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Restoring the Heart of the Everglades: The Challenges and Benefits

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Restoring the Heart of the Everglades: The Challenges and Benefits

The slow pace of Everglades restoration has drawn concern from all sides of political affiliations, non-profits, and industries alike. With such a large-scale restoration process underway, the overwhelming task of determining how and when to implement the numerous aspects of the restoration plan have become a challenge for all those working towards restoring the historic flow of water south.

By Stephen E. Davis, G. Melodie Naja, and Aida Arik

Everglades restoration is not occurring fast enough. According to whom? The National Academy of Sciences in its most recent biennial report to Congress.[1] Stakeholders and environmentalists concur, citing the latest science and agency reports[2] that point to a continued decline in the ecosystem's vital signs including wading birds, fish, and landscape pattern. Even politicians on both sides of the aisle have agreed that Everglades restoration is a national priority. To make it an even more pressing issue, there is also a growing body of evidence to suggest that restoring the Everglades is our best defense against an uncertain future climate and would allow for a more natural transition of habitats as sea levels continue to rise.[3] We all agree that *something* needs to be done and soon.

Surprisingly, there is an equally broad consensus on *what* needs to be done. In order to restore the Everglades, we must reconnect the flow of freshwater from Lake Okeechobee to this vast oligotrophic wetland dominated by sawgrass ridges, sloughs, and tree islands. This hydrologic reconnection will have the dual benefit of reducing the massive discharges of polluted freshwater to the Caloosahatchee River and St. Lucie River Estuaries, while providing the freshwater flow needs of habitats across the River of Grass and important estuaries to the south such as Florida Bay and Biscayne Bay (Figure 1). We also know that restoring this flow to the Everglades will enhance recharge of the Biscayne Aquifer, thus improving south Florida's water supply for the future.

The Comprehensive Everglades Restoration Plan (CERP), which was signed into law by President William Clinton in 2000,[4] provided the consensus road map for replumbing the ecosystem to move more water south. However, there were essential water storage components associated with CERP that were not sufficiently tested, designed, or proven to be a viable solution on a large scale. Furthermore, there were insufficient water quality improvement measures in place when CERP was passed

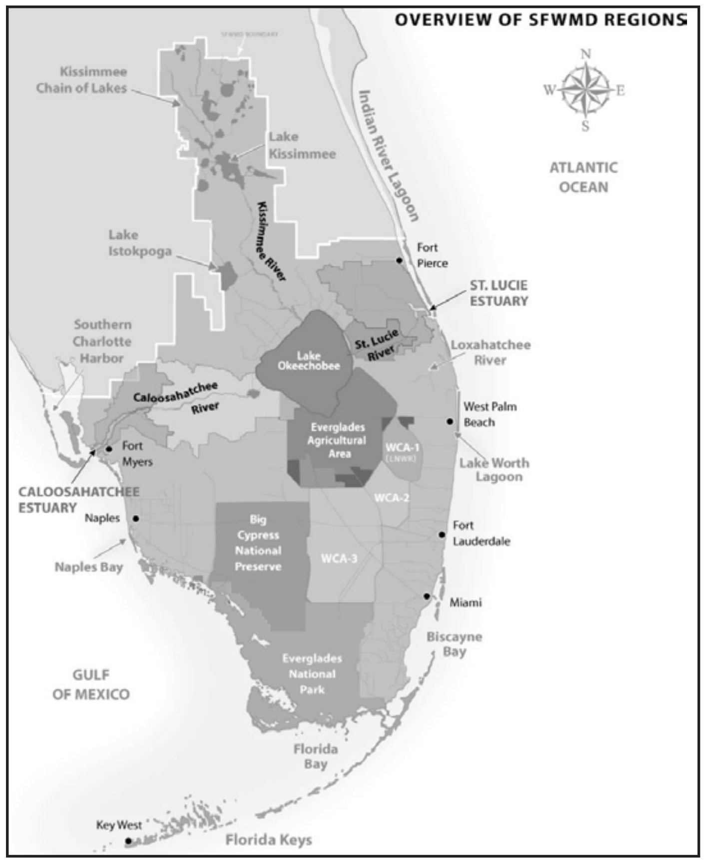

Figure 1: Map of south Florida showing the South Florida Water Management District (SFWMD) that spans the historic Everglades from the Kissimmee River-Chain of Lakes all the way to Florida Bay. Stormwater Treatment Areas (STAs) are represented by dark parcels along the southern rim of the Everglades Agricultural Area (EAA). Map provided courtesy of the SFWMD.

and no consensus opinion on a phosphorus threshold that would protect remaining Everglades habitat.

Resolving the Water Quality Issue

In 2003, the state of Florida adopted a water quality criterion for total phosphorus (TP) of 10 parts per billion (ppb) for most Everglades marshes.[5] This standard was based on years of research and field observations noting dramatic long-term changes in habitat when TP concentrations were above the 10 ppb threshold (see infographic in Figure 2). Subsequent legal action and federal court rulings[6] would establish that water reaching the Everglades must be sufficiently cleansed of agricultural pollutants (mainly phosphorus) to protect sensitive Everglades marsh habitats. To resolve the lawsuit between the federal government and the state of Florida, a settlement agreement was reached obligating the state to implement Best Management Practices (BMPs) for source control in the Everglades Agricultural Area (EAA) and build treatment wetlands called Stormwater Treatment Areas (STAs) for phosphorus removal.

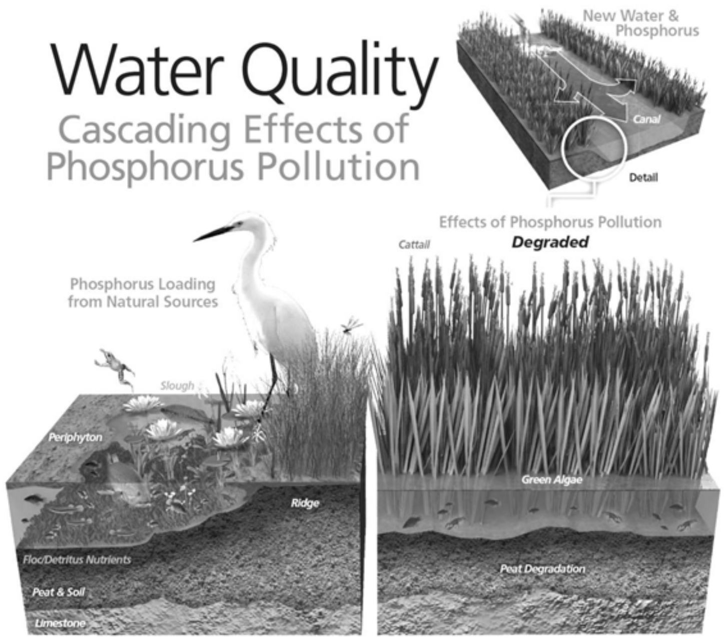

Figure 2: Infographic showing Everglades marsh habitat change resulting from chronic phosphorus pollution (above the 10 ppb TP threshold), including a loss of periphyton, invasion and expansion of cattail, loss of habitat and species diversity, and soil degradation.

STAs are a costly, yet reliable technology for reducing TP loads to the Everglades. A recent estimate shows that it costs an average of about $921 for every kilogram of phosphorus removed by STAs in the EAA.[7] In terms of surface water storage solutions, conventional above-ground storage is the most reliable and relatively cost-effective solution. Both of these treatment and storage technologies require the acquisition and conversion of lands for these purposes and subsequent connection to existing flow paths into the Everglades. Given the location of the EAA between Lake Okeechobee and the remaining River of Grass, the EAA is the best location for these features. To date, the state of Florida has invested nearly $2 billion in the construction and operation of almost 57,000 acres of STAs[8] in the southern EAA—largely at the expense of taxpayers. This is the largest treatment wetland system in the world, yet it is still not enough to meet the 10 ppb TP criterion for the ecosystem.

In 2012, the state of Florida unveiled a water quality plan called Restoration Strategies.[9] This was an $880-million effort to boost the capacity and efficiency of the current wetland treatment system through an additional 6,500 acres of STAs and shallow Flow Equalization Basins (FEBs) to maximize efficiency of STAs. Moreover, a discharge limit for the STAs was set to ensure that waters reaching the Everglades would meet the water quality criterion of 10 ppb TP. The existing network of STAs and the fixes from Restoration Strategies apply to *current inflows* only. In order to deliver additional flow to the ecosystem—which is what Everglades restoration is largely about—additional water treatment infrastructure, beyond Restoration Strategies, must be included in the plan.

How to Restore the Everglades Then?

While stakeholders across the region agree on the concept of "flowing water south," some believe that it can be achieved in a single increment of restoration. Since the summer of 2013, when discharges from Lake Okeechobee to the Caloosahatchee and St. Lucie Rivers wreaked havoc on water quality in those estuaries, there has been much public outcry and discussion of everything from near-term solutions to a panacea. This is understandable given that livelihoods and economies are tied to the environmental impacts of these discharge events. The reality is that we are unable to relieve the issues of the Caloosahatchee, the St. Lucie, and the Everglades in a single increment of restoration, and it will take time.

Why? First, it would be too costly. For every increment of water volume diverted back to the Everglades, a corresponding increment of storage and treatment is also needed because the source water has about 20 times the amount of phosphorus than the ecosystem can withstand.

Storage and treatment components require additional land acquisition and significant earthworks that reach into the hundreds of millions of dollars. Restoration also involves removing key barriers to flow such as canals and levees and bridging old roads such as Tamiami Trail (US-41), known as decompartmentalization, in order for water to flow freely as a sheet across the land rather than ponding against man-made structures. And, as more flow is restored back to the ecosystem, flood control for adjacent developed and agricultural lands must be reevaluated and maintained at existing levels—requiring changes to operations or additional infrastructure. For these reasons, agencies have adopted a phased strategy with transitional flow targets to restore the Everglades and relieve the Caloosahatchee and St. Lucie Estuaries.

So, if we can't do it all in one fell swoop, what can we do? Since the passage of CERP in 2000, multiple projects have broken ground around the periphery of the Everglades ecosystem such as Southern Golden Gate Estates (aka Picayune Strand) in southwest Florida, Site 1 Impoundment to the southeast of Water Conservation Area (WCA)-1, and Biscayne Bay Coastal Wetlands south of Miami.[10] However, none have addressed the flow needs of the core Everglades, including WCA-3, Everglades National Park (ENP), and Florida Bay. Recognizing this, the South Florida Water Management District (SFWMD), the lead state agency involved with Everglades restoration, and the U.S. Army Corps of Engineers (the Corps) initiated the Central Everglades Planning Project (CEPP—not to be confused with CERP) in late 2011. Under an expedited planning time line, these agencies were tasked with developing a plan that would jumpstart restoration in the central Everglades—the heart of the ecosystem that has been most impacted by reduced freshwater flow.

"The project will divert freshwater (about 210,000 acre-feet or more than 65 billion gallons each year) from Lake Okeechobee back to the Everglades rather than releasing it as damaging discharges to the Caloosahatchee and St. Lucie Rivers to the west and east, respectively."

In August 2014, the Corps released the Final Project Implementation Report and Environmental Impact Statement for CEPP.[11] In reality, CEPP is part of CERP. It is a reconsideration and repackaging of several CERP projects. These CERP projects were repackaged to maximize benefits in the central Everglades using state-of-the-art hydrologic models and modern processing power that allowed for screening of options for storage and treatment in a fraction of the time it took in the 1990s. Further, with an additional 15 years of monitoring and research, we have generated a richer scientific understanding of the ecosystem allowing for the development of ecological models and performance measures used to more accurately project environmental benefit.

The CEPP Plan in Detail

The CEPP plan that will be recommended for congressional authorization (aka Alternative 4R2) will be the most significant, far-reaching restoration project we have seen in south Florida as of yet, and perhaps that which has been undertaken in the world. CEPP's projected benefits will stretch from the Caloosahatchee and St. Lucie Estuaries in the north, through the state-operated WCAs to Everglades National Park, and all the way down to Florida Bay and the estuaries of the southwest coast—spanning nearly two million acres and stretching nearly 150 miles from one end to the other (see Figure 3 for CEPP project elements).

The project will divert freshwater (about 210,000 acre-feet or more than 65 billion gallons each year) from Lake Okeechobee back to the Everglades rather than releasing it as damaging discharges to the Caloosahatchee and St. Lucie Rivers to the west and east, respectively. This is more water than the city of Austin, Texas (population 850,000) consumes in an entire year and would fill the volume of the Empire State Building 2.5 times. While it represents a large volume of water diverted south, CEPP will not completely alleviate all the harmful discharges to the Caloosahatchee and St. Lucie Rivers. Instead, it will reduce high flow periods to the Caloosahatchee by 14% and about 35% to the St. Lucie—a sizable amount for a first increment of central Everglades restoration. The reduction in nutrient pollution and disturbance to estuarine salinity patterns will have significant benefits to fish habitat (e.g., oyster, seagrass) in both systems.

Water from Lake Okeechobee will be routed through a new, 14,000-acre FEB constructed in the A-2 parcel of the 1999 Talisman Sugar Co. purchase in the EAA (Figure 3). Conversion of this parcel to FEB will provide both storage and treatment functions before the water is then passed through the existing network of STAs. From there, the water

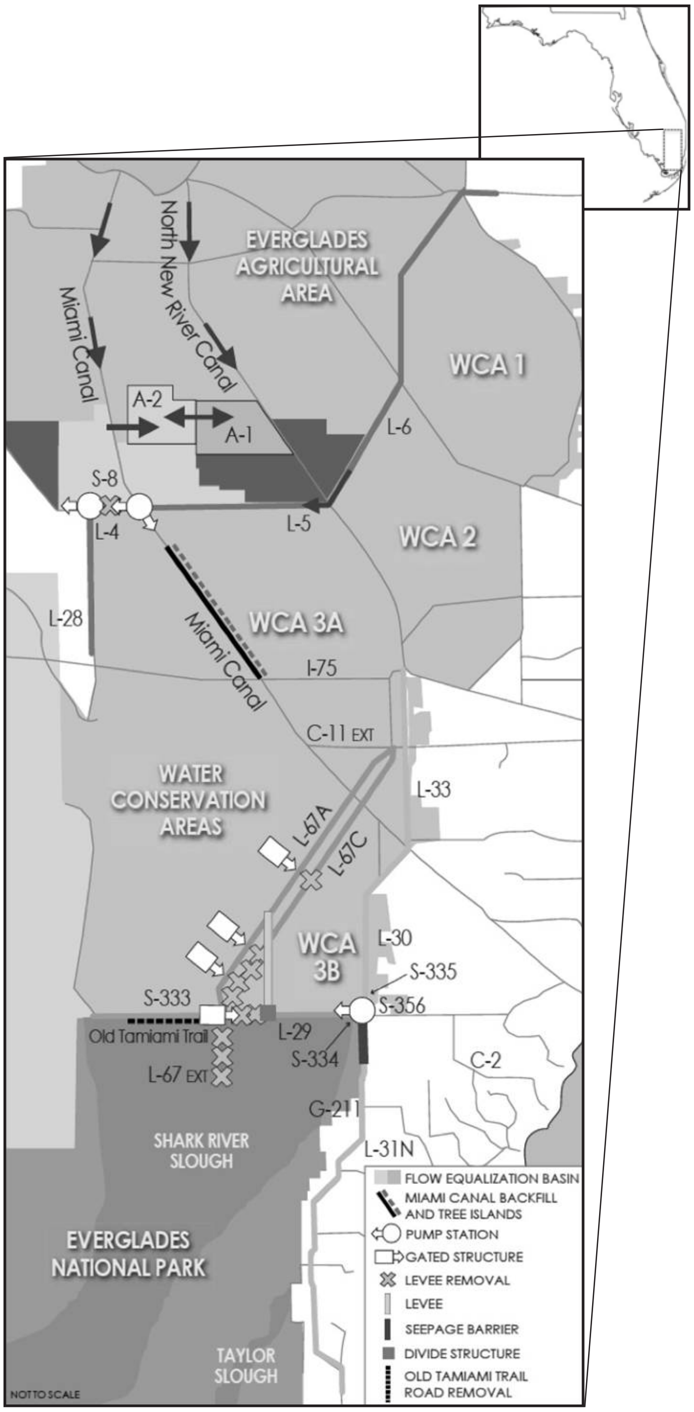

Figure 3: Map showing CEPP plan that will divert approximately 210,000 acre-feet of "new" water from Lake Okeechobee to the south and reduce harmful discharges to the Caloosahatchee and St. Lucie Rivers. A CEPP flow equalization basin (A-2) will both store and treat water before it flows to existing STAs. From there, water will flow as sheetflow into northwest WCA-3A and across a backfilled Miami Canal. Reconnecting WCA-3A and 3B will allow for restored flow under a new 2.6-mile bridge along Tamiami Trail (US-41) and into northeast Shark River Slough of Everglades National Park. From there, benefits will be realized all the way into Florida Bay and the southwest coast (See endnote 11).

will be distributed to northern WCA-3A. Restoring sheetflow to northern WCA-3A will be accomplished through a 2.9-mile spreader feature in the northwestern corner and by backfilling 14 miles of the Miami Canal from I-75 nearly all the way up to the S-8 pump station near the heel of the Holey Land Wildlife Management Area. These actions will allow water to fan out as sheetflow across the marsh, rehydrating areas that have been overdrained and reconnecting habitats that are critical for wading birds and alligators.

Further downstream, the CEPP plan will reconnect WCA-3A and WCA-3B through gated structures creating an open flow-way through the southwestern corner of WCA-3B that would align with a new 2.6-mile bridge along Tamiami Trail. In order to reconnect marsh and allow the water to move as sheetflow across this boundary, the levee (i.e., L-29) along the lower end of this flow-way will be removed, thus providing an open and safe path for fish and wildlife to move between WCA-3B and the park for the first time since Tamiami Trail was constructed in 1928. This will also help relieve excessive ponding of water in lower WCA-3A and will increase water levels nearly one-half-foot in Shark River Slough, greatly reducing fire risk and tree island loss. Dry season flows in this area will be increased about sevenfold and wet season flow will show an even more dramatic increase in this most-parched region of the Everglades ecosystem.

Increased flow volumes to Everglades National Park will have a huge benefit for Florida Bay and the estuaries of the southwest coast. This area represents the largest, most-productive contiguous mangrove-forest ecosystem in the United States. With its numerous islands, channels, and tangled network of prop roots, it is prime habitat for a variety of coastal, estuarine, and even pelagic fish and shellfish species. Florida Bay is projected to see a decrease in salinity of about 2-3 parts per thousand as a result of CEPP. In addition to fish and shellfish species such as snook, spotted seatrout, and pink shrimp, this increased freshwater flow will also benefit species such as the roseate spoonbill and American crocodile.

Overall, the CEPP plan is projected to increase Everglades habitat quality from top-to-bottom by 28%—an area covering about two million acres. In two to five years, 70% of CEPP-derived benefits to the freshwater areas (i.e., Everglades marsh habitat) will be realized, providing near-term relief for endangered or threatened species such as the Everglade snail kite and wood stork. In Florida Bay and the estuaries of the southwest coast, we will see an even more immediate improvement, with about 80% of habitat benefits being realized in the first two to five years after implementation. In addition to habitat improvement, the CEPP plan will improve water supply available for the nearly eight million people in the SFWMD. Hydrologic modeling showed an estimated increase of 17 million gallons of drinking water per day available for Broward and Miami-Dade Counties (representing about 4.5 million Floridians). Finally, through the construction of seepage barriers, the CEPP plan increases water levels in the Everglades while maintaining existing levels of flood control to the lower east coast of Florida.

Perhaps even more important, implementation of the CEPP plan will be an essential first step toward preparing for an uncertain future climate.

What Else Needs to Be Done?

Beyond CEPP, there will be much to do before we can say the Everglades ecosystem is restored. However, that end-state becomes much clearer with CEPP. We know that a fully restored Everglades will involve additional storage and treatment components. This will be necessary to fully alleviate the problems in the Caloosahatchee and St. Lucie Estuaries and to provide sufficient flow volume to Everglades National Park and Florida Bay. A restored Everglades will also involve more decompartmentalization, because for every increment of water we can move south, we will need to consider strategic removal of barriers to flow. We know this will involve completing the bridging of Tamiami Trail as laid out by the National Park Service.[12] This "opening up" of the system will prevent excessive ponding of water in some areas and is essential for restoring River of Grass habitats such as tree islands, sawgrass ridges, and sloughs.

A restored Everglades will result in improved recreational opportunities, improved water supply, improved water quality, and improved economic conditions across the region. Knowing this, why aren't we moving any faster to get the CEPP plan implemented? Well, Everglades restoration is as complex as any puzzle. Some pieces (including both projects and policies) need to be in place before CEPP can be put together and completed. However, there are some components of CEPP (e.g., backfilling of the Miami Canal) that fit into the existing picture and would bring immediate benefits to the ecosystem and would not require the addition of "new" water.

Completing restoration of America's Everglades is essential to south Florida's future. Finishing the job will draw upon the best available science (including our growing understanding of sea-level rise and climate change impacts), it will require more funding for invasive species management and continued monitoring of the ecosystem's vital signs (especially as projects are completed), and lastly prioritization of projects like CEPP that bring immediate and significant regional benefits. ■

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Endnotes

1 National Research Council, Progress Toward Restoring the Everglades: The Fifth Biennial Review (2014).

2 *Comprehensive Everglades Restoration Plan: 2014 System Status Report*, Restoration Coordination and Verification (RECOVER), *available at* http://www.evergladesplan.org/pm/ssr_2014/Docs/ssr_full_2014.pdf.

3 Meeting Summary, *Recommendations for Everglades Restoration Under a Future Climate Scenario* (2014), *available at* http://www.ces.fau.edu/climate_change/everglades-recommendations-2014/pdfs/usgs-recommendations-for-everglades-meeting-summary.pdf.

4 At the time of CERP's passage, it was estimated to cost about $8 billion over 40 years to be cost-shared 50:50 by Florida and the federal government. Today, the estimated cost of implementing CERP is more than $13.5 billion.

5 Historically, Everglades National Park had lower levels of phosphorus than the rest of the Everglades because it is located at the tail end of the system. Therefore, water quality standards in the Park are based on a different methodology that takes into account the amount of flow in a given year, and typically result in levels lower than 10 ppb.

6 U.S. EPA, *Phosphorus Water Quality Standards for the Florida Everglades Factsheet*, EPA (July 2011), *available at* http://water.epa.gov/lawsregs/rulesregs/floridaeverglades_factsheet.cfm.

7 J.A. Entry & A. Gottlieb, *The Impact of Stormwater Treatment Areas and Agricultural Best Management Practices on Water Quality in the Everglades Protection Area*, 186 Envtl. Monitoring & Assessment 1023-37.

8 Fla. Stat. §373.4592 (2014) (These are non-CERP features and part of Florida's long-term plan for meeting the 10 ppb TP criterion for protecting the Everglades as per the Everglades Forever Act).

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10 *CERP Project Locator*, CERPZone, *available at* http://cerpmap1.cerpzone.org/ProjectLocator/.

11 U.S. Army Corp of Engineers, *Comprehensive Everglades Restoration Plan: Central Everglades Planning Project: Final Integrated Project Implementation Report and Environmental Impact Statement*, The Comprehensive Everglades Restoration Plan (CERP), *available at* http://www.evergladesplan.org/docs/2014/08/01_CEPP%20Final%20PIR-EIS%20Main%20Report.pdf.

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