HOUSE OF REPRESENTATIVES STAFF ANALYSIS

BILL #: HM 489 Herbert Hoover Dike
SPONSOR(S): Vana and others
TIED BILLS: **IDEN./SIM. BILLS:** SM 1680

REFERENCE	ACTION	ANALYST	STAFF DIRECTOR
1) Committee on Conservation & State Lands		Palmer	Zeiler
2) Environment & Natural Resources Council			
3)			
4)			
5)			

SUMMARY ANALYSIS

House Memorial 489 urges the United States Congress to authorize improvements to bring the Herbert Hoover Dike (Lake Okeechobee) into compliance with current levee protection safety standards and to authorize funding to expedite the improvements.

As a House Memorial, HM 489 has no fiscal impact.

FULL ANALYSIS

I. SUBSTANTIVE ANALYSIS

A. HOUSE PRINCIPLES ANALYSIS:

Maintain Public Security Safety: This House Memorial requests Congress to bring Herbert Hoover Dike into compliance with current levee protection safety standards thus providing an increased measure of safety to communities surrounding Lake Okeechobee.

B. EFFECT OF PROPOSED CHANGES:

Present Situation

Lake Okeechobee (Seminole for "Big Water") is the second largest fresh water lake that lies entirely within the United States. The lake surface is about 35 miles north to south and 30 miles east to west occupying about 730 square miles in the center of South Florida. Prior to drainage and dike construction during the past century the lake occupied about 970 square miles. It is a shallow lake averaging about 10 feet in depth at normal water levels. The lake is the recipient of water from the Kissimmee River basin and rainfall from as far north as Orlando flows overland into streams that ultimately empty into the lake. The total area that contributes water flows to Lake Okeechobee is about 5,600 square miles.

In the 1890s a real estate developer constructed a canal connecting Lake Okeechobee with Lake Hicpochee, the headwaters of the Caloosahatchee River, providing the lake's first outlet to tidewater via the Caloosahatchee River. In the early 1900s, the Everglades Drainage District constructed several other canals that provided a slow, continuous drainage from Lake Okeechobee and the Everglades. The goal was to drain the northern Everglades to provide land for agriculture and to protect crops from flooding.

Small towns arose in this region, some very close to the lake. In the 1910s a small muck levee was constructed along the southern shore of the lake to further protect the towns and farms. This containment was breached by the storm surge from the Great Miami Hurricane in 1926 and the 1928 Okeechobee Hurricane which generated a storm surge in the lake that caused severe flooding to the south that killed more than 2,500 people. To prevent this kind of devastation from recurring, the state asked Congress for help. Congress responded by directing the United States Army Corps of Engineers (USACE) to lead efforts to prevent future tragedies of that scale. In the 1930s the USACE built a larger system of levees around the Lake. After a near catastrophe from the Fort Lauderdale Hurricane of 1947, the dike was again expanded in the 1960s to create the current levee. In 1960 Congress named the levee the Herbert Hoover Dike (HHD).

Building the levees in the 1930s was one of the first features of the USACE's solution. While the dike was being built, a system of canals and water control structures were also constructed. Today, as a result of the system of canals and levees built by the USACE, all discharges into and out of the lake are artificially controlled except Fisheating Creek.

When the levee and water control structures were completed the USACE developed a water level regulation schedule that is cooperatively administered by the USACE and the South Florida Water Management District (SFWMD). When lake levels are particularly high, large flood control discharges of freshwater are sent though canals to the St. Lucie and Caloosahatchee estuaries.

After construction of the HHD and canals, much of the land around Lake Okeechobee was converted to agricultural use. To the north, dairy farms and beef cattle ranching became the major land uses, while in the south, sugar cane and vegetable farming increased rapidly. Today there are several towns

and numerous residential communities around the Lake that support a population much larger than that which existed in the 1920s.

The HHD stretches approximately 140 miles surrounding Lake Okeechobee. The dike has a crest elevation ranging from 32 feet to 46 feet. The side slopes of the levee are steep with lakeside bank slopes as steep as three feet horizontal to one foot vertical and landside bank slopes as steep as two feet horizontal to one foot vertical. The levee was built by dragline and hydraulic dredge with gravel, rock, limestone, sand and shell – a design that was state-of-the-art in the 1930s, but inadequate by current design standards. The construction material was obtained locally by dredging a canal, known as the Rim Canal, paralleling the HHD. These materials and the foundation beneath the dike are porous and susceptible to significant seepage of water through and under the dike.

The HHD was constructed as a flood control levee. This means that it was intended to only temporarily retain an elevated water level during relatively brief flood stages and that the long term average lake level was to be near the elevation of the surrounding land. However, since 1979, increasing demands on the fresh water supply for south Florida, and environmental concerns over discharges of lake water to coastal estuaries and the Everglades have led to storing more water within the lake. Furthermore, agricultural peat lands on the south side of the lake have subsided several feet resulting in an additional increase in lake levels relative to ground levels. Thus, the dike is being used to retain a permanent elevated pool – that is, it is being used as a dam. Even by current design requirements, dams are subject to much more stringent standards than are levees.

Over the past two decades, the USACE has produced numerous reports concerning the structural deficiencies of the Herbert Hoover Dike. The common element in these reports concerns a particularly damaging and hidden mechanism known as internal erosion or piping. These terms refer to a process by which individual sand or silt-sized soil particles are transported and removed by underground erosion caused by seepage flow to form pipe-like features that enlarge to tunnels and cavities. The internal erosion process begins when seepage becomes concentrated in pervious portions of a dam or its foundation. Its symptoms include sand boils (small, cone-shaped mounds of deposited sand particles) or cloudy seepage containing finer silt particles on the landside of the dike. Left undiscovered or unabated, the continued removal of particles can form small, subterranean tunnels or “pipes” that undermine the dam, sometimes causing sinkholes to form on the surface. Eventually, the tunnels work backward to the reservoir enlarging as the flow through them increases erosive forces ultimately causing the dam to collapse or breach and releasing the reservoir entirely. Internal erosion is one of the most common structural causes of earth dam failures, in part because it can be so difficult to detect.

The same permeable soil or rock conditions that give rise to high seepage also tend to produce high pressures in the water that exists within interstitial voids or pores between particles of saturated soil. These internal pore pressures promote instability of the dike slopes – landslides, in effect. In loose, saturated soils, these slides can progressively enlarge until they encompass the crest of the dam, causing it to breach. Both pore pressures and seepage flows generally vary according to lake level, with higher lake levels increasing seepage and pore pressures.

In a 1998 draft report [1] (made final in 2000), the USACE concluded that at a lake elevation greater than 18.5 feet the likelihood of dike failure becomes significant and that an elevation greater than 21 feet (100 year flood event) would likely result in dike failure. It is emphasized that, as a lake management priority, elevations should not exceed 18.5 feet. However, heavy rain events in the Lake Okeechobee drainage basin can result in inflow to the Lake that exceeds the capacity to discharge water from the Lake. As reported by the South Florida Water Management District (SFWMD) in 2006 [2], this situation occurred in the late summer and early fall of 1995 when heavy rains resulted in a lake elevation of 18.8 feet and again in the spring of 1998 when lake elevation reached 18.6 feet – each of these events was a 30 year flood event. The dike did not fail during either of these events. However, the 1995 event caused near-failure of the dike at nine separate areas along the south and southeast shores including locations near Lake Harbor, Pahokee, and Belle Glade ranging in length from a hundred feet to over a

mile. Visual evidence of distress included excessive seepage, piping transport of dike material, and formation of sinkholes in the dike, which occurred under an unusually small head differential – a difference between toe ditch and lake water levels of as little as five feet. Of particular concern were observed cloudy flows of concentrated seepage and formation of sand boils and deltas, both of which are commonly taken as signs that the internal erosion failure process has initiated. Emergency repairs were immediately undertaken, principally sandbagging to counterbalance excessive seepage pressures, which were instrumental in saving the dike. In 1998 the dike experienced similar effects and responses at both former and new locations. An inspection campaign was mounted to monitor up to 94 separate problem locations. This time, a significant new observation was a white staining and white sand particles at many of the piping locations that is thought to indicate particle transport through limestone or the related calcareous shell deposits. The 1995 and 1998 occurrences were not isolated incidents with significant distress to the dike reported in 2003 near South Bay, again in 2004 at four locations from Belle Glade to north of Canal Point, and most recently in 2005 near the Pahokee Airport. Observation of the HHD during these events suggests there is reason to believe that the dike may be experiencing cumulative damage and progressive deterioration with respect to internal erosion and seepage.

Numerous studies of the HHD's condition have been conducted over the past twenty years. Most recently, studies by the USACE have addressed needed modifications and repairs to the dike by dividing the length of the dike into eight segments. While recognizing that the HHD operates as a single system, the USACE has evaluated these individual segments and prioritized a repair ranking based on the condition of the dike in each segment. The eastern and southern portions of the dike have been determined to be in the greatest peril. Design work has begun on the recommended modifications and in portions of segment 1 – the areas at greatest risk – work has begun. However, the studies and conclusions reached in the USACE studies are based on the identification of HHD as a levee and not as a dam. As a levee, the dike is officially a navigation project. Federal legislation requires that major rehabilitation of navigation projects (including levees) be justified according to their contribution to National Economic Development (NED) as determined by economic cost-benefit ratio and subject to environmental statutes. Consequently, although they did consider potential for loss of life in the analysis, the USACE studies were prepared for the sole purpose of economically justifying repair of known structural problems (seepage, internal erosion, and slope stability) at the authorized level of protection (levee). In 2005 the USACE placed the HHD on the national dam registry but congressional concurrence is needed to obtain an official designation for the HHD as a dam.

The SFWMD's 2006 report reviews the USACE reports along with other available data on HHD. Their conclusions differ significantly from those of the USACE's restoration design, and in response to this report Governor Bush wrote a letter in April 2006, to the Deputy Assistant Secretary of the Army listing nine specific issues regarding the safety of HHD. Among these was a request that congressional approval be sought to classify HHD as a dam and that it be brought up to dam safety standards. As a result of the SFWMD's independent contractor's assessment, the USACE has stopped work on the HHD and a new remediation design has been developed. This rehabilitation effort is planned to begin in June 2007.

In July 2006, U.S. Senators Martinez and Nelson introduced a bill in the U.S. Congress directing the Secretary of the Army to produce a supplement updating the USACE's 2000 report including a level of consideration consistent with dam safety, review of the SFWMD report and potential effects of dike failure on the Comprehensive Everglades Restoration Project.

Effect of Proposed Memorial

The House Memorial is a request by the Florida Legislature to the U.S. Congress urging Congress to authorize improvements to bring Herbert Hoover Dike in compliance with current levee standards and to authorize funding to expedite the improvements.

The Herbert Hoover Dike is currently being used as a dam. Dam safety standards are based on protection of human life and are more stringent than the cost-benefit ratio assessment associated with

levee safety standards. As presently worded, the memorial seeks to have the Herbert Hoover Dike protected at levee standards rather than at dam safety standards.

---

[1] USACE. *Draft Herbert Hoover Dike Major Rehabilitation Evaluation Report* , 4 vols., 1998.

[2] SFWMD. *Report of Expert Review Panel Technical Evaluation of Herbert Hoover Dike Lake Okeechobee, Florida*, BCI, Engineers and Scientist, April, 2006.

[3] Dennis R. Duke, P.E. Chief, Restoration Program Division, USACE. *Personal communication*. 2007.

C. SECTION DIRECTORY:

N/A

II. FISCAL ANALYSIS & ECONOMIC IMPACT STATEMENT

A. FISCAL IMPACT ON STATE GOVERNMENT:

1. Revenues:

   None.

2. Expenditures:

   None.

B. FISCAL IMPACT ON LOCAL GOVERNMENTS:

1. Revenues:

   None.

2. Expenditures:

   None.

C. DIRECT ECONOMIC IMPACT ON PRIVATE SECTOR:

None.

D. FISCAL COMMENTS:

Over the past two decades, the USACE has conducted maintenance and emergency repairs on the HHD using funds from its annual operations and maintenance budget. Beginning in 2004 the USACE designed a major rehabilitation project aimed at correcting the worst problems with the HHD. This work began in 2005 and was paid for from their Construction General Account which received a $16 million Congressional appropriation for this purpose. The selected design was not achieving its purpose and, in concurrence with the SFWMD's independent study findings, work on the rehabilitation project was stopped. A new design that takes into account the findings of the SFWMD report was developed and bids for the new contracts were requested by the USACE. In 2006 the redesign and initial work utilizing USACE staff cost $39.8 million. Work under the rehabilitation redesign is expected to resume in June 2007. The USACE schedule calls for the project to be completed in 10 to 12 years at an estimated annual cost between $50 million and $60 million. The U.S. President's budget for FY 2008 sets aside $50 million for this construction. The SFWMD has asked the USACE to expedite the rehabilitation project to achieve completion in 5 to 6 years. An accelerated program would require a commensurate need for additional annual funding. [3]

III. COMMENTS

A. CONSTITUTIONAL ISSUES:

1. Applicability of Municipality/County Mandates Provision:

Not applicable because this bill does not appear to require cities or counties to spend funds or take actions requiring the expenditure of funds, nor does it appear to reduce the authority that cities or counties have to raise revenues in the aggregate, nor does it appear to reduce the percentage of a state tax shared with cities or counties.

2. Other:

None.

B. RULE-MAKING AUTHORITY:

None.

C. DRAFTING ISSUES OR OTHER COMMENTS:

None.

D. STATEMENT OF THE SPONSOR

No statement submitted.

IV. AMENDMENTS/COUNCIL SUBSTITUTE CHANGES

N/A

FULL ANALYSIS

I. SUBSTANTIVE ANALYSIS

A. HOUSE PRINCIPLES ANALYSIS:

B. EFFECT OF PROPOSED CHANGES:

C. SECTION DIRECTORY:

II. FISCAL ANALYSIS & ECONOMIC IMPACT STATEMENT

E. FISCAL IMPACT ON STATE GOVERNMENT:

3. Revenues:

4. Expenditures:

F. FISCAL IMPACT ON LOCAL GOVERNMENTS:

3. Revenues:

4. Expenditures:

G. DIRECT ECONOMIC IMPACT ON PRIVATE SECTOR:

H. FISCAL COMMENTS:

III. COMMENTS

E. CONSTITUTIONAL ISSUES:

1. Applicability of Municipality/County Mandates Provision:

2. Other:

F. RULE-MAKING AUTHORITY:

G. DRAFTING ISSUES OR OTHER COMMENTS:

H. STATEMENT OF THE SPONSOR

IV. AMENDMENTS/COUNCIL SUBSTITUTE CHANGES