few months in 1947. The plan could not be effectively implemented without substantial additional study, and minor modifications had to be made as new data became available.⁴⁰⁰ In addition, Congress was often tardy in appropriating funds for construction. Work on the perimeter levee to protect urban areas along the Atlantic Coast began in January 1950, was about 75 percent complete by 1960, and was largely finished by 1963. The levees surrounding the EAA were completed in 1960. Work on WCA 1 was completed by 1959, but work on WCAs 2 and 3 was not completed until late 1962. Park Superintendent Warren Hamilton participated in the official dedication of WCA 3 by breaking a bottle filled with water from Lake Okeechobee on a spillway structure. Even when the levees around the WCAs were finished, it took years for the water in them to reach target levels. The FWS agreed to manage WCA 1 as the Loxahatchee National Wildlife Refuge.⁴⁰¹ The Florida Game

³⁹⁸ Godfrey, 41, 47-48; Blake, 181.

³⁹⁹ Godfrey, 41, 49-51; "Flood Board to Organize on Tuesday," *Florida Times-Union*, July 10, 1949; "Florida and National Park Service at Loggerheads Over Water," *New York Times*, May 9, 1967; Godfrey, 41, 47-48; Blake, 181. Governor Fuller Warren appointed Dave Turner, Fred Bartleson, Joe S. Earman, N. J. Hayes, and Lawrence Rogers. The board named Turner as executive director. Lamar Johnson's *Beyond the Fourth Generation* provides a fascinating first-hand account of the operations of the EDD and the FCD.

⁴⁰⁰ Changes included reducing the size of the WCAs from 1,500 to 1,300 square miles and shifting the location of some levees; they did not alter the basic plan of the project.

⁴⁰¹ Renamed the Arthur R. Marshall Loxahatchee Wildlife Refuge in 1988.

and Fresh Water Fish Commission took on a similar role, managing WCAs 2 and 3 as the Everglades Wildlife Management Area. The Congress authorized phase II of the project in 1954, and the work of channelizing the Kissimmee River and draining its marshes was conducted from 1962 to 1971. At a cost of \$35 million, the project converted a 92-mile-long river that meandered through wetlands into an arrow-straight 52-mile canal, designated C-38. Five dams with locks impounded water in shallow pools. An estimated 30,000 acres of wetland were drained.⁴⁰²

The major components of the C&SF Project were in place by the mid-1960s, essentially turning the Everglades into a managed hydrological system. Four large sealed compartments—the EAA and the three WCAs—now lay between Lake Okeechobee and Everglades National Park (see figure 8-1). Levee L-29, along the southern boundary of WCA 3, formed a 20-mile barrier across the upper portion of the Shark River Slough. The borrow canal for the levee, the L-29 Canal, ran between the levee and the Tamiami Trail. In the late 1960s, the Corps built two diagonal levees (L-67A and L-67C) that divided WCA 3A to the west from WCA 3B to the east. This was done to isolate the northwestern portion of the area (WCA 3A) from the southeastern portion (WCA 3B), because of high rates of seepage in the latter. The result was that less water was available in WCA 3B, which fed the Northeast Shark Slough. From the 40-mile



Figure 8-3. One of the S-12 water control gates, 2010

402 Blake, 181-184; Godfrey, 53-55, 141.

bend in the Tamiami Trail to a point 11 miles to the east, four gated spillways (S12-A, S12-B, S12-C, and S12-D) allowed water to be released from the L-29 Canal into the park, at the discretion of the FCD and the Corps (figure 8-3, One of the S-12 water control gates). From water control structure S12-D east to Krome Avenue, some 50 culverts running under the Tamiami Trail allowed water from the L-29 Canal to flow into the northeast Shark Slough, *if* the water level in the canal was high enough. Before the construction of L-29, surface water flows from the north had been fairly evenly distributed among culverts under the old Tamiami Trail. Now, water flows into the lower Everglades Basin would come almost entirely at a few point sources (the S-12s), all in the *northwestern* portion of Shark Slough. At the request of the NPS, the Corps between 1966 and 1968 built the L-67 extension, a 10-mile-long canal running south from the S-12D along what then was the eastern park boundary (figure 8-4, water control structures affecting the park). The L-67 was meant to separate the park from private land to the east and enhance water flows into the northeast Shark Slough.⁴⁰³

The east coast perimeter levee south of the Tamiami Trail was the L-31N; its primary purpose was to protect agricultural and residential areas in southern Dade County from flooding (figure 8-1). Between the park's eastern boundary (as it existed in the 1960s) and the L-31N lay an area of about 150,000 acres sometimes known as the East Everglades. Much of this acreage flooded seasonally. Although the planned location of the east coast perimeter levee was widely known, a few people in the 1960s built homes and plant nurseries west of the levee. The East Everglades area also formed the headwaters of Taylor Slough, which runs from near Royal Palm Hammock to Florida Bay. The Corps' plan for south Dade County went through several changes before being implemented. As first conceived, the perimeter levee was to run south to the coastal area. This was soon changed in favor of a network of drainage canals (the C-111, etc.), meant to drain excess water to Florida Bay, Barnes Sound, Card Sound, and Biscayne Bay. The NPS objected to aspects of this plan because it would direct all the run-off to the east, depriving Taylor Slough of needed water. The Corps responded by modifying the project to include Canal L-31W. This canal jogged west from the L-31N and ran along the eastern boundary of the park, potentially allowing water to be routed into Taylor Slough. Moving the perimeter levee to the west also potentially freed up more land for agriculture. Two gated culverts, S-174 and S-175, were placed in the L-31W Canal. Later a pump, S-332, was constructed as an additional means of moving water. The Corps and the park also compromised on the route of Canal C-111, placing the last few miles on a NW/SE diagonal.

403 U.S. Army Corps of Engineers, *Central and Southern Florida Project, Comprehensive Review Study Final Integrated Feasibility Report and Programmatic Environmental Impact Statement* (Jacksonville: Corps, Apr. 1999), J-243-244, http://www.evergladesplan.org/docs/comp_plan_apr99/summary.pdf. Cited hereafter as *C&SF Comp. Rev. Study*.

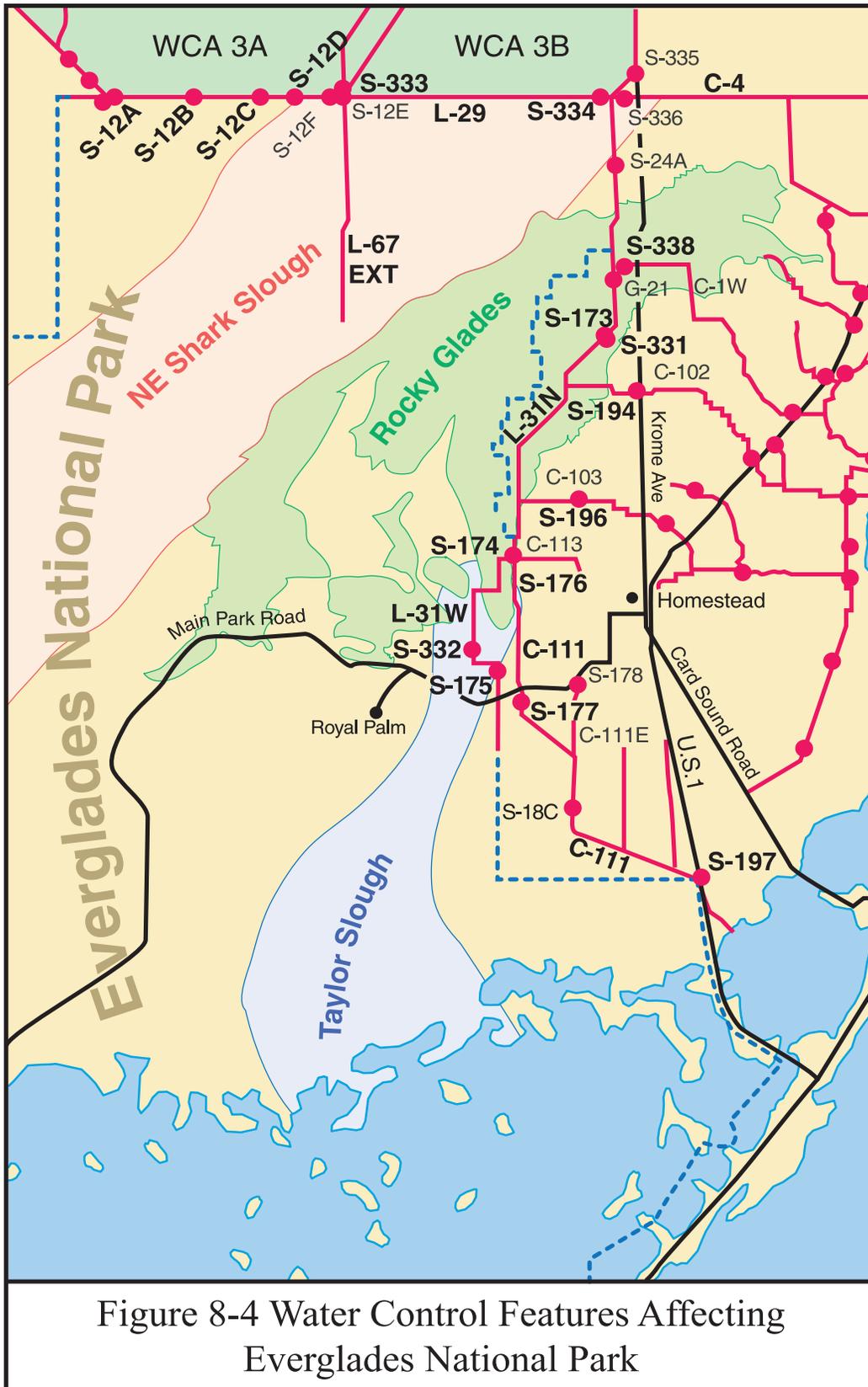


Figure 8-4 Water Control Features Affecting Everglades National Park

As originally designed and constructed, the L-31, the C-111, and related canals in southwest Dade had no surface water connection to the L-29 Canal along the southern boundary of WCA 3. The southern Dade canal system was originally meant as a drainage system only; it had no water storage function. As described below, later changes connected the parts of the system.

Canal C-111 and Aerojet

One of the six canals planned to drain southwest Dade County was the C-111, running seven miles from just south of Homestead to Barnes Sound (figure 8-4). In 1962, the Aerojet-General Corporation, a subsidiary of General Tire Corporation, purchased 25,000 acres and took options on another 50,000 acres southwest of Homestead. Aerojet was a leader in solid-fuel rocket engines and hoped to become an integral part of the National Aeronautics and Space Administration's (NASA's) effort to place a man on the moon. The company spent \$5 million (\$39 million in 2014 dollars) building a complex for researching, testing, manufacturing, and shipping rocket engines on its Dade County property. The tract was adjacent to the eastern boundary of the park, and Canal C-111 was planned to run through it. Canal C-111 was made large enough—28 feet wide and 9 feet deep—to accommodate barges carrying 25-foot-diameter rocket engines. This would allow the engines to be shipped down the C-111 to Barnes Sound and then all the way up the intracoastal waterway to the NASA launch site at Cape Canaveral. In 1967, Aerojet exercised one of its options and purchased 25,000 acres, bringing its total ownership to 50,000 acres.⁴⁰⁴

A facility one mile from the park that tested engines throwing plumes of smoke and particulate matter 1,000 feet into the air was naturally of concern to park managers. The effects of blasts on wildlife and possible air and water pollution were unpredictable, as were the effects on the water regime of such a deep canal. Superintendent Stanley Joseph attended the dedication of the Aerojet facility in May 1964, and the first test of a 260-inch diameter engine took place September 25, 1965. That test and a second test on February 23, 1966, apparently caused no harm on nearby properties. A third test of a more powerful engine on June 17, 1967, was a different story. Hydrochloric acid from the engine's exhaust caused leaf spotting on avocados, limes, and mangos and damaged paint and chrome on automobiles. When NASA decided to use only liquid-fuel rockets, Aerojet tested no more large rockets and eventually stopped using the facility. Had NASA made a different decision, the Aerojet facility would

404 "Aerojet Acquires Options in Florida," *New York Times*, Sep. 23, 1961; Asst. Dir. to Supt., ENP, Feb. 27, 1962, Asst. Dir. Tolson to RDR1, Mar. 20, 1962, NARA Ph, RG 79, 79-70-A-4751, box 53; Godfrey, 82; *Aerojet-Dade: An Unfinished Journey*, directed by Doug La Rue, 2008, <http://www.youtube.com/watch?v=o4BkDQjM2Jc>.

likely have been a serious problem for Everglades National Park. In 1980, the Trust for Public Land (TPL) purchased 17,820 acres from Aerojet for \$17 million dollars and received the remaining 32,180 acres as a donation. The state purchased the 50,000-acre tract from TPL in 1983. It is now owned by the South Florida Water Management District and managed to support Everglades restoration objectives.⁴⁰⁵

Salt water intrusion from Barnes Sound to the park via C-111 was another park concern. In constructing the canal, the Corps had built a temporary dam to carry U.S. 1 over the route of the canal. With C-111 nearing completion in spring 1967, the Corps announced its intention to remove the dam and replace it with a bridge. This move would have left no barrier to prevent salt water from flowing up the canal. Park managers and conservationists insisted that a gated barrier be installed near the canal's outlet to prevent salt water intrusion, and secondarily to retain water that potentially could be diverted into Taylor Slough during times of high water. The Corps and the FCD balked at the cost of such a water-control structure. The National Audubon Society and some local farmers and fishermen brought a suit in federal court against the Corps in March 1967. After further study and discussions with the NPS, the Corps agreed to install a barrier, which was completed in December 1968. At first, this was an earthen dike. In times of high water, the Corps bulldozed the barrier to flush water to tide, then built it anew when the emergency was over. Later the Corps installed a gated culvert structure, known as S-197.⁴⁰⁶

The Cape Sable Canals

A water issue unrelated to the C&SF Project arose in the southwest corner of the park. Settlers in the Cape Sable/Flamingo area in the 1910s and 1920s dug several canals in an attempt to drain the Cape Sable prairies for agriculture and stock raising. As related in chapter 1, these canals instead ruined the area for agriculture by saturating the land with salt water. Two of the canals, the Middle and East Cape Canals, connected Lake Ingraham with the ocean. The Homestead Canal, built in conjunction with the Ingraham Highway, extended to Lake Ingraham. The effect of building the canals and connecting inland waterways with the Gulf of Mexico was to allow salt water at times to flow all the way up the Homestead Canal to the vicinity of Royal Palm Hammock. Initially 16 feet wide, the canals at Cape Sable were gradually widened by tidal action.

405 SMR, May 1964; La Rue, *Aerojet-Dade: An Unfinished Journey*; "Florida Buys Aerojet Glades Tract," *Miami Herald*, Dec. 17, 1983.

406 "Water—Fresh or Salt—Sets Off Dispute in Everglades National Park," *New York Times*, Mar. 19, 1967; *National Audubon Society, et al. v. Stanley N. Resor, SOA, et al.*, Civil No. 67-272, U.S. District Court, So. District of Florida; DOI press release, "Federal Agencies and Florida Announce Details of a Plan for Canal-111 Problem Affecting Water Supply to Everglades National Park," EVER 42242.

The influx of seawater converted Lake Ingraham from a fresh-to-brackish regime to a decidedly marine environment. In addition, the action of tides via the canals led to considerable erosion of the canal banks. In the 1950s and 1960s, the park installed earthen dams in the Homestead and East Cape Sable Canals, but these failed. Repairs were made to both dams in 1984 and to the East Cape Sable Canal in 1991. Failures continued to occur, and in 1997, the park installed sheet-piling dams, which also failed. The park received \$12 million in funding from the American Reinvestment and Recovery Act of 2009 to plug two of the canals, the East Cape Canal and the Homestead Canal. Following an engineering study and an environmental assessment, the project was completed in 2010/2011, but problems have already emerged with the new plugs.⁴⁰⁷

Controversy Over Water Deliveries to the National Park

Cooperation among the Corps, the FCD, and the NPS was slow to develop. In the early years, park managers were largely preoccupied with effectively patrolling and developing the new park for visitation. They lacked the time and the expertise needed to closely examine the evolving C&SF Project. A general sense of unease over how the project would affect the park prevailed within the Service. In August 1949, NPS Regional Director Thomas Allen pressed the Corps for more details on the C&SF Project, requesting that the NPS be given the opportunity to suggest changes to any engineering works before they were built. He also asked the Corps to undertake studies to determine how much water the park should receive to replicate both conditions existing in 1947 and conditions existing before any drainage had been accomplished in the Everglades.⁴⁰⁸ The question of who had the responsibility for calculating the park's water requirements emerged as the first major area of conflict between the park and the Corps and its local partner, the FCD.

As early as June 1950, the Corps was informing the NPS:

Special investigations and studies related to the detailed determinations of requirements of local interests for water supply or other purposes . . . are not considered to be within the responsibilities or authorized functions of the Corps of Engineers. . . . Everglades National Park will compete with agricultural areas and urban centers for water supply.⁴⁰⁹

⁴⁰⁷ Gary E. Davis, "A Review of the Man-Made Canals in the Cape Sable Region of ENP, Fla.," June 1972, Buttram, Trebellas, Memory, and Ogden, 74-76, EVER 42242; "Everglades National Park's American Reinvestment and Recovery Act Cape Sable Canals Dam Restoration Project Moves to the Next Step!," NPS media release, Aug. 18, 2009; Buttram, Trebellas, Memory, and Ogden, 69; Melissa Memory, personal communication, June 26, 2013.

⁴⁰⁸ RDR1 Allen to District Engineer, Jacksonville District, Corps, Aug. 5, 1949, NARA II, RG 79, NPS Dir. Recs., Drury, box 7; RDR1 Allen to District Engineer, Jacksonville District, Corps, Mar. 7, 1951, EVER 42242; Supt. Warren to RDSE, Dec. 20, 1962, NARA Ph, RG 79, 79-70-A-4751, box 55.

⁴⁰⁹ Col. R. W. Pearson, District Engineer, to RDR1, June 30, 1950, cited in Godfrey, 58-59.

The Corps was not only declining to study the park's water needs, but branding the park, set aside by Congress as important to the nation as a whole, a "local interest." Regional Director Allen responded by repeating the Service's view that the Corps had responsibility for determining the park's water needs. He added that preliminary calculations indicated that the park's minimal need was for 300,000 acre-feet of water annually.⁴¹⁰ This figure came from a study of the park's hydrology undertaken by FCD engineer Lamar Johnson. Johnson had long been curious about the park's water needs and got permission from the FCD board to study the question on his own time. His May 1950 report noted that a lack of data from the era before drainage made it impossible to calculate historical water flow with any precision. Relying on descriptions of the region before drainage and more recent rainfall and evaporation data, Johnson produced some estimates. He estimated that before drainage, the area of the park received as sheet flow from north of the Tamiami Trail, "2,315,000 acre-feet in an average year; 10,744,000 acre-feet in a wet year; and negligible runoff . . . during a dry year." He concluded that if the park could get an annual minimum of 300,000 acre-feet from the C&SF Project, the prior ecological balance in the park could be restored "at least to a reasonable degree." He also recommended that, to get the maximum benefit from the water it did receive, the NPS erect a system of low dikes at six mile intervals within the park. The dikes would be gated, with gates opened or closed as needed to retain fresh water and block salt water intrusion. Johnson acknowledged that NPS officials did not favor artificial water control structures within national parks. The NPS regarded Johnson's estimates of water requirements as preliminary, subject to revision following additional study.⁴¹¹

In an exchange of letters, National Park Service Director Drury and National Audubon Society President John Baker indicated their unhappiness with aspects of Johnson's report. The study gave the NPS its first estimate of park water needs, but it emphasized that the C&SF Project would be operated primarily for the benefit of agriculture and coastal residents. Drury noted that the erection of water-control structures within the park was contrary to Service policy and could not be considered. The director understood, however, that water deliveries to the park "will depend on developments and water uses outside the park by agencies over which we have no control"

410 An acre-foot is a measure of volume equal to the amount of water needed to cover an acre of land to the depth of one foot.

411 Engineering Dept., C&SF FCD, "A Report on Water Resources of Everglades National Park, Florida," May 22, 1950; Johnson, *Beyond the Fourth Generation*, 209. 300,000 acre-feet amounted to only about one-seventh of Johnson's calculated average predrainage yearly flow; it is unclear why he believed such a small amount would be adequate.

and that “moral suasion” was the only tool he possessed in dealing with the Corps and the FCD.⁴¹²

Throughout the 1950s, park managers did what they could with very limited resources to better understand regional hydrology and the park’s water requirements. The USGS had maintained water gauging stations in the Everglades region since 1940. Beginning in the winter of 1952/1953, the NPS entered into a cooperative agreement with the Corps and the USGS for five additional stations within the park.⁴¹³ Nonetheless, the park had difficulty freeing staff from other duties to maintain the stations and analyze data from them. In late 1957, Superintendent Beard lamented that the NPS could not give the Corps a more precise idea of its water needs. He observed, “as of now we can only parrot our old line about wanting more water, but not too much. Unless we can get into a position to give more definite answers within the next year or so we’re likely to lose out.” In its early years, the park had to rely on civil engineers and other experts from the NPS regional office or the Washington office to review and comment on Corps construction and operating plans. The park hired its first hydraulic engineer, Frank Nix, in 1963, giving it in-house expertise for the first time. The park’s early research efforts focused not on the region’s hydrology, but on fish populations in Florida Bay (see chapter 11). In 1957, NPS Region 1 suggested that “the problem of ground water flow from the north” was a high priority for research, but it was too late to reallocate money already committed to fisheries studies.⁴¹⁴

In 1958, the NPS hired Lamar Johnson, now an independent consultant, to make a new study of park water needs. His report largely repeated the conclusions and recommendations of his earlier 1950 report. Based on the 1958 study, Superintendent Warren Hamilton communicated an estimate of the park’s needs to the Corps’ Jacksonville office:

[I]t appears the optimum Park water requirements should be two or more million acre feet [annually] with at least 150 thousand acre feet per month coming into the Shark River slough area during the spring season.

These requirements were stated tentatively, subject to future revisions. NPS efforts to estimate park water needs were hamstrung by a lack of research on the effects of the altered water regime on the ecological relationships within the park. As

412 Dir. Drury to John H. Baker, NAS, Jan. 24, 1951; John H. Baker to Dir. Drury, Jan. 29, 1951, Dir. Drury to John H. Baker, Jan. 30, 1951, NARA II, RG 79, NPS Dir. Recs., Drury, box 7.

413 The system of gauging stations continued to be expanded and modernized over the years.

414 Supt. Beard to RDR1, June 4, 1953; Supt. Beard to RDR1, Nov. 26, 1957, NARA Ph, RG 79, 79-67-A-1022, box 52; Acting RDR1 to Dir., July 16, 1957, NARA Ph, RG 79, 79-68-A-2955, box 48.

described in chapter 11, NPS funding for scientific research was woefully inadequate throughout the 1960s.⁴¹⁵

NPS concerns over the amount, location, and timing of water deliveries rose to the highest level of the Department of the Interior in 1961. Secretary Stewart L. Udall wrote Secretary of the Army Elvis J. Stahr Jr. requesting his assistance in concluding a formal agreement among the NPS, the Corps, and the FCD “to insure that future park [water] needs are reasonably assured.” Stahr responded that the Corps had no authority to guarantee a water supply to any user, and that the NPS should seek any desired guarantees from the FCD. An October 1961 meeting in Washington attended by NPS, Corps, and FCD officials brought the parties no closer to agreement. The Corps maintained its stance, and the FCD stated that it could not enter into an agreement with the NPS until it had a more comprehensive understanding of the water needs of both the park and coastal communities. The NPS then persuaded the Congress to request that the Corps conduct a survey and review of possible modifications to the C&SF Project “to provide for the supply, distribution, and conservation of water for or on the Everglades National Park, Florida.”⁴¹⁶ At the suggestion of the Corps, a coordinating committee was established to address water issues in South Florida and help guide the review study. This committee had field-level representatives from federal, state, and local agencies.⁴¹⁷

Drought Brings National Attention to Everglades National Park’s Water Issues

Before the Corps could begin developing the scope of work for the requested study, a severe drought in South Florida brought national attention to the park’s water situation. Much of the Everglades region received only about half of normal rainfall in 1961. By spring 1962, park managers could maintain some water in the ponds along the Anhinga Trail only by pumping from an underground well. Staff pumped water into and dredged the ponds from time to time in subsequent years to maintain some wildlife habitat. These actions were only stopgaps and did not come close to

415 Lamar Johnson, “A Survey of the Water Resources of Everglades National Park,” July 1958; Supt. Hamilton to Col. Paul D. Troxler, Corps, Jacksonville District, Dec. 29, 1958, NARA Ph, RG 79, 79-67-A-1022, box 68.

416 At the request of the FCD, the Senate committee passed a second resolution on June 5, 1963, directing that the study explore the possibility of erecting a barrier to retain fresh water in “the southwest area of the Everglades National Park.” The Corps and the FCD repeatedly proposed such barriers, but the NPS never agreed to them. Acting NPS Dir. to SOI, Apr. 7, 1964, NARA II, RG 48, DOI, CCF, box 206. The committee added a third resolution adopted Jan. 11, 1965, asking that the study address “water supply and water control for the Lake Okeechobee-Everglades agricultural area.”

417 SOI Udall to SOA Stahr, July 18, 1961, NARA Ph, RG 79, 79-67-A-1022, box 69; SOA Stahr to SOI Udall, Sep. 7, 1961, EVER 308019, box 23; Resolution of the Senate Committee on Public Works, May 4, 1962; Godfrey, 75.



Figure 8-5. Pumping from a well at the Anhinga Trail

replicating predrainage water levels. Park staff also placed explosives in the underlying limestone to blast out alligator holes that could collect water and shelter wildlife (figure 8-5, pumping from a well at the Anhinga Trail; figure 8-6, blasting a gator hole). See chapter 12 for more detail on the artificial water holes. Drought conditions persisted until 1966 and led to repeated accusations that the FCD and Corps were denying needed water to the park. A particular sore point was the fact that the gates in the S12 structures in L-29 along the park's northern boundary remained shut, except for two brief periods, from 1963 into 1965. Then, in April 1965, the Corps permitted 70,000 acre-feet of water to be flushed via canals from Lake Okeechobee to the sea, ostensibly to lower the lake level in advance of hurricane season. The NPS protested bitterly; additionally, it was not happy with the slow pace of the Corps' review study of the park's water needs. The NPS also believed that the study process was putting more emphasis on adding engineering structures rather than operating the system to get more water to the park.⁴¹⁸

⁴¹⁸ Godfrey, 76-77; Dir. Hartzog to Maj. Gen. Jackson Graham, Corps, Apr. 30, 1965, NARA Ph, RG 79, 79-68-A-636, box 5; SMR, Feb., May, June, 1962, May 1965, Mar. 1967; John O'Reilly, "Water Wanted for a Parched Park," *Sports Illustrated*, June 7, 1965; Richard W. Klukas, Management Biologist, "Dredging of Aquatic Survival Areas," Oct. 15, 1971, EVER 22965.

With the Corps moving at a snail's pace, the NPS relied on two studies to establish the park's desired "interim supply" of water. Based on a 1961 NPS water resources division study and a 1963 USGS study, the park arrived at 315,000 acre-feet per year as a minimum water flow into the park.⁴¹⁹ The NPS



Figure 8-6. Blasting a gator hole

stressed that the figure was an interim, minimum water supply, subject to revision when additional data were available to establish "water needs for ecological maintenance of the park." While the Corps pursued its review study, it and the FCD worked with the NPS on an interim plan to augment water supplies to the park. Protracted negotiations took place throughout most of 1965, and the plan went into operation in March 1966. The Corps and FCD agreed to pump excess water from Lake Okeechobee into the WCAs whenever it could, build or improve canals and pumps within WCA 3 to facilitate the southward flow of water toward the park, and enlarge and extend canals along the eastern park boundary, which potentially could channel more water to the headwaters of Taylor Slough. All parties understood that these were interim measures only.⁴²⁰

In the meantime, an avalanche of negative publicity kept up the pressure on the Corps and the FCD.⁴²¹ Some observers noted that Florida governors consistently placed agricultural industry representatives on the district's board. *St. Petersburg Times* outdoors columnist Red Marston pointedly asked, "Who speaks for the national park on the five-man FCD governing board?" High-water conditions in WCA 3 in spring and summer 1966 led to the widespread drowning of deer, drawing protests from

419 The Tamiami Trail originally had open culverts at one-mile intervals that allowed some water to flow from north to south, although not as much as flowed before the road was built.

420 Dir. Hartzog to SOI, Sep. 9, 1964, transmitting "Position Paper: Water Problem, Everglades National Park," DOI-DOA Joint Fact Sheet on Water Situation at Everglades National Park, Feb. 16, 1966, NARA Ph, RG 79, 79-70-A-4751, box 54; Blake, 188-190, Godfrey, 78-79.

421 For example, "Everglades National Park A Study in Tragedy as Man Hoards Its Water," *Daytona Beach News-Journal*, May 23, 1965; "Trouble Brewing in the Everglades," *Philadelphia Bulletin*, June 13, 1965; Editorial "Everglades in Danger," *New York Times*, July 12, 1965; Michael Straight, "The Water Situation in Everglades National Park," *National Parks Magazine*, 39/215 (August 1965). The chair of the FCD complained of the unfair treatment given his agency on the CBS Evening News of July 29, 1966, Riley S. Miles to Walter Conkrite, CBS, Aug. 4, 1966, SLH papers, box 532.

sportsmen's groups and animal lovers. By contrast, 1967 was a year of low water, and drought in the park resulted in more bad press. Perhaps the most influential piece to appear was by noted author and conservationist Wallace Stegner, "Last Chance for the Everglades," which ran in the May 6, 1967 issue of *Saturday Review*.⁴²²

The Corps shared its draft review study on South Florida water needs and its recommended modifications of the C&SF Project with the NPS and the state in July 1967. After comments from Interior, the state, and the public, the final draft appeared in May 1968. In it, the Corps accepted as a goal the delivery of 315,000 acre-feet of water per year to the park, but declined to provide a guarantee of this minimum. By this point, the NPS had broken down the overall minimum figure as follows:

- 260,000 acre-feet to Shark Slough via the S-12 structures;
- 38,000 acre-feet to eastern Shark Slough and the headwaters of Taylor Slough;
- 17,000 acre-feet to Taylor Slough in the panhandle area (where the park boundary jogs east to U.S. 1).

Delivery of the last two amounts could not be accomplished until the Corps had built new structures in south Dade County. Additionally, the Service established a monthly schedule for water releases, outlined in the following table.⁴²³

Month	Release in Acre-Feet
January	27,000
February	11,000
March	5,000
April	2,000
May	2,000
June	6,000
July	9,000
August	15,000
September	47,000
October	81,000
November	71,000
December	39,000

⁴²² Godfrey, 83; Red Marston, "Mother Nature or Engineers' Blame in the 'Glades," *St. Petersburg Times*, June 2, 1965.

⁴²³ NPS Deputy Dir. to Brig. Gen. H. G. Woodbury Jr., Director of Civil Works, DOA, Oct. 20, 1967, EVER 58222.

To meet the projected needs of the park and all other water users in South Florida through the year 2000, the Corps proposed the following:

- Increasing the water level in Lake Okeechobee by four feet, aiming for a range of 19.5 to 21.5 feet.
- Pumping excess floodwaters to the WCAs before releasing them to the sea.
- Backpumping excess water in canals and from areas of Martin and St. Lucie Counties into Lake Okeechobee.
- Building additional canals in South Dade County that potentially could supply water to Taylor Slough.⁴²⁴

The basic thrust was to increase the volume of water that could be stored and avoid wasting it. The NPS continued to press the Corps for a written water guarantee for the park. In June 1968 the acting chief of engineers provided it, writing Secretary of the Interior Udall, “the Chief of Engineers will insure the project is regulated to deliver the water requirements of the Everglades National Park as set forth in the report.” Congress then authorized the modifications embodied in the review study as part of the River & Harbor Act of 1968. The projected cost was \$70 million, with \$55 million as the federal share. State officials, however, were not pleased with the Corps’ water guarantee to the park, and the Corps began to back away from what the NPS regarded as a firm commitment.⁴²⁵

The NPS, the Corps, and state officials continued discussions in 1969 and 1970 on the park’s water needs. In the summer of 1969, the FCD and the NPS agreed to an interim water delivery schedule. The schedule called for the FCD to deliver the park’s requested minimum of 260,000 acre-feet from WCA 3 to the northwest Shark River Slough under normal operating circumstances. In times of drought, however, the Corps and FCD insisted that the park would have to compete with other users. At a February 1970 meeting, the parties agreed to implement the interim schedule immediately. Further, it was decided that the park’s requested minimum deliveries to Taylor Slough would begin once the Corps had increased the capacity of canals in south Dade County. The Corps agreed to revisit the question of water delivery to the park when the level of Lake Okeechobee had been raised. It also committed to beginning a restudy of the C&SF Project and South Florida water needs in 1980. The Corps still declined to give a minimum guarantee to the park that would give its water needs priority in time of drought.⁴²⁶

424 Corps, Draft *Survey-Review Report on Central and Southern Florida Project: Water Resources for Central and Southern Florida*, Feb. 15, 1968; Godfrey, 83-84; Blake, 191.

425 Maj. Gen. F. J. Clarke, Corps, to SOI Udall, June 14, 1968, cited in Godfrey, 86; Frank Nix, ENP Water Supply, Sept. 25, 1969, EVER-00952.

426 Godfrey, 88-89; Supt. Raftery to Robert W. Padrick, C&SF FCD, July 15, 1969, Supt. Raftery to Sen. Holland, Feb. 2, 1970, SLH papers, box 601.

As described below in Chapter 9, public concern for the environment had increased dramatically by the late 1960s, and some national lawmakers were determined to obtain a guaranteed water supply for Everglades National Park. When it became clear that the Corps, the state, and the NPS could not agree on this final point, Wisconsin Senator Gaylord Nelson and Maine Senator Edmund Muskie placed the water guarantee into the 1970 act appropriating funds for the C&SF Project. Congressman Dante Fascell led the effort in the House. The law provided that, as soon as the project modifications had been completed, the park would annually receive the lesser of 315,000 acre-feet of water or 16.5 percent of total water deliveries from the project.⁴²⁷ The act also incorporated the terms of the February 1970 agreement, placing the force of law behind the Corps promise to commence a restudy of the entire C&SF Project in 1980.⁴²⁸

The congressionally mandated minimum schedule of water deliveries to the park remained in operation from 1970 through 1983. As detailed in the following chapter, the experience gained in the 1970s and 1980s revealed the inadequacies of that schedule. This then led to a new program of experimental water releases after 1983.

427 The Corps and the FCD had the tools in place to deliver the 260,000 acre-feet earmarked for the Northwest Shark Slough (via the S-12 structures). The 55,000 acre-feet assigned to the Northeast Shark Slough and Taylor Slough could not be provided until the requisite structural modifications were finished.

428 River Basin Monetary Authorization and Miscellaneous Civil Works Amendments Act, June 19, 1970 (P.L. 91-282, 84 Stat. 310). The most detailed account of the negotiations and controversies that led to the water guarantee in the 1970 act is in Godfrey, 86-90. As Grunwald observes in *The Swamp*, both Nelson Blake and Luther Carter wrote that the water guarantee passed over Senator Holland's objections. Grunwald convincingly shows that nothing concerning Florida passed over Holland's objections in this period and that the senator gave his tacit approval to the guarantee, Grunwald, endnote to page 253.