

**Draft Formulation Strategy**  
**Everglades National Park Seepage Management Project**  
June 20, 2008

The purpose of this paper is to present an initial plan formulation approach for the Comprehensive Everglades Restoration Plan (CERP) Everglades National Park Seepage Management (ENPSM) project. This paper provides the following:

- Project Background and Yellow Book Plan
- Project Planning Issues
- Overview of Incremental Adaptive Restoration
- Recommendations

**Project Background and Yellow Book Plan**

The study area for the proposed project is located in western Miami-Dade County, Florida, and includes the eastern portions of the Everglades National Park (ENP) south to Florida Bay, the adjacent urban areas of Miami-Dade County, and Biscayne Bay (See Figure 1). The project area is bounded to the south by the C-1 Canal, to the east by Krome Avenue, water control structure S-355 to the north, and ENP to the west.

The project as envisioned in the Yellow Book was composed of three alternatives: L-31N Improvements for Seepage Management (Component FF), S-356 Structures (Component V), and Bird Drive Recharge Area. These three alternatives would work to improve water deliveries to Northeast Shark River Slough (NESRS) and restore wetland hydroperiods and hydropatterns in ENP via seepage management. The CERP L-31N Improvements for Seepage Management and S-356 Structures included relocating and enhancing L-31N, groundwater wells, and sheetflow delivery system adjacent to ENP in Miami-Dade County. More detailed planning, design, and pilot studies were to be conducted to determine the appropriate technology to control seepage from ENP. Also included was a feature to relocate the Modified Water Deliveries Structure S-357 to provide more effective water deliveries to ENP. New discharges to ENP were to be designed to meet applicable water quality criteria.

The CERP Bird Drive Recharge Area (BDRA) alternative included pumps, water control structures, canals, and an above-ground recharge area with a total storage capacity of approximately 11,500 acre-feet. The initial design of the recharge feature assumed 2,877-acres with the water levels fluctuating up to 4-feet above grade. The total estimated initial cost for the BDRA in the Yellow Book was \$124,084,000. The purposes of this feature are to:

- Recharge groundwater and reduce seepage from the ENP buffer areas by increasing water table elevations east of Krome Avenue
- Provide C-4 flood peak attenuation

- Provide water supply deliveries to the South Dade Conveyance Systems and Northeast Shark River Slough (NSRS)

### **Project Planning Issues**

The Project Planning Issues have been separated into two categories for simplification. The first category pertains to the uncertainties associated with the planning and implementation of a seepage barrier along the L-31N levee and canal. The second issue pertains to analysis of the BDRA alternative from the Yellow Book and the need to develop alternatives to satisfy the objectives of this feature.

### **L-31N Seepage Barrier**

- **Decomartmentalize Water Conservation Area 3B (Decomp) and Modified Water Deliveries to ENP (Modwaters): Planning and implementation schedule** – Large flows into Water Conservation Area (WCA) 3B and ENP are not anticipated until the “physical model” of Modwaters or Decomp is completed. Operable structures will be constructed in the L-67 A and C levees as a result of these projects. Water could then flow from WCA 3A into WCA 3B, which at times would increase seepage to the east from the project area. Additionally, as both Decomp and Modwaters have been “broken” into separate PIRs, increases in flows to the proposed ENPSM project area will come in separate increments. At this time, there is no timeframe that has been developed that would anticipate the quantity, timing, and distribution of these future flows. Although the ENPSM project could be aligned with the first PIR for both of the projects in terms of both benefits and impacts, there will be a great deal of uncertainty related to the future plans in subsequent PIRs. Any necessary changes in the scope and magnitude of the plans for Decomp and Modwaters could have extremely negative consequences for the ENPSM project, and could translate into a project that may need to be modified almost immediately after implementation.
- **Impacts to eastern urban areas and Biscayne Bay** – It is likely that a seepage barrier constructed along L-31N would restrict water flows to the east that are currently supplying the City of Miami wellfields and other legal users, as well as the CERP Biscayne Bay project; however, the amount of water that would be “blocked” is currently unknown. According to the CERP Programmatic Regulations (ProRegs), these water deliveries must be maintained as required by law.

Although canal surface water flows required for the Biscayne Bay project have been quantified from DBHydro data, efforts to quantify groundwater flows and influence on Biscayne Bay to date have been unsuccessful. Also, initial modeling during the Restudy seemed to demonstrate that the CERP plan overall would have

some negative impact on Biscayne Bay. As such, any manipulation of current groundwater flows to the east could have unforeseen negative consequences on Biscayne Bay regardless of whether the ENPSM project team was able to demonstrate that surface water flows would be maintained. As such, there is a great deal of uncertainty associated with the ENPSM project and efforts will need to be made to ensure that the proposed project does not have detrimental effects on Biscayne Bay.

- **L-31N Seepage Management Pilot Project schedule** - The L-31N Seepage Management Pilot Project is not scheduled for completion of construction until after the ENPSM PIR would be completed. The information gained from the pilot project was to be utilized for the planning and design of the proposed ENPSM seepage barrier. As the Pilot will not be completed in time for the ENPSM project team to utilize any new information, there will be no reduction in uncertainties related to using seepage barrier technology in the CERP. As such, the project team will need to utilize existing information and rely on modeling data that has not been back checked against actual situations that exist on the ground. Although the ModBranch model has been tested and used for other CERP projects in the vicinity, there will be some risk involved in conducting seepage management over such a vast expanse of land for the proposed project.
- **Seepage Barrier Design and Constructability** – The design and construction of a permanent seepage barrier present a great deal of uncertainty in regards to the design required to retard seepage while still allowing some groundwater flows. Although some “breaks” in the barrier could be established to allow flows to the east, the magnitude of these flows cannot yet be quantified. It is quite possible that any “breaks” in the seepage barrier would negate the effectiveness of the barrier. Uncertainties remain in the projected depth of the seepage barrier. Although modeling may predict the desired dimensions of a barrier, there is still a large deal of uncertainty without any in-ground design testing being performed. If a seepage barrier were constructed and then determined to be of the wrong design, dismantling of the barrier and complete removal may be required. If the removal of the barrier was required, public support for Everglades restoration projects could be negatively impacted and CERP costs could significantly increase.

### **Bird Drive Recharge Area**

Preliminary analysis of the BDRA has indicated that this entire alternative as envisioned in the Yellow Book is not implementable. Modeling and more detailed physical analyses have indicated that the design and operation of the BDRA alternative are not feasible. Real Estate values in the proposed BDRA lands has increased exponentially, creating a need to evaluate less costly alternatives that would still provide satisfy the purposes of the alternative.

### **Design Issues and Constraints**

- **Seepage from the proposed BDRA** – One of the purposes of the BRDA from the Yellow Book was to provide C-4 flood peak attenuation, which would require stacking water within the proposed BDRA. Preliminary modeling has indicated that water leakage from the BDRA would likely cause flooding impacts in areas to the east of the proposed project site. In order to provide flood protection for these privately-owned lands, another seepage management system would need to be constructed to prevent seepage from the BDRA to the east. As such, constructing another seepage management system in addition to the seepage barrier would in essence be providing “seepage management for seepage management.”
- **Substrate Transmissivity** – After an initial analysis of the transmissivity values in the proposed BDRA, it was determined that the site would not hold water as envisioned in the Yellow Book. As such, the alternative would not perform as projected in CERP. Surface water pumped into the BDRA would likely infiltrate into the ground and move laterally to the east, causing water levels in the urban areas to rise. Although the area could be lined to prevent water from moving quickly into the substrate, infiltration for recharge would be difficult if not impossible to control.
- **Associated Projects** – Preliminary modeling has indicated that the Yellow Book BDRA alternative would not be able to store surface water for deliveries to the South Dade Conveyance System (SDCS) and Northeast Shark River Slough (NESRS). As storing water for the deliveries is a primary purpose of the proposed project in the Yellow Book, other alternatives will need to be formulated to compensate for this loss of storage capacity.

### **Real Estate Issues**

Real Estate costs within the proposed BDRA were estimated at approximately \$71 million in the Yellow Book. Recent land values have been estimated between \$280-400 million, an increase of 400 percent or more. Although the South Florida Water Management District (SFWMD) has proactively acquired, 1,400 acres of land for project purposes, a significant amount of land is still required. It is likely that many of the private landowners in the project area would be unwilling to sell their property. The SFWMD has not been granted condemnation authority by the State of Florida. As such, the Corps would have to request condemnation authority from Congress in the PIR. There is a distinct possibility that the authority would not be granted by Congress. If authority is not granted, then the entire PIR would need to be re-evaluated. This re-evaluation would take considerable time and effort while Everglades restoration suffers the consequences.

### **Overview of Incremental Adaptive Restoration (IAR)**

In November 2006, a new report providing recommendations for the Everglades restoration was released. The National Research Council (NRC) Committee for Independent Scientific Review of Everglades Restoration Progress (CISRERP) concluded that if the construction of restoration projects are delayed until the many scientific uncertainties are eliminated, then there will be many negative consequences, including continued decline of the Everglades ecosystem, lagging public support, and increased project costs.

The NRC recommended an approach referred to “Incremental Adaptive Restoration” (IAR). This approach is based on a recognition that implementation of increments of CERP projects will provide some immediate restoration benefits while addressing scientific uncertainties, which will promote learning that can guide the remainder of the project implementation through adaptive management. Implementing projects using a phased approach will enable assessments of benefits and impacts to the environment as each phase is constructed. Remaining phases can then be designed to optimize performance based on actual findings from the earlier phases.

### **Recommendations**

#### **Two-PIR Approach**

The proposed ENPSM project will be implemented via a multiple-PIR approach consistent with the IAR principles recommended by the National Research Council. The first PIR will focus on establishing the first increment of a seepage management system in the project area. The intent of the first PIR is to provide immediate environmental restoration benefits to the natural system while providing a platform for further analysis in the planning and design of future restoration efforts. The first PIR will concentrate on the “leakiest” sections of the L-31N in order to maximize benefits and also provide the most learning opportunities. Additionally, the first PIR would be focused on areas that would not cause any impacts to Biscayne Bay and urban areas to the east.

The subsequent PIR/PIRs will focus on expanding the seepage management system to compensate for increased flows into the project area from other CERP projects. Information from the completion of the Seepage Management Pilot Project will be utilized to guide further planning efforts. Planning efforts will be coordinated with the CERP ModWaters and Decomp project teams to optimize future project design and operations. Additionally, observations and monitoring information gained after implementation of the first PIR will be utilized to further improve model capabilities for the project. Future design and operations should be improved to increase effectiveness of the seepage management system and provide more efficient operations for distribution of water. Well data in Miami-Dade County and observations concerning Biscayne Bay will be utilized to further ensure that no negative effects would occur as a result of future project expansion.

#### **BDRA Alternatives**

Analysis of the BRDA Yellow Book alternative has indicated that this feature is not implementable. As such, the project team intends to screen the BDRA alternative and develop alternatives that still achieve the original project purposes of the BDRA. The BDRA alternative evaluation will be included in the PIR along with any pertinent information. Some portions of the lands that would have been required for the BDRA may still be needed for conveyance features or other project elements.

A list of associated CERP projects that could possibly rely on the functions of the BDRA has been compiled. These four projects are listed as follows:

- North Lake Belt (Component XX)
- Central Lake Belt Storage Area (Components S & EEE)
- Diverting Water Conservation Area 2 and 3 flows to Central Lake Belt Storage Area (Components YY & ZZ)
- Dade Broward Levee/Canal

The team has moved forward with an initial evaluation of alternatives that would compensate for the BDRA intended features and still work in unison with the above-listed projects. The project team is exploring the possibility of continuing water supply deliveries to South Dade along the L-31 and a reconfigured L-31N, or providing water deliveries via the C-4 and a new conveyance canal along Krome Avenue. These possible alternatives and any others that are formulated by the PDT will be developed alongside alternatives for the L-31N Seepage Management portion of the proposed project in order to select a plan for the proposed PIR I.