

WORKING TOWARDS A TEXAS PREFERRED PLAN FOR THE IKE DIKE/COASTAL SPINE

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Introduction

Harvey has served as a “watershed” hurricane to focus efforts to protect the upper Texas coast from hurricanes and intense rainfall events. And, although a coastal spine such as the Ike Dike proposed after Ike to protect the region from hurricane-induced surge, would not help reduce Harvey’s rain-induced flooding, the realization that the Galveston Bay region needs increased protection from both salt and fresh water flooding has now dominated proposals for flood risk reduction. With the devastation of Harvey fresh on our minds, it’s important that we don’t solely focus on how to reduce the flooding experienced during the last hurricane. Fortunately, after Hurricane Ike struck almost a decade ago, we began a planning process to design solutions to reduce storm surge flooding. Those concepts have matured and are close to being finalized. This paper explores the necessity and status of a regional response to massive coastal surge and suggests steps that would make the currently envisioned plan by the USACE friendlier to the Texas economy and coastal communities.

The Surge Suppression Imperative

On September 13, 2008, Hurricane Ike struck the upper Texas coast causing about \$30B in damages. Many parts of the Galveston Bay region have not yet recovered and, although those of us who lived through Ike think of it as a devastating storm, it could have been much worse. The storm track forecast on the morning of September 12th would have placed Ike’s landfall to the west of Galveston forcing the maximum winds and surge over the Island and up the Houston ship channel. Had Ike stayed on this officially forecast track, the storm damages would have been over \$100B and thousands would have died instead of the dozens who lost their lives during Ike.

None of the death and destruction caused by Ike’s surge had to have happened. Moreover, even the catastrophic damage and death forecast of a strong storm making landfall west of the Island can be prevented. Surge barriers such as those long-used in Europe and now constructed in New Orleans provide proven defense against storm surge. The New Orleans region achieved protection for the 2011 hurricane season – six years after Katrina hit on 2005. Ike hit in 2008 and, although it has been almost 10 years since landfall, the Galveston Bay region remains undefended against hurricane-induced storm surge. If we had moved at the same speed as New Orleans, we would have achieved comprehensive protection before the 2014 hurricane season. A properly designed, constructed and maintained surge barrier will work for the Galveston/Houston region. Massive hurricane storm surges can be a thing of the past.

The Coastal Spine or “Ike Dike” Concept

A coastal barrier concept has been advanced by Texas A&M University at Galveston that will suppress storm surge in the entire Galveston Bay region by using a coastal spine that

would protect all communities – the Ike Dike. The Ike Dike stops the surge at the coast by extending the protection afforded by Galveston’s seawall. The concept places sand-covered revetments on the Island’s west end and on the Bolivar Peninsula. Bolivar Roads and San Luis pass are sealed during storms with flood gates.

The Ike Dike approach leaves no one in the Galveston Bay region “outside and unprotected”. This equality of treatment also makes the necessary regional approach to the implementation and long term management of the Ike Dike infrastructure more possible. All protected communities will have a stake in its creation and assuring that it functions well in the future.

Coastal Barrier Status

Texas A&M at Galveston has worked with engineers and scientists from Delft University in the Netherlands and from the Homeland Security Coastal Hazards Center of Excellence Jackson State University to advance the proof of concept for the Ike Dike in the Galveston Bay region. Results from advanced modeling of storm surge damages and cost/benefit and other economic analyses have been very encouraging.

The 6-county, Gulf Coast Community Recovery and Protection District (GCCRPD) received monies from the GLO to study surge suppression in Galveston Bay. The purpose of the Storm Surge Suppression Study was to investigate the feasibility of reducing the vulnerability of the upper Texas coast to storm surge and flood damages through studying alternatives that rely on natural or nature-based features, as well as nonstructural and structural measures. The District’s study concluded that the coastal spine was the preferred approach and that it was cost beneficial.

However, it is the United States Army Corp of Engineers (USACE) that now controls the design of the coastal protection in the Galveston Bay region. The USACE with the local sponsor the Texas General Land Office has undertaken a \$20M study, the Coastal Texas Protection and Restoration Study. As part of this study, the USACE is examining 4 different barrier options that would protect the Greater Galveston Bay region, one of those is a spine placed near the coast similar to the Ike Dike concept. Although the final Tentatively Selected Plan (TSP) won’t be out until the end of summer, the coastal spine option has been publicly supported by the GLO and is the most likely option.

The USACE will request public comment on the TSP, which will most likely occur during August and September of 2018. This public input will be considered to form a locally preferred plan and, after these considerations are combined with final engineering, economic and environmental considerations, the USACE will produce a final report in 2021.

At this point, the principal goals of the Texas A&M University at Galveston-led research are to develop and examine alternatives to the USACE’s tentatively selected plan that make the coastal spine friendlier to the region by fitting its design better into the fabric of the Texas coast. This will involve developing workable options for the design of land-based and water-based flood reduction structures and determining their relative costs and benefits. The research requires the careful use and blending of results from storm surge modeling,

economic and cost benefit analyses as well as alternate approaches to barrier and floodgate design.

Ultimately federal, state and local government support for the construction and maintenance of the coastal barrier will depend on detailed quantifiable analyses of its costs and benefits. And, although the anecdotal evidence of the national value and strategic importance of the Galveston Bay petrochemical, maritime and related economies is strong, it must be more fully detailed and documented. It is also important to quantify, wherever possible, the loss of life and other human suffering as well as the environmental degradation caused by hurricane-induced surge events. The Texas preferred plan will need to examine gains and losses to the local, state, and national economies for alternative designs and approaches from a holistic point of view.

Visits to the Netherlands and working with the Dutch have convinced us that surge protection barriers can be successfully integrated into the coastal landscape and thereby provide significant environmental, economic, recreational and other benefits. All structural components of the Ike Dike barrier need to be studied to assure that the barrier is fully integrated into the environmental, economic and social fabric on the coastal communities. Because the USACE has not released details of its TSP, it's impossible to comment on all areas that might benefit from a more regional point of view. However, enough is known to provide some examples of design choices that might be changed to improve the spines impact on the coastal communities.

Examples of Possible Design Changes

First, we shouldn't forget the good news, there are strong indications that the USACE will adopt the coastal spine as its primary protection strategy. However, the USACE work is focused on making the spine cost effective for surge reduction from a federal point of view. They do not look at the coastal spine benefits and costs from a holistic point of view or how the spine design might affect coastal communities.

As examples, we will discuss two important design features of the coastal spine where the USACE approach to maximizing benefits to costs from a federal perspective might be usefully modified to improve the coastal spines surge reduction effectiveness and spatial areas of protection.

Our first example is that the USACE design evidently leaves San Luis pass ungated at the western terminus of their design. This provides a back-door into Galveston Bay and will allow surge to enter through the pass and directly cause surge in West Bay and higher water levels on the backside of Galveston Island. It could also allow forerunner surges to enter and propagate throughout the Bay increasing water levels before the hurricane hits. A companion paper by engineers at Jackson State University explore this situation in detail using ADCIRC modeling.

A second example is the location of the proposed land barrier on both the Bolivar Peninsula and West Galveston Island. Evidently the USACE TSP puts these barriers far back from the coast, behind the coastal highways. While that leads to a lower cost of protection of the Bay

itself it potentially sacrifices the communities on the Gulf side of the barriers to higher surges and erosion. It also leads to the possibility, maybe probability, that the coast will eventually erode to the barriers essentially creating a seawall from San Luis Pass to High Island, obviously an outcome no one wants. We favor the Dutch approach of creating land barriers as part of dune fields on the coast. This involves extra expense and facing up to the increased costs of responding to erosion now.

Example 1 on the San Luis pass closure is straightforward in that it can be strongly informed by additional modeling. Example 2 is more complicated being fundamental to what the region and State want the coast to be like and thus has strong political considerations.

Public Outreach

When viable alternatives which are better for Texas are identified, they must be disseminated to the public and to local decision makers so alternative designs to the TSP can be advanced within the region and presented to the USACE for consideration.

The Texas A&M University team has been heavily involved in informing the public and decision- makers about coastal surge protection. To date, hundreds of presentations have been made to civic and governmental organizations. Presenters have included COL Len Waterworth, Dr. Sam Brody and Dr. Merrell from Texas A&M University but interested citizens have also given our presentations which are on our website at <http://www.tamug.edu/ikedike/>. This outreach effort has led to resolutions of support for the coastal barrier concept. It is now time to use it in assisting the governments of the region to help develop beneficial alternatives to the TSP.